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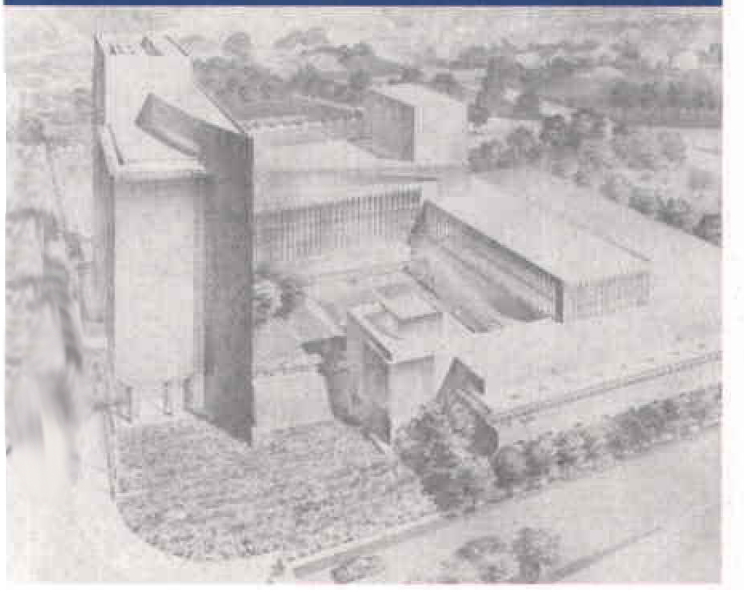

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On the cover: an architectural rendering of the new Federal Reserve Bank of Dallas headquarters.

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Six Causes of the Credit Crunch

(Or, Why Is It So Hard to Get a Loan?)

Many bankers, legislators, borrowers, and regulators have expressed their views about the cause of the credit crunch. Like the blind men examining an elephant, each has an opinion that has been formed from his perspective. Each has characterized the problem and potential solutions differently. None are completely correct or completely wrong. Bankers cite the lack of high quality loan demand. Legislators blame overzealous regulators. Borrowers say banks are too conservative. Regulators encourage bankers to lend and tell their examination staffs to facilitate the extension of credit but maintain the safety and soundness of the banking system.

Many economists studying the credit crunch explain it as a cyclical decline in credit demand. They often suggest that the cyclical swing is reinforced by structural changes in the demand for credit. These economists have minimized the numerous important factors that have reduced the ability of banks to supply credit or, at a minimum, have increased the cost of providing it.

In this article, we view credit crunches as localized events that occur at different times in different parts of the country. The Texas banking industry provides an important case study. The causes of the Texas credit crunch are highly similar to the causes of credit crunches that have developed elsewhere in the country. We focus on the past seven years because the contraction of bank credit began in Texas in 1986.

While demand may play an important part in the decline in loans outstanding during some of this period, we focus on the factors affecting the supply of loans from banks over the past seven years. While there are other sources of credit to business, banks continue to be vitally important, especially to small and mid-size businesses (Elliehausen and Wolken 1990). Many of the factors that are limiting credit supply from banks also affect other suppliers of credit. In some cases, however, the factors limiting credit from banks are unique to banks and place banks at a competitive disadvantage. As discussed in the next section, the definition of a credit crunch is fundamentally related to the supply of credit, as opposed to the demand for it. The following section presents the complexity of the credit crunch as it developed in Texas, where supply was reduced at both financially healthy and unhealthy banks. In the remainder of the article, we present six general factors that caused the supply of credit to contract.

What is a credit crunch, and are we in one?

The economics profession is unclear as to what constitutes a "credit crunch." The crucial differences in definition depend on the cause of the contraction and whether credit is rationed by means other than price.

Bernanke and Lown (1991) define a credit crunch as a decline in the supply of credit that is abnormally large for a given stage of the business cycle. Credit normally contracts during a recession, but an unusually large contraction could be seen as a credit crunch.

In their analysis, Bernanke and Lown compare the contraction in credit during the most

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recent recession to those in the previous five recessions. Total loans at domestically chartered commercial banks grew only 1.7 percent during the 1990–91 period, compared with an average of 7.1 percent during the previous five recessions. They conclude that there has been a credit crunch.

Bernanke and Lown attribute this reduced lending activity to demand and supply factors. Loan demand has been weak because borrowers' balance sheets have been weaker than normal, and as a result, borrowers have been less creditworthy than usual. The supply of credit has been reduced by the decline in bank capital caused by severe loan losses during the recession (Clair and Yeats 1991). Bernanke and Lown's analysis indicates that the demand factors have been far more important, accounting for three-fourths of the decline in lending in New England.

There is a disturbing dissonance created by the Bernanke and Lown definition of a credit crunch, the results of their analysis, and their conclusion that there was a credit crunch. They define the credit crunch as an abnormally large decline in the *supply* of credit. They argue that *demand* factors largely caused the reduction in lending. They then conclude that there is a credit crunch.

A second problem with the Bernanke and Lown analysis is their use of national data to determine if a credit crunch exists. Their cross-sectional analysis using state-level data assumes the imperfect substitutability of bank and nonbank credit and of bank credit from banks located in different states. Samolyk (1991) provides empirical evidence supporting this assumption. If bank credit cannot flow perfectly across state lines, however, then the problems of a credit crunch would be more likely to develop at the state level, not the national level, unless a nationwide economic shock caused the decline in bank capital.

The second definition of a credit crunch relies not on the contraction in lending but on the microeconomic principle of a shortage. If at the current market price the demand for a good exceeds the supply, then there is a shortage. The available supply will be rationed but by some means other than pricing. Nonprice credit rationing may occur even in a market that might not be described as experiencing a credit crunch (Stiglitz and Weiss 1981). Owens and Schreft (1992) define a credit crunch as a period of sharply increased nonprice rationing.

Owens and Schreft review historical episodes of nonprice rationing—that is, credit crunches that were accompanied by binding interest rate ceilings, credit controls, or coercive posturing by administrative officials and bank regulators to discourage banks from lending. In the current recession, researchers argue, administrative officials and bank regulators have actively encouraged banks to lend.[2] Owens and Schreft do state that there was probably nonprice rationing in loans secured by real estate, resulting from bank examiners' reaction to real estate loan losses. They cite the statements made by Robert Clarke, then comptroller of the currency, that discouraged banks from making real estate loans.

Owens and Schreft conclude that there is not a general credit crunch, but there might have been a sector–specific crunch in real estate. Since nonbank providers of credit also contracted their lending, Owens and Schreft attribute the decline in lending to ebbing loan demand.

The Owens and Schreft definition of a credit crunch has intuitive microeconomic appeal but may not provide the insights needed for economic policy analysis. Their definition does not consider actual lending activity. Consequently, a "credit crunch" can occur during a period of expanding credit as easily as during a contraction of credit.

Furthermore, Owens and Schreft dismiss anecdotal evidence from borrowers. They may be correct that borrowers would complain during any period of tight credit, but the type of complaint could be quite different. During nonprice rationing, borrowers complain about not being able to get a loan at any price. During periods of simply tight credit, borrowers complain about the cost of credit.

Despite their differences, both the Bernanke–Lown and Owens–Schreft studies agree that a decline in credit demand explains the major part of the credit contraction, and both find little support

[2] *At the same time that Bush administration officials were encouraging additional lending, Congress was holding hearings on bank failures and sending a signal to examiners that they should be conservative if they wished to avoid testifying before Congress.*

for the explanation that more stringent bank examination practices account for the contraction in loan supply. Owens and Schreft link the decline in credit demand to the deterioration of real estate asset values, similar to the Bernanke and Lown view of weakened balance sheets. In determining if the nation is in a credit crunch, Bernanke and Lown cite the abnormally slower growth of credit as a sign of the credit crunch, while Owens and Schreft see few signs of nonprice credit rationing and conclude that there is no general credit crunch.

In ascertaining that demand factors are a primary cause of the decline in bank credit, both studies cite the lack of credit supply response from nonbank sources of credit. Nonbank sources of credit to businesses are growing increasingly important (Pavel and Rosenblum 1985). Approximately 25 percent of small and mid-size businesses obtain credit from nonbank sources (Elliehausen and Wolken 1990).

If bank credit alone were being rationed or constrained, both studies argue, other providers of credit should have increased their activity. Most nonbank sources of credit to corporate businesses have contracted during the 1990–91 recession. From 1989 to 1991, not only did the annual flow of funds from bank loans contract but so did the flow of funds from finance companies, commercial paper, mortgages, and trade credit. At the same time, the flow of funds needed for capital expenditures contracted sharply. These national aggregate data are consistent with the hypothesis that demand factors have driven the credit contraction.

In a comment on the Bernanke and Lown study, Benjamin Friedman points out that they assumed that other nonbank credit providers did not suffer the same constraints (Bernanke and Lown 1991). If loan losses have caused capital to decline at banks, might not similar losses reduce the capital of nonbank creditors, such as insurance companies? Michael Keran (1992), vice president and chief economist of the Prudential Insurance Company of America, has acknowledged that financial intermediaries other than banks have also suffered declines in capital resulting from real estate and other loan losses.

Because of their analytical approaches, both of these empirical analyses have misdated the beginning of the credit crunch. The Bernanke and Lown analysis uses national data that mask important differences among various regions of the country. The Owens–Schreft analysis begins in late 1989 and focuses on New England. Texas suffered a severe contraction of its economy and of bank credit during the last half of the 1980s when the national economy was growing. By failing to examine state-level data, both studies misdate the start of the credit crunch by several years and fail to establish its regional nature (Rosenblum and Clair 1993).

Because Texas began its credit crunch earlier, Texas is a better case study to examine long-term effects. Texas' banking industry was so severely affected that even after the state's economy began a recovery in 1987, the banks did not increase their lending. Even though Texas' economy outperformed the nation's during the 1990–91 recession and experienced only a modest slowdown, lending at Texas banks did not increase for six years.

The life cycle of a credit crunch: the Texas experience

Until 1987, Texas' loan cycle was in line with the regional economic cycle. During the economic expansion of the first half of the 1980s, loans extended by Texas banks more than doubled from $52 billion in 1980 to $119 billion in 1985. In the midst of continued growth in the national economy, Texas entered a recession, triggered by a precipitous decline in oil prices in 1986. Declines in lending during an economic downturn are normal.

The abnormality in the Texas lending pattern surfaced about 1987. Despite an economic recovery, lending continued to decline. From 1987 to 1990, lending declined another 30 percent, even though employment increased 6.8 percent. Even the modest increase in loans outstanding that began in 1992 does not reflect new lending as much as it does acquisition of failed savings and loan associations (S&Ls), their assets, or assets from other nonbank institutions and consolidation of national lending operations into Texas banks.

A credit crunch is not a necessary consequence of an economic downturn. Lending declines during an economic downturn, but primarily because of decreases in business and consumer loan demand. In Texas, however, the economic climate has played an important role in the credit

crunch. A chain reaction of huge shocks to the Texas economy resulted in the near destruction of several key industries the state had relied on for growth throughout the 1970s and 1980s. To under-stand the Texas credit crunch, we must first understand the nature of this abnormally strong downturn and its repercussions on the economy.

In the late 1970s and early 1980s, the Texas economy prospered as the oil and gas industry boomed. Growth in the oil industry fostered employment growth in all sectors of the Texas economy. The climate was especially hospitable for commercial real estate.[3] Low vacancy rates, changes in tax laws, and financial deregulation in the early 1980s motivated investment in commercial real estate.[4] The state's strong economy and a drop in interest rates also encouraged the flow of funds to the real estate sector (Petersen 1992). As a result, office building permit values nearly doubled from $1,143 million in 1980 to $2,184 million in 1985.

Even when an initial weakening of oil prices in 1982 triggered a downturn in parts of the Texas economy, commercial real estate activity continued. Bankers' and other investors' interest in office buildings persevered in the face of skyrocketing vacancy rates. Office vacancy rates in major Texas cities increased from 8 percent in 1980 to 24.3 percent in 1985, as office building permits continued to rise (Petersen 1992).

Texas was not so lucky after a second sharp decline in oil prices in 1986. Recession struck the state but not the nation. Texas is an oil-producing state and an exporter of oil-field machinery, while the nation is an oil importer. Reversals of the tax laws that had favored commercial real estate investments exacerbated the state's economic problems by accelerating the flow of funds out of the office construction arena. The state lost 250,000 jobs and gained the burden of an extraordinary amount of vacant office space. In 1987, vacancy rates were near 30 percent in most major Texas cities.

Unfortunately, the shocks engendering the collapse of petroleum and construction were only the beginning for Texas. Like other investors, many aggressive banks were caught holding loans to both oil and gas producers and commercial real estate developers (Gunther 1989). Nonperforming loan rates at Texas banks increased steadily from 1984 to 1987, and troubled assets caused declines in equity capital and bank failures (Robinson 1990).

During the 1980s, equity capital at Texas banks followed the same pattern as lending. From 1980 to 1985, equity capital increased by 85 percent, or $6.2 billion. After the downturn in the Texas economy, equity capital declined by 41 percent, or $5.6 billion. The declines in equity capital resulted from $10.8 billion in loan losses experienced by Texas banks during the second half of the 1980s.[5] Although equity capital improved somewhat in 1989 and 1990, it was 23 percent below its peak.

[3] See Petersen (1992) for an excellent description of and outlook for the Texas commercial real estate industry.

[4] Petersen (1992) explains that the Economic Recovery Tax Act of 1981 redefined the business depreciation allowance for some real estate properties to allow for an accelerated recovery of investments, thus making those investments more attractive. For an extended discussion of the effects of depreciation rates on real estate decisions, see Yeats (1989). Also, the Depository Institutions Deregulation and Monetary Control Act of 1980, which helped phase out interest rate ceilings on time and savings deposits, and the Garn–St Germain Depository Institution Act of 1982, which created the money market deposit account, resulted in a large source of new funds. The Garn–St Germain Act further liberalized investments that S&Ls could make (although Texas state-chartered S&Ls already had these powers) and included provisions for the creation of nonexistent capital through the issuance of capital certificates. Together, these changes provided tremendous incentives favoring investment in commercial real estate.

[5] When loans are charged off as losses, these losses are deducted from the allowance for loan loss (a reserve account on the balance sheet), which historically was considered a part of regulatory capital. If the charge-offs are large, then the allowance must be replenished because the adequacy of the allowance is judged relative to the size of the loan portfolio and its risk. This is done by increasing the provision for loan losses (an expense item on the income statement). If this provision is large enough, it can cause net income to be negative; in other words, the bank sustains a net loss. If income is negative, then the equity capital position is reduced by the amount of the loss. Essentially, if the decline in the allowance for loan loss is so large that it cannot be absorbed by current income, then monies are diverted from equity capital to the allowance for loan losses.

Table 1
Texas Banking Statistics
(all figures are percentages)

	1988	1989	1990	1991	1992
Healthy Bank Index[1]	38.12	49.53	60.60	68.30	81.57
Return on Assets	–1.21	–.33	.41	.65	1.07
Nonperforming Loan Ratio[2]	6.41	6.59	3.14	2.85	1.70
Primary Capital Ratio[3]	6.40	6.02	7.20	7.44	7.68
Growth Rate of Securities	10.42	10.95	18.66	14.65	3.67
Growth Rate of Loans	–17.61	–7.43	–4.59	–2.53	6.69

[1] This index is the percentage of assets held by healthy banks. A bank is defined as healthy if it is earning a profit, has a troubled asset ratio below 3 percent, and has a capital ratio at least one-half percentage point above the regulatory minimum.
[2] Nonperforming loans are all loans 90 days or more past due or nonaccruing divided by total loans.
[3] Primary capital ratio is the sum of bank equity and loan loss reserves divided by the sum of total assets and loan loss reserves.

SOURCE: Federal Reserve Bank of Dallas.

For many banks, the decline in bank capital was fatal. Bank failures skyrocketed to levels not seen since the Great Depression. No Texas banks failed in 1981, but thirty-seven did in 1986, and the numbers kept climbing.[6] Texas bank failures peaked in 1988 at 149 and were down to 31 in 1992. The savings and loan industry suffered an even higher failure rate.

Pathology of a credit crunch

Researchers at the Federal Reserve Bank of Dallas have examined the connection between financial health of banks and their lending activity and have found that during the latter half of the 1980s, many Texas banks were too unhealthy to lend. Financially unhealthy banks are those with capital-asset ratios below 6 percent, with negative income, or with a troubled-asset ratio of 3 percent or more. In 1986, 55 percent of Texas banks holding 72 percent of the state's total banking assets were unhealthy by this standard. Increased lending by these banks would have exposed them to unacceptable risk of failure. Lending would have been discouraged or prohibited by bank supervisors and, in all likelihood, by the banks' own boards of directors.

Since the second quarter of 1988, the health of the state's banking industry has steadily improved. By the fourth quarter of 1992, 72 percent of Texas banks, with 82 percent of the state's assets, were healthy (*Table 1*). The improvement resulted from the failure of many unhealthy banks, from customers' switching their business from unhealthy banks to healthy banks, and the financial recovery of some unhealthy banks. However, the fact that 304 unhealthy Texas banks were holding approximately one-fifth of the state's assets as of the fourth quarter of 1992 indicates the im-provement has been slow (Clair and Sigalla 1993).

The inability of healthy Texas banks to take market share away from unhealthy banks in a timely manner contributed to the slow recovery of Texas banking. When banking problems escalated

[6] *Banks failures had slowly increased in the four years preceding the oil and construction bust. Although no Texas banks failed in 1981, five banks failed in both 1982 and 1983, six banks failed in 1984, and thirteen in 1985. This slow but steady increase signaled the increasing fragility of the banking industry before the economic shock.*

in 1986, healthy banks were small compared with their unhealthy competitors. The average healthy bank had only $67 million in assets compared with $136 million for unhealthy banks. Healthy banks controlled only 28 percent of Texas banking assets. Thus, for healthy banks to take over the market share of unhealthy banks would have required an inconceivably rapid expansion.

The rate at which healthy banks can take over the market share of unhealthy banks is limited by healthy banks' capital in excess of regulatory minimums. Raising capital in the equity markets was and is difficult for these healthy banks. Their small size means small equity offerings, which are costly to sell. Moreover, the chaotic state of the Texas banking market caused investors to shy away from Texas bank stocks. The only alternative left open to banks was to raise capital through the slow process of retaining earnings. Even if the average-size healthy Texas bank retained 75 percent of its earnings and maintained its primary capital-to-asset ratio, individually it could increase lending by only $2.4 million per year. If all healthy banks followed the same strategy, they could have only increased total lending by $2 billion—only a 1.7-percent annual increase.

But not all healthy banks increased their lending activity, which indicates an important pathology. The term pathology applies in this case because a bank in good financial condition in a growing region would normally be expected to increase its lending activity (Rosenblum 1991).

Those healthy banks not building their loan portfolios represented a significant share of the healthy banks in Texas. Of the 619 banks that were healthy as of the first quarter of 1991 and that had reported data for the past ten quarters, nearly 40 percent did not increase their lending from the first quarter of 1990 to the first quarter of 1991 (Rosenblum 1991). These banks accounted for 40 percent of the assets and 35 percent of the loans of healthy Texas banks at that time.

The pathology of financially healthy banks in a growing state not increasing their lending raises the need for an examination of the possible causes. The extension of bank credit, especially to small and mid-size businesses, supports new job creation and economic expansion. The remainder of this article discusses serious impediments affecting the supply of credit.

Six causes of the credit crunch

Declines in bank capital

Business-cycle effects typically do not cause a credit crunch. Business lending after adjusting for inflation typically moves with the business cycle with a lag. Both demand and supply shifts contribute to the cyclical movement. During a slowdown, demand for credit declines and the supply of credit also contracts because loans become riskier. After the recovery is established, demand increases and banks begin lending again.

In an atypically severe cycle, the ability of banks to begin lending after the recovery is established may be hindered. During the recession phase of a severe cycle, the larger than normal loan losses result in larger than normal reductions in bank capital and numerous bank failures. Loan losses in the recent regional and national recessions have been severe, especially when viewed relative to bank capital. During the 1985–90 period, banks in Texas made provisions for $14.5 billion in loan losses, and their total capital at the end of this period was $10.3 billion. Even among surviving banks, capital may fall below either the level desired by bank management or the minimums established by regulatory agencies. In either case, the expansion of credit will be limited by the bank capital levels (Clair and Yeats 1991, Hancock and Wilcox 1992).

Not only did loan losses reduce bank capital, but minimum capital standards rose. Baer and McElravey (1993) have examined the factors causing an increased demand for bank capital in the two-year period beginning in June 1989. By their estimates, meeting higher capital standards, whether imposed by regulators or adopted by more conservative bankers, had twice the effect of loan losses in creating the need for new bank capital.

Bank capital standards rose substantially over the 1980s and early 1990s (Baer and McElravey 1993). In the 1970s, bank supervisors set minimum capital ratios for each bank, based on ratios at similar banks. Bank capital ratios had been declining during the 1970s, and concerned regulators established a minimum primary capital ratio of 5.5 percent in late 1981, to be phased in over time.

By the latter half of the 1980s, bank regulators, as part of an international agreement, established risk-based capital ratios. Regulators assign

risk weights to various types of assets and off-balance-sheet risks and require capital to be held in proportion to the credit risk of the bank portfolio. For example, short-term Treasuries have a zero credit risk weight, and business loans have a 100-percent risk weight.

Risk-based capital ratios may have raised the relative cost of lending compared with investing in securities. If these risk-based ratios are a binding constraint on banks, then increasing business lending will require additional capital to be raised, but investing in short-term Treasuries requires no additional capital.[7] Since capital is costly, the risk-based system increases the cost of business loans relative to securities, thereby discouraging business lending.[8]

In addition to risk-based capital ratios, regulators removed the primary capital ratio requirement and replaced it with a leverage ratio requirement. Whether the leverage ratio is a higher constraint is uncertain. The required leverage ratio is dependent on a bank's risk rating. Nominally, a top-rated bank could have a leverage ratio of 3 percent, but most banks were expected to maintain leverage ratios in the neighborhood of 4 percent to 5 percent.[9] The old primary capital ratio was 5.5 percent, but it included loan loss reserves in the definition of capital, which the new leverage ratio does not.

While a direct comparison of these new capital regulations is not possible, an empirical analysis by Baer and McElravey (1993) indicates that banks are behaving as though their minimum capital requirements have risen substantially over the past few years. Based on their analysis, banks now respond as though their required leverage ratio has risen from 4 percent in the 1973–75 period to 7 percent in the 1989–91 period. Banks are behaving as though they are setting internal minimum capital standards much higher than the regulatory minimums. The pressure on banks, whether from regulators or internal management, to maintain higher capital ratios has severely limited their ability to extend new credit.

FDIC and RTC resolution of failed depository institutions

While loan losses directly reduced capital, the resolution of failed banks and thrifts increased the demand for capital. After a depository institution fails, its assets are taken over by the deposit insurer. Typically, the insurer sells the institution, often after cleaning the portfolio of the nonperforming assets.[10] The acquiring institution must have sufficient capital in excess of regulatory minimums to be able to increase its total asset holdings without becoming undercapitalized.

The resolution of failed banks and thrifts was not the only source of assets to be acquired. Many banks that did not fail but were undercapitalized reduced their assets to improve their leverage ratios. They had to sell these assets to healthier institutions that had sufficient excess capital to purchase the assets and remain sufficiently capitalized.

Baer and McElravey (1993) term this process the recycling of assets, suggesting that assets are recycled from undercapitalized to well-capitalized banks and thrifts. During the two-year period beginning June 1989, undercapitalized bank holding companies sold $82.8 billion in assets, failed banks accounted for $58.6 billion, and failed thrifts accounted for $177 billion, for a total $318.4 billion in recycled assets. Recycling these assets increased the need for capital by more than $22 billion, a

[7] There is a requirement for a minimum leverage ratio that requires a bank hold some capital regardless of the composition of its asset portfolio.

[8] Risk-based capital is not a bad idea in theory. That riskier institutions should hold greater capital is logical. If the loans diversify the bank's overall portfolio, however, then increased lending may decrease a bank's risk.

[9] It is erroneous to think that a bank is permitted to operate with a leverage ratio of 3 percent. There is a catch-22. Banks are rated from one to five on the CAMEL scale, with one being the highest rating possible. CAMEL is an acronym for capital, asset quality, management, earnings, and liquidity. A bank can't get a CAMEL-one rating with only 3 percent capital, but if the bank has a CAMEL-one rating, it is permitted to have only 3 percent capital.

[10] In some cases, the acquiring institution also acted as a collecting bank for the Federal Deposit Insurance Corporation (FDIC). In these cases, it was common for the bank to carry the assets in the collection operation under a special classification of "other assets," and the bank was not required to hold capital against these assets. Since the losses incurred from these collecting bank assets would be borne by the FDIC, the bank did not need to hold capital against these assets.

28.7-percent increase in capital at the time.

Beyond increasing the demand for capital by recycling assets of failed institutions, the failure–resolution process destroyed valuable information—reducing the ability of many borrowers to obtain credit (Board of Directors of the Federal Reserve Bank of Dallas 1991). Effective lending involves the ability of bankers to develop specialized information regarding their borrowers. This information allows bankers to make informed credit decisions at minimal cost. Anything that disrupts the banker–borrower relationship can lose or destroy the specialized information a banker has about a specific borrower.

One type of this specialized information is the banker's assessment of the borrower's character —a signal of the borrower's commitment to repay a loan under adverse conditions. Bankers attempt to assess the character of a borrower prior to making a loan. This assessment is hard to quantify or document and is an important judgment call that a bank officer must make.

Many borrowers will face difficulty in repaying during an economic downturn. Some will be unwilling to accept any personal sacrifice and will be quick to declare bankruptcy or otherwise force a bank into losses. Other borrowers, those with greater character, will make every reasonable effort to repay their obligations and will make personal sacrifices in the process.

During an economic downturn, the loan documentation of borrowers with radically different characters may appear very similar. The repayment may appear poor—that is, late or partial payments or violated loan covenants. Bankers know which borrowers are making tremendous efforts to meet their obligations and which borrowers expect the bank to be the first to forgo payment. Both loans may be classified as nonperforming.

When a failed bank is resolved, nonperforming loans are often either placed in a collecting bank or are held by the FDIC for liquidation. Borrowers must establish new banking relationships. But being placed in these collecting or liquidating operations places an equal stigma on borrowers of good and poor character. Resolving the failed bank destroyed the information that distinguished low-risk from high-risk borrowers.

Being placed in a collecting bank can even tarnish the reputation of borrowers with perfect repayment records. In the late 1980s, regulators created the "nonperforming performing" loan category. These loans were current on payments and not in violation of any loan covenants. Because the examiners considered the loans unlikely to be repaid given the examiners' current economic outlook, they classified them as nonperforming. As a result, another group of borrowers may have been inappropriately placed in the collecting bank and thereby faced substantial damage to their reputations.

The resolution of the failed banks and thrifts was inevitable, and it improved the health of the financial industry. The huge demand for capital required to recycle assets was unavoidable. Still, the increased demand for capital to fund these assets limited the capital available to fund new loans. The resolution process, however, destroyed valuable information on borrower relationships, and a reevaluation of the process to determine if the negative economic impacts of closing failed banks and thrifts can be reduced is warranted.

Bank supervision overreaction

The evidence that an overreaction by bank supervisors caused the credit crunch is mixed. Since the potential impact of bank examiners on credit decisions is large, the evidence needs to be presented. There are many different ways in which bank examiners, in the process of enforcing safety and soundness guidelines, might constrain bank lending.

1. Examiners could criticize existing loans—requiring banks to increase loan loss provisions and charge-offs, and thus reduce their capital.
2. Examiners could become more conservative in evaluating a bank's condition and thereby require a higher leverage ratio.
3. The specter of examiners' criticism alone could discourage loans from being extended.
4. For more troubled institutions, examiners may be directly setting restrictions on lending activity
5. Higher loan documentation requirements could raise costs, but these requirements may be more directly related to the regulatory burden and will be discussed elsewhere.

Each of these supervisory and regulatory impositions will have different effects on bank financial statements.

The hypothesis that bank examiner overreaction caused the credit crunch arises from the February 1990 advisory sent by the Office of the Comptroller of the Currency (OCC) to all banks warning against making imprudent real estate loans. In November 1990, as the national economy weakened, the Bush administration blamed the tight credit conditions on an overreaction by bank supervisors. Most bankers responded, however, that it had been and was the lack of loan demand and deteriorating economic conditions that discouraged their lending and not supervisory excess (Owens and Schreft 1992).

The evidence indicates that bank examiners did not overreact in criticizing existing loans and requiring good loans to be charged off. Bernanke and Lown (1991) examine this issue by analyzing the trend of provisions for loan losses relative to actual net charge-offs. Certainly, provisions for loan losses and net charge-offs rose during the 1980s, but the ratio of provision to charge-offs was very steady, indicating that examiners did not raise the standard for provisioning excessively. Accordingly, Bernanke and Lown conclude that examiners have not suddenly imposed new tighter examination standards that have constrained credit.

Even so, there is evidence that bank examiners are enforcing a more conservative view of what constitutes a healthy bank. David Bizer of the Securities and Exchange Commission has argued that bank examiners have raised the financial standards for any given CAMEL rating (Bizer 1993).

This change to more conservative CAMEL ratings is related to the credit crunch because the required leverage ratio is tied to a bank's CAMEL rating. The minimum leverage ratio is set at 3 percent for banks rated CAMEL one and rises as CAMEL ratings worsen. If bank examiners raise the standards for any given CAMEL rating, they are, in fact, increasing the minimum capital standard.

Bank examiners could also affect credit decisions by raising the expected cost of funding the credit. The cost of funds is a combination of the cost of the necessary capital and the cost of deposit funds. If bankers perceive, even erroneously, that examiners might criticize new credit extensions, then they expect that a larger share of new credits will have to be funded with relatively expensive capital, driving up the expected funding cost and discouraging new lending. These concerns could drive up funding costs by 70 basis points or more. (For a detailed example of this effect, see the box entitled "Examiners and Funding Costs.")

It is possible that bank supervisors are constraining lending activity beyond their power to set higher leverage ratios. Peek and Rosengren (1993) analyzed new lending activity of banks in New England, adjusting for whether a bank was operating under a formal agreement with its primary regulator. Regulators impose formal agreements on banks considered seriously troubled or even recalcitrant in repairing their financial condition. Such agreements allow the regulator to seek civil or even criminal penalties in the case of noncompliance.

After controlling for differences in leverage ratios, Rosengren and Peek's results indicate that new lending was significantly lower at banks operating under formal agreements than at banks with equally low capital ratios but not under such agreements. They conclude that banks may be slow to constrain their lending or to rebuild their capital on their own. Once the formal agreement is in place, however, banks respond much more quickly.

In sum, regulators constrain credit growth at weak institutions that are unwilling to temper their own behavior when faced with declining capital. But constraining the credit expansion of weak institutions does not cause credit crunches. In fact, it may prevent them in the future. Texas had many institutions that lent freely despite their weak financial condition. As a result, imprudent loans were extended, especially in commercial real estate development. The overbuilding that ensued affected the value of collateral supporting what otherwise would probably have been good loans made by financially strong institutions. During the worst of the Texas banking crisis, managers of well-run banks called for bank supervisors to shut down the activity of insolvent or nearly insolvent institutions.

In conclusion, bank supervisors do not appear to have required excessive charge-offs of nonperforming loans. Supervisors did constrain lending at financially weak institutions, but that is the proper role of supervisors. Bankers' concerns

Examiners and Funding Costs

Bank examiners can change the expected cost of funding a new loan by changing the banker perception of what loans might be criticized, which would change the required mix of capital and deposits needed to fund the loan. Loans are funded by a combination of capital and deposits.[1] Baer and McElravey's (1993) results indicate that banks would want a loan to be funded with 7 percent capital and 93 percent deposits. Capital is more costly to raise than deposits. For the purposes of our example here, it is assumed that capital requires a 15-percent return, and deposits cost 3 percent. In this simple example, the funding cost of a loan is the weighted average of these two costs, 3.8 percent, or

$$(.07 \times 15\%) + (.93 \times 3\%).$$

If, however, bankers believe examiners will criticize the loan, then the funding cost of the loan will rise sharply. Suppose bankers believe examiners will criticize the loan and require 30 percent of the loan to be reserved. In this case, approximately 65 percent of the loan would be funded with deposits and 35 percent with capital (30 percent of the loan is 100 percent funded by capital by being reserved and the remaining 70 percent of the loan that still requires a 7-percent leverage ratio.) In this case, the funding cost would rise to 7.2 percent, or

$$\{[.30 + (.70 \times .07)] \times 15\%\} + (.65 \times 3\%).$$

Now, if the banker believes there is only a 20-percent probability that the loan will be criticized, then the cost of funding would be the weighted average of these two funding costs, that is, 4.5 percent, or

$$(.20 \times 7.2\%) + (.80 \times 3.8\%).$$

Therefore, just the specter of examiner overreaction could increase the expected cost of funding 70 basis points, from 3.8 percent to 4.5 percent. Given this expectation, many loans would never be made. Beyond a lack of lending, there would be no direct evidence of this effect in bank financial statements, that is, no sharp rise in provisions for loan losses or charge-offs.

[1] To be precise, loans are funded by capital and liabilities. Liabilities include deposits in addition to federal funds purchased, other debt instruments, etc. For the purposes of this example, we have simplified the bank's funding to capital and deposits only.

that new loans might be criticized, however, may have discouraged lending by raising the expected cost of funding these loans.

New credit standards set by bankers

Atypically severe recessions alter both bankers' and bank supervisors' perception of risk. After an unusually severe recession and a sharp increase in bank failures, bankers will likely reevaluate risk and change their risk-taking behavior, require more capital to buffer against it, or both. Their willingness to supply credit is likely reduced.

In hindsight, the old credit standards were too lax.[11] If loans had been properly priced, banks would have accumulated sufficient capital during expansions to absorb loan losses during down-

[11] *Hindsight is always 20-20. For example, most cities will not grant building permits for land within a 100-year flood plain. If a new record flood results in the destruction of homes, it could be said that the previous standard was too lax. Higher standards would mean less risk, but the cost would be more land that could not be used for buildings.*

turns. This is not what happened in Texas. Many banks failed because their reserves and capital were insufficient to absorb loan losses. The inability of banks to properly price risk is related to the disincentives inherent in the deposit insurance system (Short and O'Driscoll 1983).

Bankers have contracted the supply of credit by raising credit standards and denying credit to many borrowers. Some of the rejected applicants have qualified for loans in the past or are even current borrowers seeking credit extensions. This change in status from creditworthy to uncreditworthy can be difficult to accept and can damage borrowers' businesses since many planned on continued access to credit.

Probably the greatest difference between borrowers' and bankers' perceptions is that borrowers perceive creditworthiness as an individual characteristic, while bankers view creditworthiness on both an individual basis and on the basis of the entire portfolio of loans. To illustrate, suppose that prior to a severe recession, a banker expects a 2-percent loss rate on loans to a given industry but during the recession, actually sustains a 5-percent loss rate. In response, the banker raises the credit standards for borrowers in this industry with the intention of obtaining a 2-percent loss rate. The higher standards, however, might result in, say, 25 percent of the previous borrowers being unable to qualify for credit.

The majority of rejected borrowers will have repaid their loans on time and in full. These borrowers are not different—in either financial characteristics or character—from the minority that defaulted. The bank realizes that the likelihood that an individual borrower will default is not easily guessed but that the default rate for a portfolio of loans is fairly predictable. The borrowers see themselves as good bank customers—not as the inadvertently lucky ones who did not default—and do not understand why they have been rejected. They complain, accordingly, that there is a credit crunch.

Returning to the issue of real, rather than hypothetical problems, the reevaluation of risk-return tradeoffs during the 1980s in Texas was not uniform across industries or types of loans. During this regional recession, some industries proved far riskier than bankers previously thought. In the 1980s, energy prices fell by more than 50 percent. Real estate values plunged. Consequently, many bankers revised their expectations for these industries more than for others.

Borrowers' confusion over their own creditworthiness was compounded by banks that were too weak financially to lend but pretended to consider loans for approval. If a bank's condition deteriorates to the point that it is unable to extend credit, the bank would likely want to conceal that fact. Otherwise, depositors might demand higher interest rates, and the bank's best borrowers might take their business elsewhere (Rosenblum 1991). To create the appearance of financial health, the bank pretends to continue its lending operations—including marketing activities. Even high-quality loan proposals are rejected, however, under the pretense that they are too "risky."

This masquerade is costly. The cost of camouflaging is borne by the borrowers that waste time and resources applying for loans from banks that are incapable of lending. In addition, other banks consider the rejection of the loan proposal a sign that the proposal really is too risky. As a result, with each rejection borrowers find it increasingly difficult to locate a willing lender.

Regulatory burden

Banking has been and currently is one of the most regulated industries in the United States. In its report on the regulatory burden, the Federal Financial Institutions Examination Council (1992) stated, "Certainly federal regulation of banking is pervasive in 1992; it affects virtually every aspect of industry behavior." The American Bankers Association estimates that banks employ more than 75,000 people just to comply with regulations, an average of more than six employees per bank.

The extent of the burden of regulation is best summarized by the following quote on the extension of just one type of credit (*Greater Cincinnati Business Record* 1992):

> Our biggest concern in the banking industry is the overregulation. It's unbelievable the regulations that the bank has to live with. If one of our people at one of our banking centers at one of our branches wants to make a car loan to you, here's the legislation that they have to be totally familiar with: the Consumer Credit Protection Act, the Truth in Lending Act, the Equal

> Credit Opportunity Act, the Fair Credit and Charge Card Disclosure Act, the Home Equity Loan Consumer Protection Act of 1988, the Fair Housing Act, the Real Estate Settlement Procedures Act, the Flood Insurance Protection Act, the Fair Credit Billing Act, the Fair Credit Reporting Act, the Home Mortgage Disclosure Act, the Fair Debt Collection Practice Act, the Consumer Leasing Act, the Community Reinvestment Act, the Bank Bribery Act, and the Securities and Exchange Act....And this isn't an inclusive listing. It's absolute insanity.
>
> — George A. Schaefer, Jr., president and chief executive officer, Fifth Third Bank.

There are costs and benefits to every regulation. Consumer protection and antidiscrimination laws are worthwhile goals. Achieving these goals is costly, and one cost is the effect of regulatory burden on the availability of credit. Judging whether the costs outweigh the benefits of any given regulation is outside the scope of this article, which is presenting only an explanation of some of the more hidden costs of regulation.

If banks have always faced a heavy regulatory burden, why is this now being proposed as a source of the credit crunch? The credit crunch did not begin until 1986 in Texas and even later elsewhere in the nation. It is crucial then to focus on what new regulations were enforced during this period. In addition, the financial condition of the banking industry should to be taken into account when, the effect of additional regulation is assessed.

Following the failures of banks and thrifts, Congress passed three major banking bills that increased the regulatory micromanagement of banks: the Competitive Equality Banking Act of 1987; the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA); and the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA). These statutes funded the closure of insolvent thrifts and constrained banking activity.

Consumer protection laws also have increased sharply, with seven new laws since 1985 (Spong 1990). In addition, enforcement of some previously passed legislation increased suddenly in the early 1980s. By many accounts, the Community Reinvestment Act of 1977 (CRA) caused bankers relatively little concern until 1989, when a major bank's application for an acquisition was denied because it failed to meet its CRA responsibilities.

The increased regulatory burden further extended the time needed for healthy banks to take over the market share of unhealthy banks and for unhealthy banks to recover. The additional costs imposed on banks lowered their net income, slowing the rebuilding of capital through retained earnings. If the capital losses of the 1980s created a credit crunch, then the increased regulatory burden extended its life.[12]

The regulatory burden's impact on the credit crunch is directly related to increased compliance costs. Four different estimates of the compliance cost are presented in Table 2 and range from $7.5 billion to $17 billion for 1992. Based on the lowest estimate of $7.5 billion, if these funds could have been applied to capital rebuilding, banks could have funded an asset expansion of $93 billion (assuming an 8-percent capital-to-asset ratio). This analysis, however, has not attempted to measure the benefits of regulation.

The regulatory burden not only contributed to the credit crunch by imposing a cost on banks, but it also discouraged lending by imposing relatively higher costs on lending than on investing in securities. Most discussions of the cost of the regulatory burden treat the cost as a lump-sum tax that must be paid by the bank. A lump-sum cost would not affect the banks' decisions to lend relative to invest in securities.

In reality, many regulatory requirements impose a greater burden on lending than on investing in securities. For example, regulatory requirements for frequent appraisals on real estate loans impose a cost on a type of loan that is not imposed on securities. If compliance costs are directly related to lending, then the regulatory

[12] *If the regulatory burden had been imposed on a healthy, thriving banking industry, then it still would have had a negative effect on lending. The effect might not have been as noticeable. It might have been the difference between slower credit growth instead of credit contraction. In either case, the effect of the regulatory burden might be equal, but in a healthy banking industry it would be offset by capital growth.*

Table 2
Cost of Regulatory Burden

Group conducting the study	Estimated annual costs for 1992 (billions of dollars)	Cost as a percent on noninterest expenses[1]
FFIEC[2]	7.5 to 17	6% to 14%
ABA[3]	10.7	10%
McKinsey	10.4*	8.1%
IBAA[4] Grant Thorton	11.1	8.7%

*Estimated value based on 1992 total noninterest expense of $128 billion.

[1] Costs do not include the opportunity cost of holding required reserves that are not bearing interest.
[2] Federal Financial Institutions Examination Council (FFIEC).
[3] American Bankers Association (ABA) estimate does not include the cost of deposit insurance premiums, which could raise their ratio by 5.3 percentage points based on the McKinsey & Co. study, and does not include the costs of FDICIA, which McKinsey & Co. estimates to be at least 1.5 percentage points.
[4] Independent Bankers Association of America (IBAA).

SOURCES: FFIEC; ABA; McKinsey & Co., Inc.; and IBAA.

burden will discourage lending even after the banks have replenished their capital.

A third way that regulation might reduce lending is through mandates for direct credit allocation. Through the CRA, Congress has sent a message to banks and bank regulators that it wants increased lending in lower income neighborhoods. If banks are required to lend more to lower income borrowers, then they will reduce their lending to other borrowers (Gruben, Neuberger, and Schmidt 1990), and they may reduce their total lending and increase investment in Treasury securities (Wood 1991). Borrowers from higher income areas could perceive this shift as a constraint on credit availability.[13]

This analysis is based on the following assumptions:

1. that banks are judged for CRA compliance by the percentage of their loan portfolio that is lent in lower income areas;[14]
2. that bankers are adverse to taking risk; and
3. that bankers believe loans in lower income neighborhoods are riskier than loans in higher income neighborhoods.

If the cost of failing to comply with CRA is substantial, then banks will raise the proportion of lower income loans in their loan portfolio. As banks hold more of the riskiest assets, bankers balance their portfolio's risk exposure by investing more in risk-free Treasury securities, and total lending declines. In an extreme case, banks may even decrease their loan portfolios so much that the lower income group receives fewer total loans than previously, even though their proportion of the loan portfolio has risen.

Consequently, the enforcement of CRA, while achieving certain goals, is an example of how regulatory burden can reduce total lending through three different mechanisms. First, by imposing compliance costs, such as those for record keeping, regulation can reduce net income and slow

[13] The reduction in lending to other borrowers would be especially severe if banks are operating at the minimum acceptable levels of capital. If banks had excess capital, then increased mandated lending to one group of borrowers might not affect credit availability to other borrowers.

[14] Currently, banks' CRA compliance is judged on the basis of making a good faith effort to serve the credit needs of low-income communities within their markets.

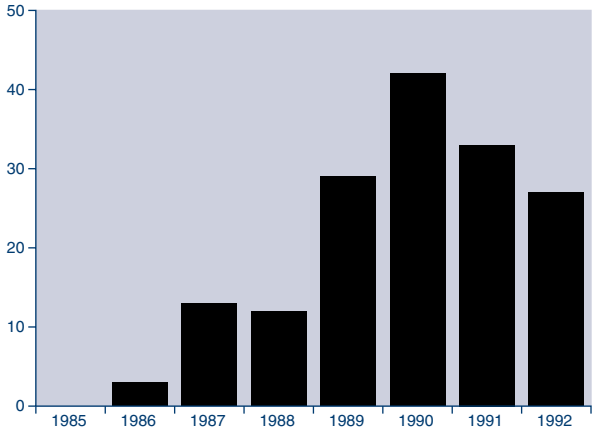
the rebuilding of capital. Second, by imposing costs on lending, such as those for geographic loan coding, that are not imposed on investing, regulation can discourage lending and encourage investment in securities. Third, the direct allocation of loan portfolio shares into loans that are perceived to be riskier can lead banks to balance their overall risk by reducing total lending.

Cost of increased legal exposure

Lender liability lawsuits. Lender liability is a growing concern and an important risk exposure for banks. Bankers' increasing concern over these issues can be demonstrated by the rise in the number of citations of "lender liability" in the *American Banker* over the past seven years (*Figure 1*). The sharp rise in citations that began in 1986 is a clear indicator of bankers' interest and concern. The timing of the increase is likely related to a 1985 case on wrongful termination of credit.

One of the biggest legal problems for banks is that uncertainty in the law makes it difficult to determine what actions create liability. Uncertainty raises the risk of extending loans, because banks are unable to estimate their exposure to lawsuits. Increased risk discourages lending and exacerbates problems in credit availability.

Figure 1
Number of Articles on "Lender Liability" in the *American Banker*



SOURCE: Federal Reserve Bank of Dallas.

A major area of concern for bankers is potential liability for environmental cleanup costs of property belonging to the banks' borrowers. Banks' environmental liability arises from several sources —the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA, or the Superfund law), the Resources Conservation Recovery Act (RCRA), and other state and federal environmental laws.

Banking environmental litigation often concerns CERCLA provisions that make owners or operators of contaminated properties responsible for environmental cleanup, even if they did not cause the contamination. CERCLA contains an exemption for creditors that take ownership in a foreclosure (Scranton 1992). An interpretation by the courts, however, left banks susceptible to liability for conducting ordinary banking activities (Garsson and Kleege 1991).

Bankers objected to this interpretation, which made foreclosures especially risky. A bank implicated under CERCLA faces liability for claims limited only by the total cost of the cleanup, possibly billions of dollars. The size of the bank's loan to the owner or operator of the contaminated property does not limit the bank's total exposure to claims (Kleege 1992). The Environmental Protection Agency (EPA) has settled with banks for smaller amounts, but as American Bankers Association associate counsel Thomas J. Greco notes, "If a bank hasn't done anything, why should it be paying anything at all?" (Kleege 1991a).

Some relief has been given. The EPA has written new rules that define the terms when a bank is liable for cleanup costs. These new rules, however, have not been fully challenged in the courts, and attempts to make the rules into law have been unsuccessful in Congress.

Requiring banks to pay for property contamination cleanup expenses has contributed to the credit crunch. The cost of screening loans for environmental risks discourages lending. Banks shy away from extending loans to businesses that utilize hazardous materials. Many of these businesses are small, local businesses such as dry cleaners, funeral parlors, gasoline stations, and farms (Garsson and Kleege 1991). Knowledge or fears about environmental liability can halt loans to businesses of any kind, if bankers have reason to suspect contamination (Kleege 1990). Beyond legal liability, the

bank is not protected from the borrower reducing the value of the collateral through pollution.

Environmental issues are not the only ones that can land banks in court. Banks face legal liability in providing many banking services. With regard to their borrowers, banks can be sued if they exercise excessive control over borrowers or if they wrongfully terminate credit. In addition, banks can be sued under the Racketeer-Influenced and Corrupt Organizations Act of 1970, also known as the RICO Act, which was originally designed to attack organized crime.

The issue of excessive control dates to a 1984 Texas court decision that established limits as to what direct influence a bank can exert over its borrowers. The effect of this decision is best summarized by A. Barry Cappello, a lawyer specializing in lender liability, who said, "Whenever a lender has anything other than an arm's-length relationship with its borrower, the potential for liability exists" (Adkins 1992).

This decision has discouraged lending in at least two ways. First, lending is now riskier because banks are more limited in the actions they can take to enhance the probability of repayment and protect their collateral. Second, the cost of defending against such suits and the possible damages that must be paid are costs to supplying credit and must be factored in the bank's pricing. As a result, the amount of credit a bank is willing to supply at any given price is reduced.

Legal exposure for the wrongful termination of credit was a problem for banks in the mid-1980s, but it has diminished in recent years. Court rulings had made it no longer sufficient merely to stay within the terms of the loan agreement; banks had to show reasonable cause. In recent years, however, the courts have allowed banks to enforce the terms of a loan agreement without imposing additional requirements. The timing here is important. Even if this legal issue has diminished in importance in recent years, it could have contributed to the Texas credit crunch that began in 1985.

Though the RICO Act was passed in 1970, it did not become a problem for bankers until 1985, when the Supreme Court expanded RICO to include banks. The RICO designation permits the plaintiff to ask for treble damages. RICO is yet another example of an increase in lender liability that occurred in the mid-1980s. Protecting against such lawsuits is costly and discourages lending. In contrast, no one has ever been sued by the federal government for buying Treasury securities.

Regulator lawsuits. In the 1980s, financial institutions failed for a variety of reasons, only some of which might be considered criminal. Some thrift and bank managers were guilty of criminal misconduct because of insider dealing or other fraudulent acts. Many other banks and thrifts failed because they made mistakes in their loan decisions. Often these mistakes were only apparent after the fact and could not necessarily have been foreseen at the time the loan was approved.

The FDIC, however, has reacted to the bank failures with scores of lawsuits against bank officers and directors. These lawsuits serve two purposes for the FDIC. First, the lawsuits seek to collect on the director and officer insurance banks routinely purchase, shifting a portion of the costs to the private insurance industry. Second, these lawsuits tend to focus attention on the industry's responsibility for the problems.

In the 1990s, the FDIC has attempted to raise the acceptable standard for bank officers' and directors' behavior. Under the proposed standard, a bank failure in the normal course of business would be evidence of simple negligence, and the FDIC would sue for damages. The courts have failed to accept this new standard (Rehm 1993).

These lawsuits contribute to the credit crunch. Bank officers and directors are encouraged to be more cautious in assessing risk and return tradeoffs. Directors and officers are expected to avoid ex post any risk that resulted in a loss to the bank. Of course, the best way for a bank to avoid risk is to avoid lending, an inherently risky activity.

These lawsuits also increase the difficulty of recruiting highly competent individuals for positions on banks' boards of directors. High-quality directors monitoring bank management reduces regulators' burden monitoring the industry. Furthermore, these lawsuits have resulted in higher premiums for directors' and officers' insurance for nearly all banks. These higher costs must be factored into loan pricing.

Conclusion

Sometimes, six observers can find six different causes for a single problem, and they can all be

right. The credit crunch is an example. The credit crunch is the result of multiple factors adversely affecting banks' ability to supply credit at a time when banks' ability to adjust to these factors was unusually limited.

Increased lending is limited to some degree by the necessary rebuilding of banks' capital positions. The drains on capital in recent years have been substantial. Loan losses have directly reduced capital at the banks experiencing the loss; recycling the assets of failed banks and thrifts also created a huge need for additional capital; and following an atypically severe economic contraction, both regulators and bankers appear to have raised the acceptable minimum capital levels and credit standards.

The costs of lending have also risen substantially over this time period. The resolution of failed banks and thrifts destroyed valuable information. The perception of an overreaction by bank examiners has raised the expected cost of funding lending activity. Regulatory burden and increased exposure to legal liability has raised the cost of doing business for banks. By decreasing net income, these costs compound the problem of raising capital through retained earnings, and in many cases, these costs skew the cost of extending loans relative to investing in securities.

Since there are multiple causes of the credit crunch, the solutions to the credit crunch need to be multifaceted. Some causes are temporary in nature and will correct themselves over time. Other causes, however, are structural and will not be eliminated with economic recovery. Some causes are the unintended side effects of policies addressing other societal problems. Simply addressing the financial condition of the banks is unlikely to generate a quick solution. Many healthy banks in Texas have declined to increase their lending in the first five years of the regional economic expansion. While it is beyond the scope of this article to propose solutions, solutions need to be found. Many of the causes of the credit crunch are the result of policies addressing other problems, such as bank failures, community development, credit discrimination, and access to the courts. The positive outcome of these policies must be carefully weighed against the economic consequences of inhibiting the flow of credit and slowing economic growth and job creation.

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America's Health Care Problem: An Economic Perspective

Health care expenditures in the United States are expanding rapidly. Real per capita expenditures on health care more than doubled over the period 1970–90.[1] Real expenditures for health care are now growing nearly 4 percent per year, while real expenditures on other consumer goods are growing only 2.5 percent per year.[2] Furthermore, health services grew more than twice as fast as any other major industry during the recent recession. If expenditures continue to grow at the current rate, health care will represent a larger share of the United States' gross domestic product (GDP) than manufacturing by 2000.[3]

The explosive growth in health care expenditures concerns many Americans. Citizens fear that they will be priced out of the market for health care. Business people worry that rising health care costs will reduce the international competitiveness of U.S. corporations. Politicians worry that rising bills for health care programs like Medicare and Medicaid will force the government to raise taxes or run increasingly large deficits.

The widespread concern has led to demands for substantial reform of the U.S. health care system. Some groups call for controls on health care prices. Others want to reform the insurance industry. There are plans that call for managed competition and plans that eliminate competition by making the government the sole provider of health services. There are almost as many plans as there are interested parties.

However, before we can fix the system, we have to know what parts of it are broken. If the increase in health expenditures reflects distortions in demand, then we should focus on reforming consumer incentives. If distortions in supply fuel the expenditures increase, then we should respond with policies that affect suppliers. If the increase in health expenditures reflects shifts in market fundamentals—for example, the increasing health care demands of an aging population—then economic analysis suggests that the system does not need fixing, and we should leave it alone.

Why is everyone so concerned?

Until recently, health care costs were not a major concern of most Americans. Surveys on the top problems facing the United States in 1984 did not even mention health care.[4] Today, however, reforming the health care system is one of the primary objectives of state and federal governments.

A look at health care prices suggests one reason for this change in perspective. As Figure 1

Our thanks to Zsolt Becsi, Steve Brown, and Mark Wynne for their comments and suggestions.

[1] *Levit et al. (1991).*

[2] *Based on data from the U.S. Department of Commerce, Bureau of Economic Analysis.*

[3] *Based on data from the U.S. Department of Commerce, Bureau of Economic Analysis.*

[4] *For example, see the reader survey in* Tift *(1984).*

indicates, health care prices increased at roughly the same rate as the general price level until the early 1980s. After the mid-1980s, however, the medical care component of the consumer price index shot upward. By 1992, medical care prices were increasing at more than twice the rate of inflation.[5]

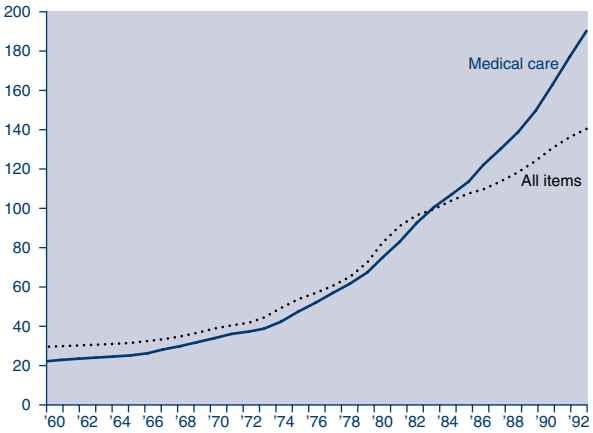
This sharp increase in health care prices has led consumers to fear that they are being priced out of the market for health care. Publicity on the 35 million uninsured Americans lends credibility to those fears.[6] Because many Americans view health care as essential, the prospect of being unable to afford it frightens them.

Rising health care prices also concern business because employers pay a large proportion of the Medicare and Medicaid taxes and 64 percent of private insurance premiums.[7] Wage and price controls during World War II encouraged employers to provide fringe benefits such as health insurance in lieu of wage increases. The tax-exempt status of fringe benefits led many employers to continue the practice after the controls were removed. Therefore, much of the increase in health care expenditures is a drag on the balance sheets of American employers.

Furthermore, government is concerned about increasing health care costs. Federal expenditures for Medicare, which finances health care services for the elderly, and Medicaid, which finances health care services for the poor and disabled, have been growing more than 10 percent per year since 1985.[8] The Congressional Budget Office estimates that health spending consumed 15 percent of the federal budget in 1992 and will consume 28 percent of the federal budget by 2002.[9]

Figure 1
Consumer Prices

Index, 1982–84 = 100



SOURCE: U.S. Bureau of Labor Statistics.

Ultimately, however, consumers bear the burden of increases in health care spending. Much of the increase in employer health costs is passed along to employees in the form of lower wages (see the box entitled "Health Care Costs and Profitability"). The increase in government health costs is passed along to citizens in the form of higher taxes or fewer alternative services. Therefore, consumers would be the primary beneficiaries of health care reform.

Sources of increasing health care expenditures

It is possible to determine the best way to reform the health care system using the basic principles of supply and demand. If no distortions exist, the health care market achieves the optimal resource allocation for a given income distribution. The increase in health care expenditures then reflects either an increase in the public's desire for health services or an increase in legitimate costs. Under these conditions, if society is unhappy with the allocation, the best solution is to redistribute income without meddling in the health care market.

[5] *The medical care component of the consumer price index may mismeasure medical inflation somewhat, because it is difficult to adjust properly for changes in medical technology and the quality of care. However, it undoubtedly influences the public's perceptions of health care prices.*

[6] *Garrison (1990).*

[7] *Levit and Cowan (1991).*

[8] *Levit et al. (1991).*

[9] *Burman and Rodgers (1992).*

Health Care Costs and Profitability

Businesses pay most of the nation's health bills, but the effect of increasing health care costs on profits is not straightforward. Although increases in health costs for retirees would have a negative effect on firm profitability, increases in health costs for current employees can have a positive effect on firm profitability.

The health care costs of current workers are part of a total compensation offer that is determined by the worker's contribution to the firm's output. As long as the worker's productivity is unaffected by increases in health care costs, the amount of total compensation the firm is willing to offer is unaffected by increases in health costs. Therefore, increases in health costs should be offset by decreases in wages to keep the total compensation package unchanged.

Furthermore, the increase in health care costs increases the value to employees of the tax exemption for fringe benefits. The advantages of being employed by a firm that offers health benefits increase, so more workers are attracted to such firms. As the supply of labor offered to firms that provide health benefits increases, the total price those firms must pay for it decreases, and those firms' total compensation costs can fall. Therefore, firms that offer health insurance as a fringe benefit to their employees can be made better off—not worse off—by the increase in health costs.

Unfortunately, the savings on total compensation for current employees can be more than offset by increased costs for the health care of retirees. After all, the increases in health costs for retirees cannot be offset by decreases in wages. The problem has become particularly evident recently as accounting rule changes have forced firms to indicate their commitments to retiree benefits on their balance sheets. For example, General Motors was forced to record a $22.2 billion charge in 1992 for retiree and future retiree health costs.[1] Firms that respond to the increase in health care costs by modifying or eliminating health care coverage for the retired may face increased wage demands by current employees who fear being treated in a similar way when they retire.

[1] *Dallas Morning News* (1993).

However, if the health care system is distorted, reform is needed to eliminate the distortions.

We have identified several distortions in the current system of health care. First, tax subsidies for employer-provided health insurance lead to excess demand for health insurance and, consequently, to excess consumption of health care. Second, regulations and industry practices restrict the supply of health care professionals, leading to higher prices for health services. Finally, the structure of the health insurance industry promotes inefficiency. These distortions of both supply and demand lead to excessive expenditures on health care.

Expenditures also are increasing for several reasons that are nondistortionary. These reasons include uncertainty about causes and appropriate treatments for health problems, changes in population demographics, and society's reluctance to place limits on the value of human life.

The implicit tax subsidy for health insurance

For nearly fifty years, employer-provided fringe benefits have been exempt from both personal income taxes and payroll taxes such as those for Social Security. Thus, employees avoid taxes by taking some of their compensation in the form of health insurance. If the combined marginal tax rate is 28 percent, an employee can receive $1's worth of health care instead of 72 cents' worth of after-tax take-home pay (*Table 1*). The difference represents an implied tax subsidy. As Table 1

Table 1
The Subsidized Price of Health Care

Wage	Income tax (percent)	Effective marginal tax rate* (percent)	Price of health care in terms of take-home pay
$1	0	14	$.86
$1	15	28	$.72
$1	28	40	$.60
$1	33	45	$.55

*Effective marginal tax rate equals share of the last dollar of monetary compensation paid in federal taxes and includes both payroll and income taxes.

indicates, those in the highest tax bracket receive the largest tax subsidy, while those in the lowest tax bracket receive a much smaller subsidy.[10]

Because employees will naturally buy more health insurance at 72 cents than at $1, excluding health-related fringe benefits from taxable income increases expenditures on health insurance by those receiving the subsidy. Burman and Rodgers (1992) estimate that the subsidy costs the federal government $65 billion per year in foregone revenue and increases private health insurance spending by roughly one-third.

Excessive consumption of health insurance has a number of disquieting consequences. First, because health insurance leads to increased consumption of health care, excessive consumption of health insurance produces excessive consumption of health care. (For a discussion of the ways in which health insurance increases health care consumption, see the box entitled "The Relationship Between Health Insurance and Health Care Consumption.") Second, overconsumption of health insurance by those receiving the implicit subsidy increases the insurance premiums of the unsubsidized and may cause some consumers to be underinsured. Finally, excessive health insurance distorts medical research in favor of technologies that extend or improve life at any price rather than technologies that reduce the costs of treatment.

By its nature, health insurance makes consumers less sensitive to health care prices, thereby generating more expenditures on health care than would otherwise occur. Given this relationship, excessive insurance consumption necessarily leads to excessive health care consumption. Phelps (1992) estimates that annual health care expenditures are between 10 percent and 20 percent higher because of the subsidy.

By leading to excessive health care expenditures, the tax subsidy also can exacerbate the problem of the uninsured. Because the subsidy increases demand for health care, health care prices rise, putting upward pressure on health insurer costs. Higher payouts result in higher insurance premiums. Thus, the subsidy distorts the distribution of health insurance so that higher income households overconsume health insurance, while lower income households can be priced out of the market for health insurance and health care.

Overconsumption of health insurance also plays a role in directing technical progress in health care and has reinforced the development of costly technologies. Contrary to conventional wisdom, technological improvements in health care generally have not lowered costs. Rather, technological innovations have brought about a higher quality

[10] *Residents of cities and states with income taxes receive additional subsidies because their fringe benefits are also exempt from local income taxes.*

The Relationship Between Health Insurance and Health Care Consumption

Substantial research indicates that as the price to consumers decreases, health care consumption increases (Long and Rodgers 1990, Phelps 1992, Keeler and Rolph 1988, Manning et al. 1987). According to the Rand Health Insurance Experiment, the price elasticity of demand for health care is –0.2 (Keeler and Rolph 1988, Manning et al. 1987). In other words, every 1 percent decrease in consumer prices for health care increases health care consumption by 0.2 percent.

Insurance reduces the consumer's effective price of health care in two ways. First, because health insurers typically pay for health treatments rather than for health losses, insurance lowers the marginal price of treatment. If a consumer is fully insured (and, therefore, pays none of the billable costs of treatment), then the marginal cost of health care becomes the opportunity cost of the consumer's time. If a consumer is co-insured, then the marginal cost of treatment becomes a predetermined fraction of the treatment cost, plus the consumer's opportunity costs. For example, with a copayment of 20 percent, a $10 prescription antihistamine costs the consumer only $2. In either case, health insurance effectively reduces the consumer's marginal cost of health care.

Second, because health insurance premiums are only loosely connected to claims, insurance insulates people from some of the costs of their decisions. Theoretically, insurance premiums, which reflect expected losses, are a function of health risk and the extent of claims. In such a case, consumers have incentives to limit their health care consumption and submit only those claims that are worth the resulting increase in premiums. In practice, however, an individual in a large health insurance plan pays an average premium that is almost independent of the individual's risk or health care consumption. Hence, consumers do not bear the full costs of their decisions about the extent of claims.

Furthermore, the loose connection between premiums and claims in health insurance exacerbates problems of moral hazard. Moral hazard arises when insurance changes the insured's behavior in a way that increases claims. For example, people who are insured and who, therefore, know that they will bear only part of the cost of illness, may not be as careful of their health as people who are not insured. Individuals will have no incentive to curb unhealthy behavior if increased claims are not reflected in higher premiums, especially if behavior cannot be easily monitored.

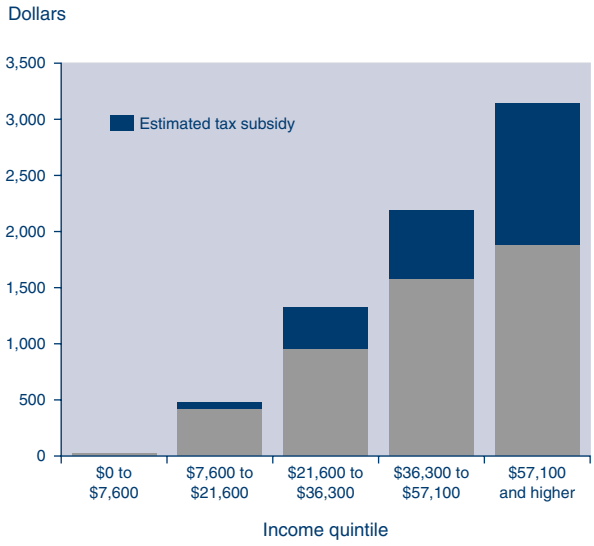
Thus, health insurance increases expenditures on health care. In the Rand experiment, fully insured individuals spent 30 percent more on outpatient services than individuals with a 25 percent copayment. In turn, individuals with a 25 percent copayment spent 28 percent more than individuals with a 95 percent copayment (Manning et al. 1987).[1]

[1] Both co-insurance programs had an annual cap on out-of-pocket expenses.

product, which is most often more expensive than the older product. Weisbrod (1991) finds that our system of pricing (that is, paying the health care provider based on costs incurred or on a fee-for-service basis) has led the research and development sector to develop new technologies that enhance the quality of care irrespective of cost rather than the cost-effective technologies that probably would develop if consumers were more sensitive to health care prices.

One could argue that the tax subsidy is necessary because without it, poor people would receive less medical care and there would be greater public health risks from communicable

Figure 2
Average Employer-Provided Health Benefits



SOURCE: U.S. Department of Commerce, Bureau of the Census.

diseases such as tuberculosis. However, the progressive nature of the income tax code negates those arguments. As Figure 2 indicates, high-income households receive a greater health insurance subsidy than low-income households. Households that fall in the lowest income tax bracket receive a small subsidy because health benefits are exempt from Social Security and other payroll taxes. Meanwhile, some of the households in the highest income tax bracket receive a federal subsidy of nearly 50 percent when both income and payroll taxes are considered. In combination with an exemption from state taxes, high-income households in high-tax states receive an even larger subsidy. There is little risk that high-income households will not be able to afford insurance and no obvious consensus that these groups deserve public assistance.

Supply constraints

Numerous restrictions on entry to the health care profession distort health care supply and lead to higher consumer prices. These restrictions include limits on access to medical training, licensing and certification requirements for doctors, and work rules that exclude paraprofessionals from performing many medical tasks. The restrictions are ostensibly designed to protect the consumer by increasing the quality of the health care product. Studies have shown, however, that regulations that limit supply do not always lead to higher quality and tend to increase expenditures because they increase incomes in the profession.

People who want to become doctors must first gain entry into an accredited U.S. medical school. Doctors who train at nonaccredited schools or in other countries frequently are not permitted to practice medicine in the United States. The market for medical training is monopolistic, and the number of medical school applicants greatly exceeds the number of openings at accredited schools. Each year since 1960, medical school applications have exceeded classroom openings by at least 50 percent (Association of American Medical Colleges 1993, Table B–1). In the 1992–93 school year, there were two applicants for every opening. Restrictions on the supply of medical training necessarily restricts the supply of physicians. Assuming that those students who were not accepted into medical schools were only 50 percent as likely to complete their education as those who were accepted, the restriction reduces physician supply by approximately 30 percent.

Once physicians have graduated from medical school, they face additional restrictions imposed by state and local agencies. States have licensing and regulatory agencies or boards that regulate the medical profession. The agencies establish the minimum level of education and experience required to practice, define the functions of the profession, and limit the performance of certain functions to licensed professionals. Restrictions include the use of trade names, restrictions on branch offices and location of offices, and, until 1977, a ban on advertising (Haas–Wilson 1992).

Many studies have shown that occupational licensing leads to lower consumer welfare and higher incomes in the licensed profession. Economic theory suggests that self-licensing by the medical profession leads to economic rents (Friedman 1962 and Stigler 1971). Leland (1979) finds that although minimum quality standards may be desirable in markets in which suppliers have more information than consumers, the minimum quality standards set by the medical industry may be too high. Chan and Leland (1982) show that when both price and quality are hard to observe, uninformed

consumers may pay a higher price and receive a lower quality of goods. Haas–Wilson (1986) finds that increasing the restrictiveness of optometrists' licensing examinations increased the price of eye exams and eyeglasses significantly but had an insignificant effect on the quality of the eye exams.

Whenever entry into a market is artificially constrained, either through restricted access to medical training or through obstacles such as licensing and certification, consumer prices are inefficiently high. Therefore, restrictions on entry into the health care profession, together with work rules that prevent competition within the profession between physicians and less-expensive paraprofessionals, increase medical costs.

Relaxing some of the restrictions on entry into the medical profession should make consumers better off. Shaked and Sutton (1981) show that granting monopolistic powers to the self-regulating profession is likely to be welfare-reducing and that the entry of paraprofessionals would be welfare-improving. Moreover, the size of the paraprofession that leads to the greatest improvement in welfare is the size that leads to the greatest income loss for members already in the profession. Evans and Williamson (1978) estimate that in Ontario, Canada, a dental care system that made optimal use of paraprofessionals could reduce the cost of care by 30 percent to 40 percent. More recent studies on restrictions in the dental profession (Liang and Ogur 1987) estimate that state restrictions on the number of auxiliaries a dentist can hire and the functions they may perform cost consumers $700 million in 1982.

Counter to the principles of supply and demand, there are some who assert that an increase in physician supply would, in fact, cause higher prices. They cite the phenomenon that doctors charge higher fees in communities with high physician-to-patient ratios than they charge in communities that are less well supplied, even after adjusting for input cost differences.

However, there is no need to suspend the laws of supply and demand to explain this phenomenon. Where there is a greater density of physicians, there also may be a greater degree of specialization and nonprice competition. Physicians segment a large market and respond to a greater variety of needs and preferences by treating fewer patients but charging higher prices.[11]

Inefficiencies in the insurance industry's structure

Another distortion in the health care system arises from the structure of the insurance industry. The market for health insurance is dominated by noncompetitive firms. Medicare and Medicaid, which represent 57 percent of the insurance market, are government entities.[12] Furthermore, much of the private market for health insurance is dominated by not-for-profit groups like Blue Cross and Blue Shield. Only 30 percent of the health insurance market is served by for-profit commercial insurers. Without the discipline of competition, the market for health insurance is inefficient and encourages higher health care costs.

Considerable economic research indicates that government agencies are, in general, inefficient (Breton 1974, Downs 1967, and Tullock 1965 and 1967). According to Niskanen (1971), government agencies are more likely to try to maximize the size of their budgets than to maximize profits because budget size is a mark of the power and prestige of the agency. Among other bureaucratic goals are salaries, office perks, and patronage. Weatherby (1971) cites the expansion of personnel as a goal pursued by bureaucrats. Borcherding's (1977) and Spann's (1977) findings on the growth of government and lack of productivity growth are consistent with Niskanen's theory. Since agencies have to return any unused moneys to the U.S. Treasury, they are not residual claimants on cost savings in the budget and have few incentives to cut costs. There is no reason to believe that Medicare and Medicaid administrators behave differently than other bureaucrats.

Like government agencies, not-for-profit firms also face incentives to behave inefficiently. (Alchian and Demsetz 1972, Eisenstadt and Kennedy 1981, and Sindelar 1988). Nonprofit health insurers have incentives to dissipate any potential profits through excess payments to doctors and

[11] *Phelps (1992, 202).*

[12] *U.S. Bureau of the Census (1992).*

hospitals, unusually generous insurance coverage, or artificially low insurance premiums. Sindelar (1988) finds that, unlike for-profit insurers, Blue Cross and Blue Shield plans (the Blues) do not respond to market forces by changing the price of health insurance (measured as the ratio of premiums to benefits). In particular, Sindelar finds that administrative costs for the Blues increase as the size of the typical insurance claim increases, suggesting that the Blues do not take advantage of economies of scale that are exploited by commercial insurers.

In most industries, the existence of a competitive fringe of efficient firms would discipline the inefficient nonprofit firms (Baumol, Panzar and Willig 1988; Caves and Christensen 1980). However, in the insurance industry, inefficient nonprofit insurers receive tax advantages not available to for-profit insurers. Most states tax the insurance premiums of for-profit insurers, while they exempt the premiums of nonprofit insurers or tax them at lower rates. Eisenstadt and Kennedy (1981) find that Blue Shield plans were less efficient in states where the plans had a tax advantage than in states where they did not.[13] According to Eisenstadt and Kennedy, "the regulatory advantages given to the 'blues'...allow inefficient behavior to be maintained."[14]

One could argue that nonprofit insurers should receive tax advantages because they generally accept customers with preexisting conditions that other insurers consider uninsurable. However, society could subsidize insurance for individuals with preexisting conditions without requiring that the insurer be a nonprofit organization. For example, the government could provide Medicare and Medicaid recipients with the resources to purchase private insurance rather than providing the insurance itself. There is no need to finance an inefficient market structure.

Nondistortionary sources of increasing expenditures

In addition to the distortions, a number of nondistortionary factors lead to higher health care expenditures. Uncertainties on the part of both physicians and consumers as to the nature and causes of health problems lead to more health care consumption than would occur if all information were freely available. However, information is not free, and some of these expenditures are the natural result of optimization under uncertainty. Other nondistortionary factors that contribute to higher expenditures include changes in the demographic composition of the U.S. population and the nearly infinite value placed on human lives.

Uncertainty has a major influence on medical decision-making. Doctors and patients have incomplete information about causes and cures for many health problems. Phelps (1992) shows that there is substantial disagreement and uncertainty within the medical profession about the marginal productivity of alternative medical treatments. Uncertainty about the optimal course of action for various health problems, together with consumers' distaste for taking risks with their health, leads to increased testing and treatments and, therefore, higher health expenditures.

Further, because patients lack the information to reliably judge medical care quality, they must rely on their doctor's advice and judgment. But much like an auto mechanic, the doctor has incentives to provide (and bill for) more services than absolutely necessary and to provide those services with less than maximum effort. Economists refer to these situations as principal–agent problems. The usual solution to such problems is a contract that provides the agent (in this case the health professional) with incentives to behave optimally and a mechanism for monitoring the agent's compliance with that contract. The mechanism to monitor doctors' behavior and provide incentives for optimal performance is the malpractice suit.

Unfortunately, asymmetric damages make malpractice suits more effective at inducing careful care than cost-effective care. After all, if the doctor orders too few tests and a patient is injured or killed, the potential damage is huge. However, if the doctor orders too many tests, the damage is

[13] *Inefficiency is measured by the ratio of administrative costs to premiums. Both administrative costs and premiums are expressed as net of premium taxes, if any.*

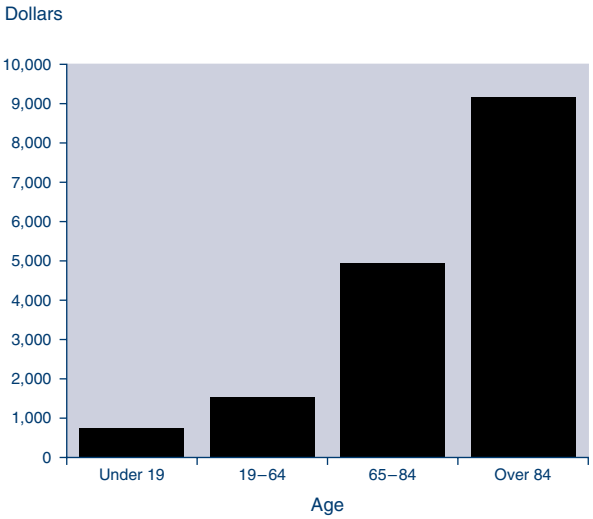
[14] *Eisenstadt and Kennedy (1981, 27).*

limited to the cost of the tests. Whenever there is uncertainty about the appropriate number of tests, the risk-averse doctor will prescribe more tests. Thus, malpractice laws and asymmetric damages create incentives for defensive medicine—procedures designed to ward off lawsuits rather than diseases. According to the American Medical Association, defensive medicine and malpractice insurance add $36 billion to the nation's medical bills each year.[15]

In addition to uncertainty, the changing demographics of the U.S. population also contribute to increases in health care expenditures. Per capita health care expenditures increase with both age and income. For example, consumers 65 and over consume more than three-and-one-half times as much health care as consumers ages 19 to 64 (*Figure 3*). The aging of the population is expected to explain one-seventh of the increase in health care expenditures over the 40 years from 1990 to 2030.[16] Furthermore, real U.S. income per capita has grown 2.2 percent per year over the past three decades, and as populations grow wealthier, they consume more of all normal goods, including health care. Simple regression analysis suggests that one-quarter of the increase in per capita health expenditures over the period 1960–90 can be explained by these two demographic factors.

Finally, the high value we place on human life leads to higher expenditures in the health care system. Because most consumers would be willing to spend huge amounts to avoid dying, insured consumers will demand any treatment, however costly, that will prolong a patient's life. The Council of Economic Advisers (1993) estimates that the 5 percent of beneficiaries who are in the last year of their lives consume 29 percent of the Medicare budget.

Figure 3
Per Capita Health Care Expenditures by Age, 1987



SOURCE: U.S. Bureau of Labor Statistics.

Summary and conclusions

Health care expenditures in the United States have expanded rapidly in the past twenty years. This growth in expenditures concerns business people, politicians, and individual consumers of health care, although most of the burden falls on the consumer. Hence, health care reform has become a primary objective of policymakers.

Increasing expenditures for health care are not a problem when they reflect consumer demands for health care in an undistorted market, and some of the recent increases clearly represent the demands of an aging and increasingly wealthy population. However, we have identified a number of distortions in the health care market that have a substantial impact on health care expenditures. The personal income tax code subsidizes health insurance consumption, thereby fostering excessive consumption of health care. Tax exemptions for nonprofit insurers and restrictions on the supply of health services also lead to higher costs.

To be effective, health care reform must address these distortions in the health care system. Eliminating the tax subsidy for employer-provided health insurance, reducing the tax advantages of nonprofit insurers, and reducing the restriction on health care providers would go a long way toward eliminating America's health care problem. Only after these distortions are removed can the economy achieve an efficient allocation of health resources.

[15] *Felsenthal (1993).*

[16] *Council of Economic Advisers (1993).*

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Rethinking the IS in IS–LM: Adapting Keynesian Tools to Non-Keynesian Economies

Part 1

This article attempts to narrow the gap between two macroeconomic paradigms by showing that, in modified form, a graphical tool taken from one of these paradigms can be used to analyze models drawn from the other. The two paradigms are the Keynesian and real-business-cycle approaches to macroeconomics. The graphical tool is the IS–LM diagram.

The IS–LM diagram was originally developed by Hicks (1937) as a graphical representation of ideas put forth by Keynes in his *General Theory*. Not surprisingly, given its origins, the IS–LM diagram has come to be associated with traditional Keynesian macroeconomic analysis—analysis that treats household expectations as either irrelevant or exogenously determined and in which prices fail, in the near term, to clear the markets for goods and for labor. Not all Keynesians are comfortable with the assumption that households are myopic. Nevertheless, the IS–LM diagram remains the graphical framework of choice among those who treat sluggish price adjustment seriously.[1] Expectations have usually been incorporated into textbook IS–LM analysis in only the most rudimentary way.

Given its pedigree, the IS–LM diagram would seem ill-suited to analyzing an economy like that described by Barro (1990), in which prices adjust instantaneously to clear all markets, households are forward-looking, and macroeconomic fluctuations are due solely to shocks to tastes, technology, and government purchases. The point of this article, however, is that household myopia is not an essential component of the IS–LM framework. Once this myopia is eliminated, the IS–LM framework becomes flexible enough to encompass a simple Barro-style real-business-cycle model as a special case. Furthermore, in working through the modified IS–LM model, one gains an appreciation for which of the traditional Keynesian results flow from the assumed myopia of households, as opposed to sluggish price adjustment.

No attempt is made here to pass judgment on the relative merits of alternative models; nor does this article attempt to develop new theoretical insights. The models examined are simple, comparable to those typically included in popular undergraduate textbooks. A more intellectually satisfying reconciliation of the Keynesian and real-business-cycle paradigms would move away from the assumption—maintained throughout this article—that households and firms are price takers. Until research in this direction makes further progress, any device that provides common ground for macroeconomists and policymakers with differing perspectives provides a valuable service.

Overview

The article begins with a review of how a simple market-clearing economy responds to policy and technology shocks. Then, under the assumption that people comprehend the long-run implications of such shocks, the short-run responses of

Stephen P. A. Brown, Zsolt Becsi, and Mark A. Wynne offered valuable comments and suggestions. The views expressed are not necessarily those of the Federal Reserve Bank of Dallas or the Federal Reserve System.

[1] *Examples of intermediate-level texts that rely heavily on the IS–LM model are Mankiw (1992), Hall and Taylor (1988), Dornbusch and Fischer (1987), and Gordon (1987).*

the economy to current and anticipated future changes in the money supply, government purchases, and technology are determined. The short-run analysis has two parts. The first part is a thought experiment in which the dollar price of output is held fixed at an arbitrary level and output and employment are sales-determined. It is in this thought experiment that variants of the traditional IS and LM curves play an important role in determining the level of output. While the LM curve is fairly standard, the IS curve, because it reflects the savings decisions of households, depends heavily on expectations about the future. The final step in the analysis is to determine what, in fact, the short-run equilibrium price level will be. Depending on the speed of price adjustment, results either are identical to those obtained from Barro's real-business-cycle model or are reminiscent of those obtained from Keynesian models.

The essential features of the expectations-augmented IS–LM approach can be presented in a setting that abstracts from capital investment. In models without investment, causality runs entirely from the future to the present: the current actions of private decisionmakers depend on expected future economic conditions, while future economic conditions are independent of people's current actions. This one-way causality considerably simplifies the analysis of policy and technology shocks. Accordingly, I defer discussion of macroeconomic models with investment to Part 2 of the article, which will be published in a subsequent issue of this *Review*.

Long-run equilibrium

In real-business-cycle models, the economy is assumed always to be in a full-information, market-clearing equilibrium. This section reviews how a typical real-business-cycle economy responds to technology and policy shocks. Similar, but more detailed, analyses have been presented by Barro (1990) and Barro and King (1984). Later in the article, we allow for the possibility that sluggish price adjustment or imperfect information may delay the economy's response to current shocks. Accordingly, for our purposes, it is both convenient and accurate to call the full-information, market-clearing equilibrium "long-run equilibrium."

Briefly, the analysis of this section shows that an increase in government purchases raises long-run equilibrium output and employment while reducing long-run equilibrium consumption and the real wage. An adverse technology shock reduces long-run equilibrium output, the long-run equilibrium real wage, and long-run equilibrium consumption. Its effect on long-run equilibrium employment is ambiguous. The real interest rate is determined by the requirement that aggregate saving equal zero. Monetary policy determines the long-run equilibrium price level.

The representative household. The representative household is endowed with a certain quantity of time, L. The household divides this time between market and nonmarket activities (between "labor" and "leisure"). Earnings from market activities are used to purchase output from firms ("consumption"). To maximize its total satisfaction, the household will allocate its time so as to equate the rate at which it is willing to trade leisure for consumption to the rate at which leisure and consumption trade for one another in the marketplace. Thus,

$$MRS_{lc} = w, \tag{1}$$

where MRS_{lc} denotes the household's willingness to exchange leisure for consumption (its marginal rate of substitution between leisure and consumption) and where w denotes the real wage rate. It is usual to assume that both leisure and consumption are "normal" goods, meaning that as the household's wealth increases (holding the real wage constant), the household chooses more of both. In equation 1, assuming normality is equivalent to assuming that the marginal rate of substitution is a decreasing function of leisure and an increasing function of consumption.

Graphically, in a plot with leisure on the horizontal axis and consumption on the vertical axis, the real wage is the negative of the slope of the household's budget line, while the marginal rate of substitution is the negative of the slope of the household's indifference curve map. Equation 1 says that the household selects the point on its budget line that is tangent to one of its indifference curves. See Figure 1.

The representative firm. The representative firm hires labor from the representative household and produces output, which is sold either to households or to the government. The firm finds it profitable

Figure 1
The Representative Household

The representative household chooses l units of leisure and c units of consumption.

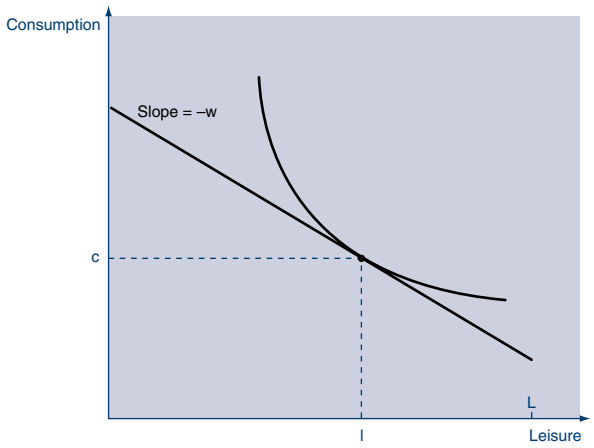
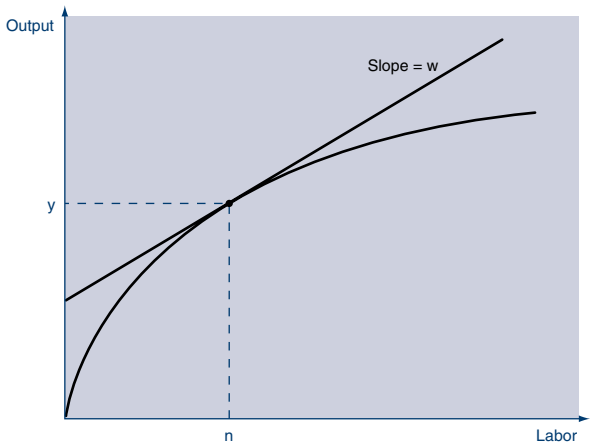


Figure 2
The Representative Firm

The representative firm hires n units of labor and produces y units of output.



to hire labor up to the point where the output produced by an additional unit of labor equals the real wage. Thus,

$$MP_n = w, \tag{2}$$

where MP_n denotes the marginal product of labor. It is usual to assume that labor is subject to the law of diminishing marginal returns: in equation 2, the marginal product of labor is a decreasing function of the hours of work purchased by the firm.

Graphically, equation 2 says that the firm will operate at that point on its production function where the slope of its production function equals the real wage. See Figure 2.[2]

The government. The government purchases output from firms, financing its spending with lump-sum (that is, nondistortionary) taxes. For simplicity, changes in government purchases will be assumed to have no effect on household preferences for private consumption and leisure and to have no effect on the production technology. As a practical matter, these simplifying assumptions mean that fluctuations in government purchases are probably best interpreted as the counterpart to threat-offsetting changes in real-world military spending.

Equilibrium. Figure 1 depicts the optimum of the representative household in a plot of consumption against leisure. Figure 2 depicts the optimum of the representative firm in a plot of output against labor. Leisure and labor are related to one another by the equation

$$n = L - l, \tag{3}$$

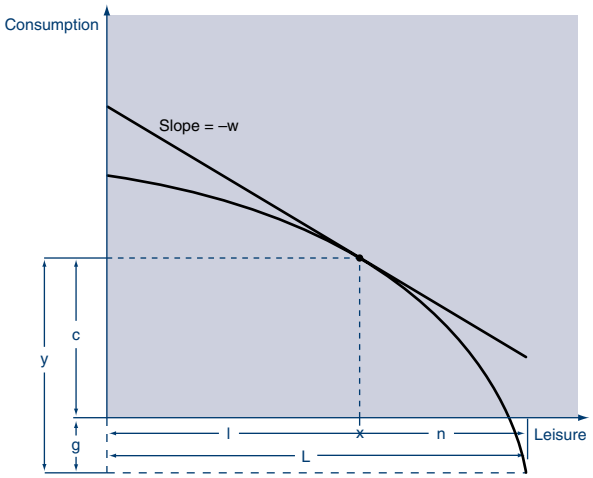
where n and l denote hours of work and of leisure, respectively. Output and consumption are related to one another by the equation

$$y = c + g, \tag{4}$$

where y, c, and g denote output, consumption, and government purchases, respectively. Equations 3 and 4 allow one to transfer Figure 2 into the same space as Figure 1. This transfer is accomplished by taking the mirror image of Figure 2 and shifting the resultant graph downward by the amount g. See Figure 3. Finally, Figure 4 combines Figures 1 and 3 to depict the overall long-run equilibrium of the economy. In the figure, the

[2] *This and all subsequent figures assume that labor is essential to production.*

Figure 3
The Leisure–Consumption Opportunity Set of the Representative Household



equilibrium levels of leisure and consumption are l^e and c^e, respectively, and the equilibrium real wage is w^e.

Comparative statics. An increase in government purchases reduces the amount of output available for consumption at any given quantity of leisure. In Figure 4, the effect of an increase in government purchases is to shift the leisure–consumption opportunity locus downward by the amount of the increase in *g*. Because leisure and consumption are normal goods, the representative household will choose to absorb the impact of the downward shift in its opportunity locus by cutting back on *both* leisure and consumption, rather than on consumption alone. As shown in Figure 5, the new equilibrium of the economy is below and to the left of the original equilibrium. Because the new equilibrium lies to the left of the original equilibrium, it corresponds to a point that is farther out along the production function. Thus, output is higher—and the real wage is lower—than before. The intuition underlying these results is that households, feeling poorer, are more willing to work than before. The resultant rightward shift in the labor supply schedule drives down the equilibrium real wage, making it profitable for firms to increase hours of work and expand production.

An adverse technology shock, which might be due, for example, to a deterioration in the weather, can be modeled as a constant-percentage reduction in the amount of output produced at any given quantity of labor. In Figure 4, the leisure–consumption opportunity locus rotates downward, falling more (in absolute terms) at low levels of leisure than at high levels of leisure. The representative household is unambiguously worse off than before, and the reduction in its wealth tends to induce declines in both leisure and consumption (much as in Figure 5). On the other hand, the new opportunity locus is flatter than the old. The flattening of the opportunity locus reduces the marginal reward for working, so it provides households with an incentive to substitute leisure for consumption. The net effect of these wealth and substitution effects is negative for consumption but ambiguous for leisure. The decline in consumption is accompanied by an equal decline in output. The real wage falls, reflecting both households' increased supply of labor (due to the wealth effect) and firms' increased hesitancy to demand labor (due to labor's lower marginal productivity). See Figure 6.

The interest rate. In a full-information, market-clearing economy without capital investment, the real interest rate plays a largely passive role. As we have seen, the equilibrium levels of consumption, output, and hours can be found, in each period, without bringing the interest rate into the analysis

Figure 4
Long-Run Equilibrium

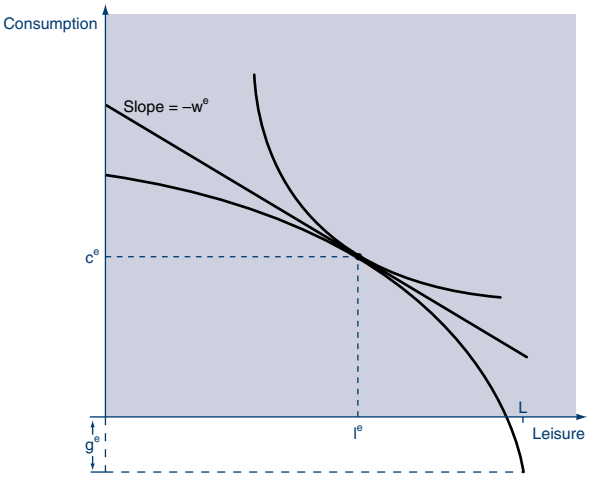


Figure 5
Effects of Increased Government Purchases

An increase in government purchases lowers equilibrium leisure and consumption.

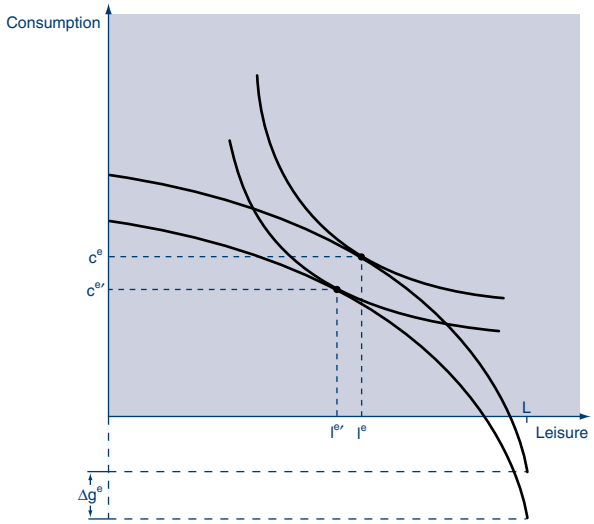
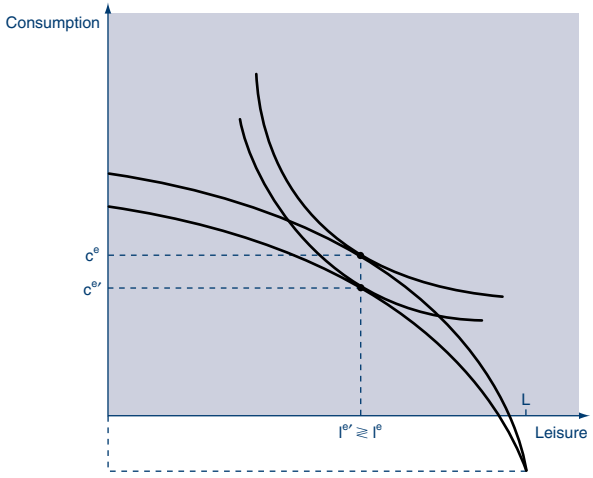


Figure 6
Effects of an Adverse Technology Shock

An adverse technology shock lowers equilibrium consumption and has an ambiguous effect on equilibrium leisure.



at all. It will, nevertheless, be useful later to have an expression for the equilibrium real return on bonds.[3] We can obtain such an expression from the representative household's optimality conditions.

Although aggregate saving must be zero in equilibrium, each individual household feels free to borrow and lend. The representative household will want to adjust its borrowing and lending until the rate at which it is willing to trade current consumption for future consumption matches the rate at which current consumption trades for future consumption in the marketplace. Thus,

$$MRS_{c\bar{c}} = r, \tag{5}$$

where $MRS_{c\bar{c}}$ denotes the amount of future consumption ($\bar{c}$) that the household requires as compensation for a one-unit reduction in current consumption and where r denotes the (gross) rate of return on bonds (equal to 1 plus the real interest rate). Turning equation 5 around and substituting into it equilibrium levels of current consumption and future consumption, each determined as in Figure 4, yields the real return on bonds that is consistent with zero desired aggregate saving.

Because current consumption and future consumption are normal goods, the marginal rate of substitution between current consumption and future consumption is negatively related to current consumption and positively related to expected future consumption. Hence, the equilibrium real rate of return rises in response to shocks that increase expected future consumption relative to current consumption. Intuitively, when they expect the future to be bright in comparison to the present, households are tempted to borrow against their future prosperity. In an economy without investment opportunities, the real interest rate must rise to choke off this incipient borrowing. When they expect the future to be dark in comparison to the present, households are tempted to save for the coming "rainy day." The real interest rate must fall until the desire to save is eliminated.

[3] *Note that in an economy with identical households and no capital investment, government bonds are the only securities traded in equilibrium.*

Money and prices. There is no single, generally accepted way of modeling the demand for money.[4] Here, we assume that the representative household makes trade-offs between real money balances and consumption in much the same way it makes trade-offs between leisure and consumption. We assume, in particular, that the demand for real money balances is determined by the equation

$$(6) \qquad MRS_{mc} = (R - 1)/R,$$

where MRS_{mc} denotes the additional current consumption that the household demands in compensation for a one-unit reduction in end-of-current-period real money balances and where R denotes the gross nominal return on bonds. (Thus, R equals 1 plus the nominal interest rate.) Intuitively, MRS_{mc} is the rate at which the household is willing to trade money (m) for consumption, while $(R - 1)/R$ is the opportunity cost of holding money, measured in units of current consumption.[5]

Assuming that consumption and money balances are both normal goods, equation 6 implies that the demand for money is an increasing function of consumption and a decreasing function of the nominal return on bonds.[6]

The nominal rate of return on bonds is related to the real rate of return and inflation by the identity

$$(7) \qquad R = r\pi,$$

where π denotes the ratio of the future price level to the current price level. Hence, equation 6 can be rewritten as

$$(6') \qquad MRS_{mc} = 1 - P/(r\bar{P}),$$

where P and $\bar{P}$ denote the current price level and next period's price level, respectively.

Suppose that equation 6′ is satisfied in the current and all future periods. Then a simultaneous doubling of the current and all future nominal money supplies and of the current and all future price levels leaves equation 6′ unaltered. In general, the only effect of a once-and-for-all surprise change in the level of the nominal money supply is to cause a proportionate change in the price level. The equilibrium values of real variables are entirely unaffected.

A short-run thought experiment

There is considerable debate among economists about whether prices actually adjust sufficiently, in the short run, to keep the economy in full-information, market-clearing equilibrium. It is worthwhile, therefore, to adopt an analytical framework that allows price adjustment to be less than immediate. Even if one is personally convinced that market imperfections are of negligible importance, a framework that does not *impose* market clearing has the advantage of keeping channels of communication open to those holding contrary views.

Accordingly, this section attempts to answer a "What if…" question: What would happen to output and interest rates, in response to policy and technology shocks, if the price level were to remain fixed in the short run, with output and employment adjusting to match the level of sales?[7] The twist on traditional IS–LM analysis here is that

[4] *Most undergraduate macro textbooks assume that the demand for money is an ad hoc function of gross income. Real money balances are also sometimes modeled as an argument of the production function, as an argument of the household utility function, or as a constraint on current household spending (the "cash in advance" approach).*

[5] *By transferring $1 from cash into bonds, the household raises its purchasing power in the next period by $(R – 1), which has a current purchasing power of $(R – 1)/R. See Barro (1990, 96–98). The Baumol–Tobin money demand model is obtained in the special case in which the household utility function takes the form u(c,m) = ln(c) + ln[2m/(2m + γ/P)] = ln(C), where γ/P is the real transaction cost associated with each exchange of interest-bearing assets for money and where C ≡ c[2m/(2m + γ/P)] is consumption net of transaction costs.*

[6] *Both consumption and money balances are assumed to be additively separable from leisure in the household utility function, so that the marginal rate of substitution between real balances and consumption is independent of leisure.*

[7] *By assuming that production adjusts to match changes in sales, I avoid having to deal with the possibility that households might be rationed in the output market. Whether such rationing is of practical significance is controversial. For an attempt to analyze an economy in which such rationing occurs, see Neary and Stiglitz (1983).*

people's expectations of future economic conditions are acknowledged to be an important determinant of their current behavior, and people are assumed to comprehend fully the implications of each shock for the future course of the economy. For example, people recognize that a sustained increase in government purchases will eventually reduce the amount of output available for private consumption. Consequently, the announcement of a defense buildup may have an adverse impact on *current* household demand and, hence, on current output and employment.

We will assume that the short run in our thought experiment—the interval over which the price level is held fixed and output and employment are sales-determined—lasts only one period.[8] Next period, all markets are expected to clear, with equilibrium determined as in Figure 4.

The IS and LM curves. We adopt the standard Keynesian assumption that the markets for money and bonds must continue to clear, even if the markets for output and employment do not. The requirement that the demand for money equal the supply of money yields the LM schedule. The requirement that the supply of bonds equal the demand for bonds—or, equivalently, that investment equal savings—yields the IS schedule.

Here, the demand for money is determined by equation 6′. Because the current price level is held fixed in our thought experiment, the monetary authority controls the short-run *real* money supply through its choice of the short-run *nominal* money supply. Thus, for a given short-run nominal money supply and long-run price level target, equation 6′ defines an upward-sloping LM schedule.[9] The LM schedule shifts to the right in response to increases in the short-run nominal money supply and in response to increases in the monetary authority's perceived long-run price level target. The only unconventional feature of the LM schedule is that it is a relationship between *consumption* and the real rate of return on bonds rather than between *income* and the real rate of return on bonds.

The condition that investment equals savings, in the current model, reduces to the requirement that equation 5 be satisfied. Recall that the marginal rate of substitution between current consumption and future consumption, which appears on the left-hand side of equation 5, is a decreasing function of current consumption and an increasing function of expected future consumption. Consequently, for any given level of expected future consumption, equation 5 defines a negative relationship between current consumption and the real return on bonds. It is this negative relationship that takes the place of the traditional IS curve.[10]

Unlike the traditional IS curve, the IS curve defined by equation 5 depends explicitly on expectations of the future. Intuitively, households want to smooth consumption through time. If expected future consumption rises, households desire more consumption today as well. Thus, with current consumption plotted on the horizontal axis and the real return on bonds on the vertical axis, increases in expected future consumption shift the expectations-augmented IS schedule to the right. Indeed, when $MRS_{c\bar{c}}$ depends only on the ratio of future consumption to current consumption (that is, when household preferences are homothetic), the rightward shift in the augmented IS schedule is exactly proportionate to the increase in expected future consumption. The stronger is the desire to smooth consumption, the steeper is the IS curve.

It is important to note that the optimality conditions from which the expectations-augmented IS and LM curves are derived are not ad hoc additions to the full-information, market-clearing

[8] *See Koenig (1987) for an analysis of the case in which the short run lasts several periods.*

[9] *I have chosen to assume that the monetary authority targets the long-run price level because critics of Keynesian economic models have often advocated just such a policy. (See, for example, Barro 1986.) One could assume equally well that the monetary authority holds the long-run money supply fixed, that the monetary authority fixes money growth between the two periods, or that the monetary authority targets the rate of inflation between the two periods. Results differ, somewhat, depending on the long-run policy rule adopted (though the basic methodology outlined here carries through).*

[10] *As defined here, the expectations-augmented IS curve is a relationship between consumption and the interest rate, rather than between income and the interest rate. Given the manner in which I have chosen to model the demand for money, plotting the expectations-augmented IS and LM curves in consumption × interest rate space seems natural. For further discussion, see the Appendix.*

economy we analyzed earlier. In that economy, equations 5 and 6′ played critical roles in determining the real return on bonds and the equilibrium price path. Now, with the current-period price level held exogenously fixed, these same equations determine the current-period levels of consumption, output, and employment.

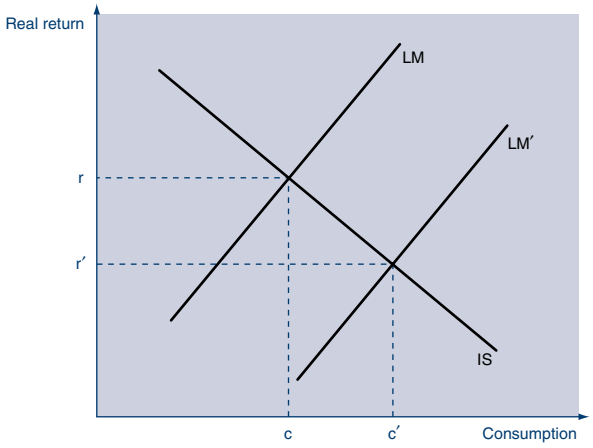
Comparative statics. Figure 7 plots the expectations-augmented IS and LM curves defined by equations 5 and 6′ and illustrates the effects of an increase in the current-period money supply. As in traditional IS–LM analysis, consumption (and, so, output) rises and the real interest rate falls, eliminating what would otherwise be an excess supply of money.[11] Similar results are obtained if it becomes known that the monetary authority has adopted a higher long-run price level target.

An increase in current-period government purchases has no impact on either the IS or the LM curve and, hence, has no impact on consumption or interest rates. With consumption unchanged, output must rise by the full amount of the increase in government purchases. These results will seem strange to those used to textbook Keynesian analysis, and they merit explanation.

First, given that interest rates fail to rise, why is there no multiplier effect in the model developed here? That is, why does consumption remain constant, rather than increase, as aggregate income expands? In the standard textbook IS–LM model, households are assumed to ignore the future tax

Figure 7
Impact of an Increased Money Supply

In the short run, for a given price level, an increase in the money supply raises consumption and lowers the real return on bonds.



liabilities implied by an increase in government purchases. Consistent with most of the real-business-cycle literature, here we have implicitly gone to the opposite extreme and assumed that people are fully cognizant of the tax implications of changes in government spending. The absence of a multiplier effect is exactly what one would expect in a model in which the timing of (lump-sum) taxes is irrelevant, so that any change in government purchases might just as well be financed through an increase in current taxes.[12] After all, when a balanced-budget constraint is imposed on the textbook model, multiplier effects disappear from it too.

Second, interest rates fail to rise in response to increased government purchases because the demand for money is a function of consumption rather than income.[13] If the more conventional textbook specification of money demand were adopted, the current model would yield the standard result that increases in government purchases tend to raise interest rates. (See the Appendix.) Consumption would then tend to fall somewhat (though by less than the increase in government purchases) rather than remain constant.

Summarizing, the response of the current model to monetary policy is entirely conventional. The response of the current model to near-term

[11] *Figure 7 assumes that household utility is additively separable between consumption and money balances. Though not essential to the analysis, this assumption is convenient and will be retained throughout the remainder of the article. For empirical evidence on the separability question, see Koenig (1990). For an analysis of the nonseparable case, see Koenig (1989).*

[12] *That the representative household cares only about the present discounted value of tax payments follows from equation 5.*

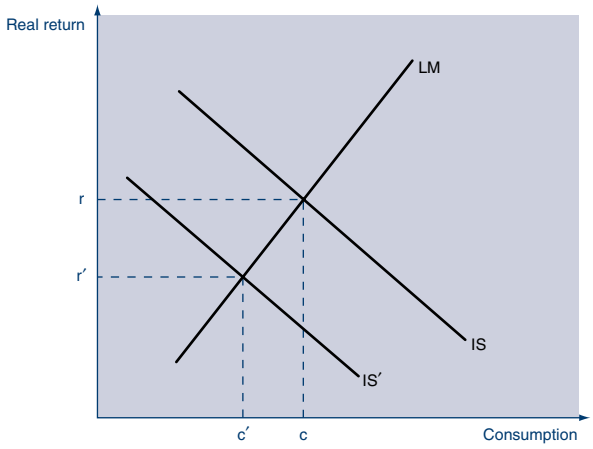
[13] *See Mankiw and Summers (1986) for an analysis of fiscal policy in a model in which the demand for money is a function of consumption, rather than income, but households are myopic.*

changes in fiscal policy would be much like that of a conventional IS–LM model with a balanced-budget constraint, were it not for our assumption that the demand for money depends on consumption rather than on gross income. This assumption is not essential to the expectations-augmented approach to IS–LM analysis.

Expectations-augmented IS–LM analysis, unlike conventional IS–LM analysis, explicitly recognizes that *prospective* fiscal and technology shocks can have every bit as much near-term impact on the economy as realized shocks. The impact of prospective shocks is transmitted to today's economy through changes in expected future consumption, which proxy for changes in permanent income. For example, we saw (in Figure 5) that an increase in long-run government purchases tends to lower long-run consumption. Thus, the prospect of a defense buildup will lower expectations of future consumption and, by equation 5, shift today's IS curve to the left. Today's consumption and today's interest rates, consequently, fall at any given current price level (*Figure 8*). Today's output falls, too, if current government purchases are unchanged. (See the box titled "The Short-Run Impact of a Permanent Defense Cut" for a discussion of what happens if current purchases and expectations of future purchases change simultaneously.) Effects qualitatively similar to those displayed in Figure 8 are also observed in response to a prospective adverse technology shock.

Figure 8
Impact of an Anticipated Increase in Future Government Purchases

In the short run, for a given price level, an anticipated increase in future government purchases lowers consumption and the real return on bonds.



Closing the short-run model

Thus far, our analysis has taken the short-run price level as given. This assumption is unnecessarily restrictive, and we now take steps to relax it. Several alternative models of short-run price determination are considered. At one extreme we have the real-business-cycle model, which assumes that the wage rate and price level adjust instantaneously to clear the labor and output markets. At the other extreme is a model in which output prices are set in contracts before complete information on technology and government policies is available. Between these extremes are models in which the price of output is flexible, but labor contracts prespecify the wage, and models in which firms adjust their output in partial ignorance of the prices prevailing in other markets.

As in the preceding section, we find that the tools of traditional Keynesian analysis can be adapted to analyze models in which people's current behavior depends nontrivially on their expectations of the future course of the economy. In particular, we can derive well-defined counterparts to the traditional Keynesian "aggregate demand" and "aggregate supply" curves. The intersection of these two curves determines the short-run equilibrium price and quantity of output.

The aggregate demand schedule. As a first step in the direction of relaxing the fixed-price assumption, consider what happens to the IS–LM intersection as the current price of output declines. The position of the IS curve depends only on future consumption, which is independent of the current price level. For any given current nominal supply of money, however, a decline in the current price level raises the real money supply, shifting the LM curve to the right, as in Figure 7. Given our assumption that the monetary authority targets the long-run price level, this rightward LM shift is not quite the end of the story. A lower current price level raises expected inflation (or lowers expected deflation) and, hence, lowers the demand for money at any given real rate of return on

bonds, shifting the LM curve a bit further to the right (or, more accurately, down).[14] Thus, the level of current consumption determined by the intersection of the IS and LM curves rises as the current price level falls.

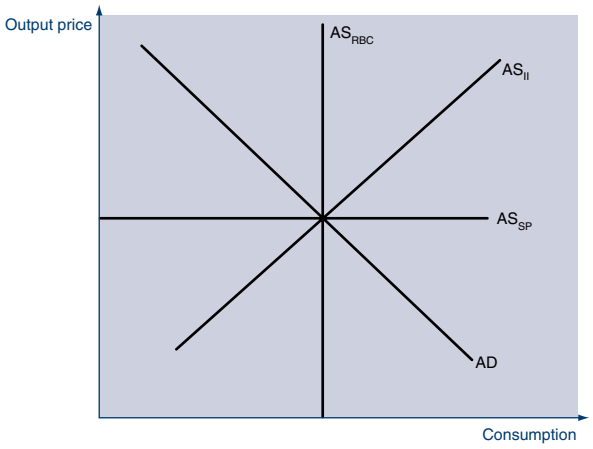
The negative short-run relationship between consumption and the price level is plotted in Figure 9 and labeled "*AD*." Like the so-called aggregate demand curve of traditional Keynesian analysis, the *AD* schedule represents output–price combinations (or, in the present model, consumption–price combinations) in which the demand for money equals the supply of money and, simultaneously, the representative household is content with the intertemporal allocation of output.

Obviously, any disturbance that shifts the IS–LM intersection to the right for a given price level will shift the *AD* schedule to the right by exactly the same amount. Thus, an increase in the current-period nominal money supply, an increase in the monetary authority's long-run price target, a cut in long-run government purchases, and positive long-run technology shocks will tend to move the *AD* schedule to the right. Changes in current technology and current government purchases, on the other hand, have no effect on the *AD* schedule.[15]

The aggregate supply schedule: alternative models

The real-business-cycle model. In the real-business-cycle model, prices adjust instantaneously to clear all markets. In the present context, equations 1 and 2, which define the supply of labor and the demand for labor, must both be satisfied—even in the short run. Thus, short-run equilibrium levels of consumption and leisure are determined as in Figure 4.

Figure 9
Aggregate Demand Curve with Alternative Aggregate Supply Schedules



In Figure 9, the combinations of price and consumption consistent with the clearing of the labor market are labeled "AS_{RBC}." The curve AS_{RBC} is very much the counterpart of the traditional Keynesian "aggregate supply schedule," except that the curve AS_{RBC} represents the total amount of output available to the *private* sector rather than the total amount of output available to the public and private sectors combined. That the AS_{RBC} schedule is vertical reflects the fact that the indifference curves and production function plotted in Figure 4 are independent of the price of output.

The sticky-price model. The sticky-price model assumes that the price of output is fixed in advance. Usually, this approach also assumes that output adjusts one for one in response to unanticipated changes in sales. (Presumably, either labor contracts give employers discretion in setting hours of work or the wage rate adjusts so that employees are content with whatever hours are required of them.) Equation 2 may be satisfied ex ante but is not, in general, satisfied ex post.

In Figure 9, the assumption that output adjusts one for one in response to changes in sales at a preset price is reflected in a horizontal aggregate supply schedule, AS_{SP}.

[14] *Note that this endogenous response of expected inflation to changes in P implies a more elastic aggregate demand curve than does an inflation target.*

[15] *If the demand for money were assumed to be a function of income rather than consumption, the IS, LM, and AD schedules would be more appropriately plotted with income on the horizontal axis. Increases in current government purchases would shift the IS schedule—and, hence, the AD schedule also—to the right, much as in a traditional Keynesian analysis.*

The Short-Run Impact of a Permanent Defense Cut

In traditional textbook Keynesian analysis, no distinction is made between permanent changes and temporary changes in government purchases. Implicitly, the traditional analysis assumes that it is only the contemporaneous change in government purchases that affects the short-run equilibrium of the economy. In expectations-augmented IS–LM analysis, in contrast, whether a change in government purchases is thought to be temporary or thought to be permanent is of considerable importance. An analysis of the impact of a permanent cut in defense spending illustrates the point.

Recall that changes in government purchases that are expected to be transitory have no impact whatsoever on the expectations-augmented IS and LM schedules. In our short-run thought experiment, therefore, consumption and the real return on bonds are not affected by short-term defense cuts. Output falls one for one with government purchases: a $20 billion cut in defense spending results in a $20 billion decline in gross domestic product. A *prospective* change in government purchases, however, shifts the expectations-augmented IS schedule in the same direction as the resultant prospective change in long-run consumption. A prospective cut in the defense budget would, therefore, shift the IS schedule to the right. Assuming that preferences are homothetic in current and future consumption (so that the marginal rate of substitution between current and future consumption depends only on the ratio of current to future consumption) and assuming that current consumption and future consumption are initially equal, the rightward shift in the IS curve will exactly match the increase in future consumption. Because the LM schedule slopes upward, the actual short-run equilibrium level of consumption in our thought experiment rises by *less* than the increase in future consumption, which, in turn, rises by less than the future cut in government spending. If a $20 billion cut in the defense budget raises long-run consumption by $15 billion, then short-run consumption might rise by only $5 billion.

What, then, is the impact of an immediate, permanent cut in the defense budget? Consumption rises in the short run but not as much as it will rise in the long run. The prospect of a rising consumption path puts upward near-term pressure on interest rates. Output falls in the short run, by more than it will fall in the long run. In our numerical example, consumption rises by $5 billion in the short run and by $15 billion in the long run. Output falls by $15 billion in the short run and by $5 billion in the long run.

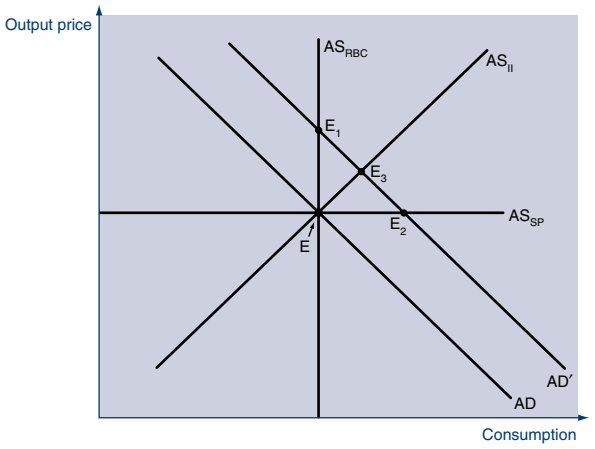
Of course, these results assume that the monetary authority holds both the long-run price level and the current money supply fixed.

The sticky-wage and imperfect-information models. Sticky-wage and imperfect-information models yield an aggregate supply schedule with an elasticity that lies between the elasticities of the real-business-cycle and sticky-price supply schedules. The sticky-wage model assumes that money wages are set in advance. If the price of output rises, unexpectedly, relative to the preset wage, firms find it profitable to expand their production and hiring (Fischer 1977; Taylor 1980). Equation 1 may be satisfied ex ante but is not, in general, satisfied ex post.

In the imperfect-information model, when a firm sees the price of its product rise, the firm is not certain whether this rise reflects an increase in the price of its product relative to the prices of other goods or, instead, an increase in the general level of prices. Because of this confusion, an unexpected increase in the general price level is

Figure 10
Impact of Monetary Stimulus

An increase in the current-period money supply or in the monetary authority's long-run price level target will shift the aggregate demand schedule to the right.



usually accompanied by some increase in each firm's output level. Each firm believes that its behavior is consistent with profit maximization but discovers, after the fact, that it was mistaken.[16]

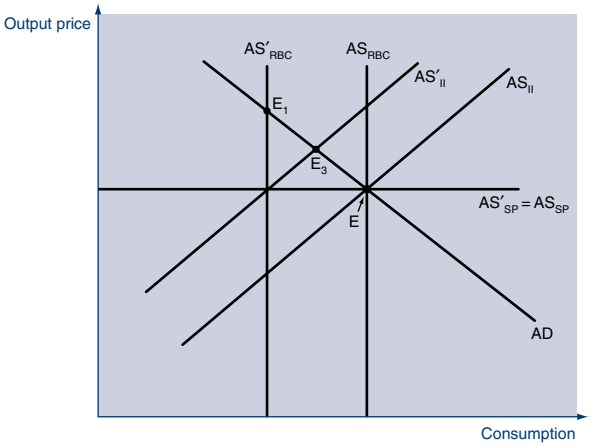
In Figure 9, the sticky-wage and imperfect-information models yield aggregate supply curves like that labeled "AS_{II}."

Comparative statics. Figure 10 illustrates the price and output (consumption) effects of a variety of economic shocks. Much as in the traditional Keynesian model, expansionary monetary policy—as reflected in either an unexpected increase in the current money supply or an upward revision in the monetary authority's perceived long-run price level target—shifts the aggregate demand schedule to the right. In the real-business-cycle model, the only effect of this shift is to cause an increase in the current price level.[17] (The economy moves from point E to point E_1.) In the sticky-price model, it is output, rather than the price level, that increases. (The economy moves from point E to point E_2.) The sticky-wage and imperfect-information models yield increases in both consumption and the price level. (The economy moves from point E to a point like E_3.)

As shown in Figure 11, an unexpected increase in current-period government purchases shifts each aggregate supply curve to the left. (Recall that "aggregate supply" in the current model refers to the amount of output available to the private sector, rather than the amount of output available to the economy as a whole.) In the real-business-cycle, sticky-wage, and imperfect-information versions of the model, consumption falls (but by less than the increase in government spending) and the price level is driven up. The economy moves from E to E_1 in the real-business-cycle model and from E to a point like E_3 in the sticky-wage and imperfect-information models. In the sticky-price model, output rises by the full amount of the increase in government spending, leaving consumption and the price level unchanged. (The economy stays at point E.)

Figure 11
Impact of Increased Government Purchases

An increase in current-period government purchases shifts the aggregate supply curve to the left.



[16] *For additional explanation of the imperfect-information model, see Lucas (1972), Barro (1990, chap. 19), or Mankiw (1992, chap. 11).*

[17] *Recall that, for simplicity, we are assuming that real money balances are additively separable from both consumption and leisure in the household utility function.*

An adverse current-period technology shock has consumption and price effects very like those associated with an increase in current-period government purchases.

Prospective changes in government purchases and technology affect the current-period equilibrium of the economy by altering households' long-run consumption prospects. The announcement of future defense cuts or the future implementation of improved technology will shift the current-period aggregate demand schedule to the right in much the same way as expansionary monetary policy. In Figure 10, the economy will move from E to E_1, E_2, or a point like E_3, depending on whether markets clear instantaneously, the short-run price level is fixed, or firms have difficulty distinguishing general price level movements from relative price level movements.

Concluding remarks

The basic idea underlying IS–LM analysis is that supply and demand in the financial markets determine the economy's short-run equilibrium quantities of labor and output in the event that the wage rate and price level fail to achieve their full-information, market-clearing levels. Traditional Keynesian analysis, in addition, treats household expectations as either exogenous or irrelevant. In this article, we have seen that it is possible to abandon traditional Keynesian myopia without abandoning the basic IS–LM framework.

Admittedly, the thought experiment that underlies IS–LM analysis seems artificial in real-business-cycle models, where prices adjust instantaneously to clear all markets. Even in real-business-cycle models, however, the equilibrium conditions used to derive the expectations-augmented IS and LM curves are indispensable. Thus, the "money demand equals money supply" condition that defines the LM curve determines the equilibrium price path in a real-business-cycle world, while the intertemporal optimality condition that defines the expectations-augmented IS curve determines the real interest rate. In brief, real-business-cycle models *impose* instantaneous market clearing. Expectations-augmented IS–LM analysis is *consistent* with instantaneous market clearing but allows for the possibility that price adjustment in the labor and output markets is less than immediate.

By analyzing a variety of macroeconomic models within a common framework, one obtains insights into how the models relate to one another, facilitating discussion. A particular advantage of the IS–LM approach developed here is that, in using it, one gains some appreciation for which of the traditional Keynesian results flow from the assumed myopia of households and firms, which flow from sluggish wage and price adjustment, and which flow from special assumptions about the determinants of the demand for money.

For example, the impact of monetary policy in the current model is quite traditional, despite forward-looking expectations and despite our use of consumption rather than income as the scale variable in the money demand function. On the other hand, we found that forward-looking expectations eliminate the short-run multiplier effect usually associated with an increase in current government purchases. And whether an increase in current government purchases puts near-term upward pressure on interest rates depends critically on how one models the demand for money.

Finally, the traditional distinction between demand shocks and supply shocks is blurred when household consumption demand is forward-looking, rather than myopic. Thus, the expectation of a future shift in aggregate supply—the result, perhaps, of an anticipated change in technology—affects current aggregate demand.

Postscript. The analysis presented here is incomplete in that it fails to allow for endogenous changes in capital investment. This omission is potentially serious. Fluctuations in investment were given a prominent place in Keynes' own account of the business cycle. Recently, a study by Fama (1992) has confirmed that fluctuations in investment are an important source of transitory movements in real-world aggregate output. Accordingly, Part 2 of this article, to be published in a future issue of the Economic Review, *extends the expectations-augmented IS–LM framework developed here to an economy in which investment is endogenous.*

Appendix

Derivation of the Comparative Statics Results

This Appendix formally derives many of the comparative statics results presented in the main text, and it clarifies the relationship between the model developed in this article and standard textbook Keynesian models.

The basic model

Suppose, for analytical convenience, that the representative household's willingness to trade current consumption for future consumption and its willingness to trade consumption for money balances depend only on the ratios of the quantities of the goods in question, so that, for example, the marginal rate of substitution between current consumption and future consumption depends only on the ratio of current consumption to future consumption.[1] Equations 5 and 6′ then imply

$$c = \bar{c}\phi(r) \tag{A.1}$$

and

$$m = c\kappa(r\bar{P}/P), \tag{A.2}$$

respectively, where both $\phi(\bullet)$ and $\kappa(\bullet)$ are strictly decreasing.

Equation A.1 defines an IS schedule, and equation A.2 defines an LM schedule. Differentiating logarithmically,

$$d\ln(c) = d\ln(\bar{c}) - \epsilon_{\phi} d\ln(r) \tag{A.1′}$$

and

$$\begin{aligned} d\ln(c) = {} & d\ln(M) - d\ln(P) \\ & + \epsilon_{\kappa}[d\ln(r) + d\ln(\bar{P}) \\ & - d\ln(P)], \end{aligned} \tag{A.2′}$$

where $\epsilon_{\phi} \equiv -r\phi'/\phi > 0$ and $\epsilon_{\kappa} \equiv -R\kappa'/\kappa > 0$ equal, in absolute value, the rate-of-return elasticities of consumption demand and money demand, respectively.

Solving for the percentage change in consumption and the percentage change in the real return on bonds,

$$\begin{aligned} d\ln(c) = {} & \{\epsilon_{\kappa} d\ln(\bar{c}) \\ & + \epsilon_{\phi}[d\ln(M) - d\ln(P)] \\ & + \epsilon_{\kappa}\epsilon_{\phi}[d\ln(\bar{P}) - d\ln(P)]\} \\ & /(\epsilon_{\kappa} + \epsilon_{\phi}) \end{aligned} \tag{A.3}$$

and

$$\begin{aligned} d\ln(r) = {} & \{d\ln(\bar{c}) - [d\ln(M) - d\ln(P)] \\ & - \epsilon_{\kappa}[d\ln(\bar{P}) - d\ln(P)]\} \\ & /(\epsilon_{\kappa} + \epsilon_{\phi}). \end{aligned} \tag{A.4}$$

Note that consumption and the real rate of return are increasing in expected future consumption. If households are forward-looking, we know that expected future consumption will be increasing in expected future productivity and decreasing in expected future government purchases: $\bar{c} = \psi(\bar{\theta}, \bar{g})$, where $\bar{\theta}$ is a positive technology-shock variable and where $\psi_1 > 0$ and $-1 < \psi_2 < 0$. Increases in both current real money balances and expected inflation have a positive effect on current consumption and a negative effect on the real rate of return. Both consumption and the real rate of return are completely independent of

[1] This condition will be satisfied if the household utility function is additively separable in its arguments and preferences are homothetic. Additional realism can be obtained—at the expense of some additional complexity—by relaxing the separability conditions.

(Continued on the next page)

Appendix

Derivation of the Comparative Statics Results—*Continued*

current government purchases.

Thus far, we have treated the current price level, P, as fixed. If, at the opposite extreme, the wage rate and price level adjust instantaneously to clear the labor and output markets, current consumption is determined as in Figure 4—that is, $c = \psi(\theta, g)$. Given c and $\bar{c}$, equation A.1′ determines the real rate of return on bonds. Equation A.2′ determines the current price level. In general, one might expect the aggregate supply schedule to be neither horizontal nor vertical, so that the changes in consumption predicted by equation A.3 will be only partially offset by changes in P.

Encompassing traditional IS–LM analysis

By generalizing equations A.1 and A.2, we can formulate a model that includes traditional Keynesian IS–LM analysis as a special case. Suppose, in particular, that

$$c = [\bar{c}\,\phi(r)]^{1-\lambda} y^{\lambda} \tag{A.5}$$

and

$$m = c^{1-\gamma} y^{\gamma} \kappa(r\bar{P}/P), \tag{A.6}$$

where $0 \quad \lambda < 1$ and $0 \quad \gamma \quad 1$. The parameter λ measures the "excess sensitivity" of consumption to current income.[2] The parameter γ will be positive to the extent that the demand for money depends on components of income other than consumption (Mankiw and Summers 1986). Standard textbook Keynesian analysis assumes that λ is close to 1 and that γ is equal to 1. Furthermore, expected future consumption ($\bar{c}$) is held fixed.[3]

Logarithmic differentiation of A.5 and A.6 yields IS and LM curves:

$$d\ln(c) = [(1-\lambda)d\ln(\bar{c}) - (1-\lambda)\epsilon_{\phi} d\ln(r) + \lambda\alpha_g d\ln(g)]/(1-\lambda\alpha_c). \tag{A.5′}$$

$$d\ln(c) = \{d\ln(M) - d\ln(P) - \gamma\alpha_g d\ln(g) + \epsilon_{\kappa}[d\ln(r) + d\ln(\bar{P}) - d\ln(P)]\} /(1-\gamma+\gamma\alpha_c). \tag{A.6′}$$

In deriving these expressions, use has been made of the fact that $d\ln(y) = \alpha_c d\ln(c) + \alpha_g d\ln(g)$, where α_c and α_g are the respective shares of consumption and government purchases in national income. Alternatively, one can write

$$d\ln(y) = [\alpha_c(1-\lambda)d\ln(\bar{c}) - \alpha_c(1-\lambda)\epsilon_{\phi} d\ln(r) + \alpha_g d\ln(g)]/(1-\lambda\alpha_c) \tag{A.5″}$$

and

$$d\ln(y) = \{\alpha_c[d\ln(M) - d\ln(P)] + (1-\gamma)\alpha_g d\ln(g) + \alpha_c\epsilon_{\kappa}[d\ln(r) + d\ln(\bar{P}) - d\ln(P)]\}/(1-\gamma+\gamma\alpha_c). \tag{A.6″}$$

[2] Campbell and Mankiw (1989) put λ at 0.5, but most empirical studies suggest that a value like 0.1 is closer to the mark. Koenig (1990) tests the Campbell–Mankiw specification and finds it inferior to an alternative model in which all households are forward-looking but utility is not separable between consumption and money balances.

[3] An alternative interpretation of the standard Keynesian model is that λ is equal to zero, but households base their expectations of future consumption solely on their current incomes.

(Continued on the next page)

Appendix

Derivation of the Comparative Statics Results—*Continued*

In the special case in which γ equals 1, so that the demand for money depends on income rather than consumption, the LM equation simplifies to

$$d\ln(y) = d\ln(M) - d\ln(P) + \epsilon_\kappa[d\ln(r) + d\ln(\bar{P}) - d\ln(P)].$$

The importance of excess sensitivity in determining the strength of the "multiplier effect" is clear from equations A.5′ and A.5″. In equation A.5′, increases in government purchases have a positive impact on consumption demand (for a given rate of return on bonds) only insofar as λ, which measures the excess sensitivity of consumption to current income, is greater than zero. Similarly, it follows from equation A.5″ that $dy/dg = 1/(1 - \lambda\alpha_c)$. Thus, changes in government purchases have a larger than one-for-one impact on the demand for output only to the extent that λ is greater than zero.

The IS and LM equations can be solved for percentage changes in income, consumption, and the real rate of return. The general solutions follow:

$$\begin{aligned}(A.7)\quad d\ln(y) = \{&\alpha_c(1-\lambda)\epsilon_\phi[d\ln(M) - d\ln(P)] \\ &+ \alpha_c(1-\lambda)\epsilon_\phi\epsilon_\kappa[d\ln(\bar{P}) - d\ln(P)] \\ &+ \alpha_g[(1-\gamma)(1-\lambda)\epsilon_\phi + \epsilon_\kappa]d\ln(g) \\ &+ \alpha_c(1-\lambda)\epsilon_\kappa d\ln(\bar{c})\}/\Delta,\end{aligned}$$

$$\begin{aligned}(A.8)\quad d\ln(c) = \{&(1-\lambda)\epsilon_\phi[d\ln(M) - d\ln(P)] \\ &+ (1-\lambda)\epsilon_\phi\epsilon_\kappa[d\ln(\bar{P}) - d\ln(P)] \\ &- \alpha_g[\gamma(1-\lambda)\epsilon_\phi - \lambda\epsilon_\kappa]d\ln(g) \\ &+ (1-\lambda)\epsilon_\kappa d\ln(\bar{c})\}/\Delta,\end{aligned}$$

and

$$\begin{aligned}(A.9)\quad d\ln(r) = \{&-(1-\lambda\alpha_c)[d\ln(M) - d\ln(P)] \\ &- (1-\lambda\alpha_c)\epsilon_\kappa[d\ln(\bar{P}) - d\ln(P)] \\ &+ \alpha_g[1-(1-\gamma)(1-\lambda)]d\ln(g) \\ &+ (1-\gamma+\gamma\alpha_c)(1-\lambda)d\ln(\bar{c})\}/\Delta,\end{aligned}$$

where

$$\Delta \equiv (1-\lambda\alpha_c)\epsilon_\kappa + (1-\gamma+\gamma\alpha_c)(1-\lambda)\epsilon_\phi > 0.$$

Standard textbook results are obtained in the special case where $\gamma = 1$, $\lambda > 0$, and $\bar{c}$ is held fixed (so that $d\ln(\bar{c}) = 0$).

Equations A.7 and A.8 imply that $dy/dg = [(1 - \gamma)(1 - \lambda)\epsilon_\phi + \epsilon_\kappa]/\Delta$ and $dc/dg = -\alpha_c[\gamma(1 - \lambda)\epsilon_\phi - \lambda\epsilon_\kappa]/\Delta$, respectively. The importance of γ in determining the extent to which crowding out reduces the stimulatory effects of increased government purchases can be seen by differentiating these multipliers with respect to γ. One obtains

$$\begin{aligned}(A.10)\quad \partial(dy/dg)/\partial\gamma &= \partial(dc/dg)/\partial\gamma \\ &= -\alpha_c\epsilon_\phi(\epsilon_\kappa + \epsilon_\phi)(1-\lambda)^2/\Delta^2 < 0.\end{aligned}$$

Not surprisingly, the more sensitive is the demand for money to changes in government purchases (the larger is γ), the more increases in such purchases tend to crowd out private spending.

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The Long (and Short) on Taxation and Expenditure Policies

One of the central issues in the 1992 presidential campaign was how best to promote economic growth. Because much of the growth debate concerned fiscal policy, taxation and expenditure plans came under intense public scrutiny. At issue were both the level of taxation and the proper mix of taxes. Similarly, voters were concerned with the composition as well as the level of government expenditures. While voter interest was high, the various programs put forth grew so detailed that their long- and short-run effects became difficult to evaluate and compare.

What distinguished the 1992 campaign was a fiscally sober post–Cold War reassessment of the government's economic priorities. All major candidates argued for cuts in defense spending and agreed that the resources saved—the peace dividend—should be spent on enhancing the nation's productivity. This productivity enhancement was to come from some combination of public investment and a more investment-friendly business tax structure. While the candidates' broad visions were similar, they disagreed on how much public investment to allocate to human capital (such as education and training) versus physical capital (such as roads, bridges, mass transit, and so on). Proposals also differed on how to change business taxation to promote investment, although all called for lower costs of private capital. Most candidates did not openly acknowledge that promoting growth usually entails a current sacrifice for future public and private consumption.

This article presents an analytical and graphical framework for evaluating the long- and short-run effects of a broad range of fiscal policies. Except for two simplifying assumptions on the structure of preferences and the production process, the model is fairly general. The model is well-suited for insights into the dynamic effects of some of the 1992 fiscal policy proposals, and it can easily be expanded to analyze distributional, educational, and industrial policy questions.[1] To set the stage, I focus first on the effects of changes in factor income taxation. Factor income taxes are the main components of an income tax. Factor income taxes also have a simple connection to most tax proposals, and this article shows how they relate to consumption and corporate taxes. Lastly, to frame the debate on what to do with the peace dividend, I analyze the effects of changes in government defense and investment expenditures.

Description of the model

This section presents a simple growth model that can be used to analyze the macroeconomic effects of alternative fiscal policies. The model consists of three sectors. The household sector determines current and planned future levels of

I wish to thank my reviewer, Evan Koenig, for helpful suggestions and my readers, Steve Brown, Ping Wang, and Mark Wynne, for their comments. Of course, any remaining errors are my own.

[1] *The analytical model used is a variant on Aschauer (1988, 1989) and Barro (1989). The graphical exposition is based on and complements that of Wynne (1991). This framework is extended by Becsi (1991) to deal with heterogeneity and distributional concerns. For extensions to an endogenous growth framework with education and industrial policies, see, for example, Barro and Sala-I-Martin (1992).*

consumption, labor, and savings. These plans are optimal in the sense that households' choices maximize lifetime utility subject to after-tax budget constraints. In the production sector, firms maximize after-tax profits. This is accomplished by choosing optimal paths for output and for capital and labor inputs. In the government sector, tax receipts from various sources are used to finance government consumption and investment. Equilibrium occurs when factor and goods markets clear in every period.[2]

The household sector is represented by an average household that values the amount of consumption, c, and leisure it obtains in each period of its life.[3] Individuals have a certain number of hours, H, per year to allocate to leisure and labor. Let h, where $0 \quad h \quad H$, be the number of hours devoted to market labor. Thus, $H - h$ is the amount of time devoted to leisure. For simplicity, preferences between any two time periods are described by $U(c, H - h) + (1 + \rho)^{-1}U(c_{+1}, H - h_{+1})$.[4,5] The pure rate of time preference that discounts future utility is given by $\rho > 0$. An increase in this parameter reflects an increase in the individual's desire for early gratification.

The representative individual chooses those feasible time streams of consumption and labor that maximize lifetime utility. Feasibility is determined by the individual's period-by-period budget constraint. The budget constraint requires that purchases of consumption goods and purchases of assets (which are held until the next period) not exceed current period after-tax income. After-tax income is defined as the sum of after-tax labor income, after-tax income from assets, and lump-sum transfers. Savings are put into interest-earning productive capital. The budget constraint for each period is summarized by

$$(1) \qquad c + (k_{+1} - k) = (1 - t_w)wh + (1 - t_r)rk + \bar{l},$$

where $\bar{l}$ is the lump-sum transfer (or tax), k is the physical capital accumulated up to the current period, and $k_{+1} - k$ is the net purchase of capital. The pretax real wage and real interest rate are given by w and r, while the t_i $(i = w, r)$ are the tax rates on wage and interest income. For example, the wage tax encompasses payroll taxes for social security and the salary component of personal income taxes. The interest income tax is a tax on the real returns to capital including dividends, capital gains, and so on.

Households choose feasible streams of consumption, labor, and savings that maximize utility. This leads to well-known optimality conditions for constrained utility maximization: the marginal rate of substitution (*MRS*)—which equals the rate at which the household is just willing to trade one good for another—is equated to the price ratio of the two goods. The price ratio is the rate at which the two goods can be substituted and still satisfy the budget constraint.

Within a time period, households adjust private consumption and labor until the *MRS* between consumption and leisure is equal to the ratio of the after-tax wage to the price of consumption goods, that is, is equal to the after-tax real wage:

$$(2) \qquad MRS(c, H - h) = (1 - t_w)w.$$

The *MRS* between consumption and leisure tells

[2] *For simplicity, the model abstracts from money and uncertainty. It also does not consider market imperfections and intergenerational issues.*

[3] *The representative household is assumed to live infinitely long. An infinite lifetime can be viewed as dynastic families that care about the welfare of future generations. Or, it can be viewed as a useful abstraction of long lives. Time begins in period one, at which point the individual is endowed with* k_1 *units of capital.*

[4] *From time to time, it will be convenient to assume, additionally, that utility is separable between consumption and labor, so that* $U(c, H - h) = u(c) + v(H - h)$.

[5] *Alternatively, one could easily expand utility to include composite consumption, where composite consumption is defined as private consumption plus the consumption services derived from public spending. The services of such spending as health care, education, food stamps, and transportation enter individual utility as substitutes for private consumption. Similarly, services from some government expenditures may substitute or complement private inputs into production. Thus, the only difference between public consumption and public capital is that the latter takes time to be productive and depreciates over time. I abstract from these considerations by assuming that the consumption services from public spending enter utility separably, and that only public investment has productive services. However, in several footnotes below, extensions are considered.*

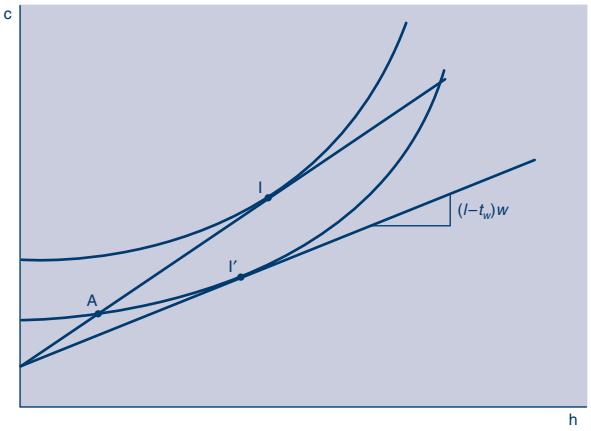
how much additional consumption is required to compensate for a reduction in leisure (an increase in labor). Since a reduction in leisure lowers utility, consumption must rise to increase utility to its original level. However, as leisure falls, a unit of leisure becomes more valuable to individuals, so that progressively more consumption is required to compensate for a unit loss of leisure. In other words, the additional consumption required as compensation for lost leisure rises as leisure falls. Thus, the *MRS* is negatively related to leisure (positively related to labor) and, by the same logic, positively related to consumption.

From the budget constraint, increasing labor by one hour of work increases the household's take-home pay by $(1 - t_w)w$ units. This allows consumption purchases to rise by $(1 - t_w)w$, which is the ratio of the price of leisure to the price of consumption. If the *MRS* is smaller than this price ratio, consumers require less consumption to make up for the disutility of working than they actually can get. Thus, households find it desirable to work more, because utility rises when work effort (and consumption) are increased. Since the *MRS* is positively related to consumption and labor, as households increase their labor and consumption the *MRS* rises until condition 2 is satisfied.

When hours of labor are plotted on the horizontal axis and private consumption on the vertical axis, one can trace the trade-offs between consumption and labor for a given level of utility (*Figure 1*). These indifference curves are convex to the origin and curve upward because an increase in labor requires an increase in consumption to keep utility constant. The slope of the indifference curve is the *MRS* and increases with labor and consumption. Higher indifference curves represent higher levels of utility. The budget constraint also slopes upward and has as its slope the after-tax real wage rate. The vertical intercept of the budget line is nonlabor household income such as capital income and transfers.

Household plans for consumption and labor are determined by the tangency of household indifference curves and budget constraints at point I in Figure 1. At point A the *MRS* is below the after-tax real wage rate. Since the slope of the indifference curve is less than the slope of the budget line, the household can increase its utility while staying on its budget line. The household

Figure 1
Optimal Consumption–Labor Combination



moves to a higher indifference curve by substituting leisure for consumption or increasing labor and consumption. Consumption and leisure are assumed to be normal goods: a good is said to be "normal" when consumption of the good increases for a parallel upward shift of the budget line. Reducing the after-tax wage rate is equivalent to a flattening of the budget line. When consumption and leisure are normal goods, this will move the individual to point I′ where consumption and labor are lower.

Households adjust consumption and savings across time until the *MRS* between consumption in adjacent periods equals the price of current consumption in terms of future consumption:

$$(3) \qquad MRS(c_{+1}, c) = 1 + r_{+1}(1 - t_r).$$

The *MRS* tells how much next period's consumption must rise to compensate for the fall in lifetime utility that occurs when current consumption is reduced. When current consumption is low relative to future consumption, its value is relatively high for the individual. Thus, the compensation required for a fall in current consumption rises as current consumption is reduced. In turn, progressively more future consumption is required to compensate for a unit loss of current consumption. Thus, the *MRS* is negatively related to current consumption. Similarly, it is positively related to future

consumption.[6] An impatient household has a high rate of time preference, ρ. This means that an impatient household requires a higher return of future consumption for a sacrifice of current consumption than a patient household. Thus, the *MRS* will tend to be higher the more impatient the individual is.

From the budget constraint, decreasing current consumption by one unit allows the household to increase savings by one unit. In turn, this increased saving allows future consumption to rise by $[1 + r_{+1} (1 - t_r)]$. Thus, the after-tax interest rate affects how much additional future consumption one can have for a unit reduction of current consumption. As long as the *MRS* exceeds this relative price, the individual requires more future consumption to keep utility constant for a sacrifice of current consumption than the budget constraints allow. Thus, households will have an incentive to raise current consumption relative to future consumption. As current consumption rises relative to future consumption, the *MRS* falls until equality in equation 3 is reestablished.

Given the stock of public capital, $\bar{k}$, the representative firm chooses two inputs, labor and private capital, to maximize its after-tax profit from selling its final output, y. The firm's profits are given by

$$(4) \qquad y - wh - (r + \delta)k - (k_{+1} - k),$$

where δ is the physical rate of depreciation of capital, and $(r + \delta)$ is the cost of capital. I assume that the output production function is constant returns to scale in all inputs and given by $y = f(k,h) + g(\bar{k})$.[7] In other words, total final output is the sum of output produced by private inputs and output produced by public inputs.[8]

Profit maximization by the firm implies that the firm adjusts private inputs until their marginal products equal their factor costs:[9]

$$(5) \qquad f_h(k,h) = w, \text{ and}$$

$$(6) \qquad f_k(k,h) = r + \delta.$$

If the marginal product of labor is greater than the cost of labor, an additional hour of labor will add more to revenues than to costs. Thus, firms can increase profits by hiring more labor. As labor is increased, each additional unit of labor becomes less productive. The marginal product of labor falls until equality in equation 5 is reestablished. Similarly, if the cost of capital is greater than the marginal product, firms will cut back on capital to raise the marginal product of capital.

For a given stock of private capital, the production sector's plans for output and labor are determined by the point on the firm's production function where the slope—the marginal product of labor—equals the ratio of the after-tax wage cost to the after-tax output price. Increasing labor increases output at a decreasing rate so that the production function is concave to the origin. In other words, the slope decreases as labor is increased. Point F in Figure 2 gives the profit maximizing labor–output combination for a given stock of capital.

Increasing public capital causes a parallel upward shift in the production function, and the firm's optimal combination of labor and output moves from F to F′. An increase in private capital causes the production function to twist upward.

[6] *When utility is separable in consumption and leisure, the intertemporal* MRS *has the following form:*

$$MRS(c_{+1},c) = \frac{u'(c)}{\frac{1}{1+\rho}u'(c_{+1})}.$$

In steady state, consumption is constant across time, so that the MRS *equals* $1 + \rho$.

[7] *Constant returns to scale means that if all inputs are scaled up by the same proportion, output will rise by the same scaling factor.*

[8] *To simplify the analysis, public capital is assumed to enter production separably. Thus, public capital does not raise (or lower) the marginal product of a private input. Empirical evidence suggests that this is an oversimplification. For instance, Lynde and Richmond (1992) estimate that a constant-returns-to-scale production function with a positive marginal product of capital is plausible. However, they find that public capital raises the marginal product of private capital and lowers the marginal product of labor. Their evidence on the complementarity in production of private and public capital is consistent with previous findings.*

[9] *Equation 6 is inoperative in the short run when the capital stock is fixed.*

This causes the firm's labor and output to move from F to F″. Also, an increase in wage costs increases the slope of the tangency line and causes point F to move down the production function.

The public sector purchases consumption and investment goods. It finances its expenditures and lump-sum transfers with tax revenues. For simplicity, in the model the government's budget is balanced in each period. In this case, the revenue constraint of the government is described by

$$(7) \qquad \bar{d} + [(\bar{k}_{+1} - \bar{k}) + \delta\bar{k}] + \bar{l} = t_w wh + t_r rk,$$

where $\bar{d}$ denotes defense expenditures. This is a comprehensive revenue constraint that aggregates federal, state, and local levels of the government.[10]

Finally, the goods, factor, and asset markets are assumed to clear in all periods. In particular, equilibrium in the goods markets is

$$(8) \qquad c + (k_{+1} - k) + \delta k + \bar{d} + (\bar{k}_{+1} - \bar{k}) + \delta\bar{k} = f(k,h) + g(\bar{k}).$$

A dynamic equilibrium occurs when all markets clear. Also, households and firms must be behaving optimally subject to their feasibility constraints and the government's actions.[11]

Graphing the model

In this model, the short run is defined as the amount of time it takes to adjust the capital stock. The short-run equilibrium can be described by equations 2, 5, and 8 and by the fact that the capital stock is constant. To study the long-run effects of fiscal policies, one needs the steady-state version of equations 2, 3, 5, 6, and 8. In a steady state, all variables are constant through time. Thus, time subscripts may be dropped. In particular, this means that the net increments to capital are zero. The only investment is replacement investment to offset physical depreciation.

The optimality conditions can be jointly analyzed by combining Figures 1 and 2. Subtracting private investment and public spending from output gives the amount of output available for private consumption. This is equivalent to a parallel downward shift of the production function and causes points F and I to coincide. Where the two points coincide is depicted as point O in

Figure 2
Optimal Output–Labor Combination

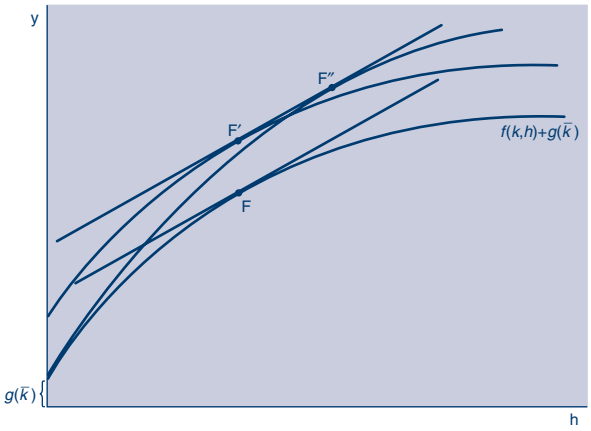


Figure 3. At point O, the (downward-shifted) production function and the indifference curve intersect at their points of tangency with their respective budget lines. Thus, point O determines the profit and utility maximizing aggregate consumption and labor levels.

Point O is optimal for individual households and firms. However, it is suboptimal for the economy as a whole as long as the slope of the indifference curve does not equal the slope of the production function. If firms increased labor by one unit, the additional output produced would increase utility for the household sector. However, the tax structure makes this move unprofitable for

[10] *As a point of reference, defense expenditures averaged 18.4 percent of total government expenditures, transfers to the private sector were 35.8 percent, and gross public investment averaged around 6.8 percent for the period 1986–90. (See Akhtar and Harris [1992] and Council of Economic Advisers [1992]. Also, see footnote 15.)*

[11] *A perfect foresight equilibrium is defined as sequences of optimal household consumption, labor, and savings plans and sequences of optimal firm plans of output and inputs that perfectly forecast the time path of all prices and government variables. These optimal plans also clear product and factor markets.*

the firms. In fact, the difference between the intercepts of the two tangency lines is a measure of the aggregate distortion from the tax system. This distortion is termed the aggregate tax wedge.

Figure 3 can be augmented to show the long and short-run equilibrium levels of consumption and labor. First, market equilibrium is given by equation 8. In steady state, this equation reduces to

$$(9) \qquad c + \bar{d} + \delta\bar{k} = h\left[f\left(\frac{k}{h},1\right) - \delta\frac{k}{h}\right] + g(\bar{k}).$$

Also, combining household and firm optimality conditions and imposing steady state yields

$$(10) \qquad MRS(c, H-h) = (1-t_w) f_h\left(\frac{k}{h},1\right).$$

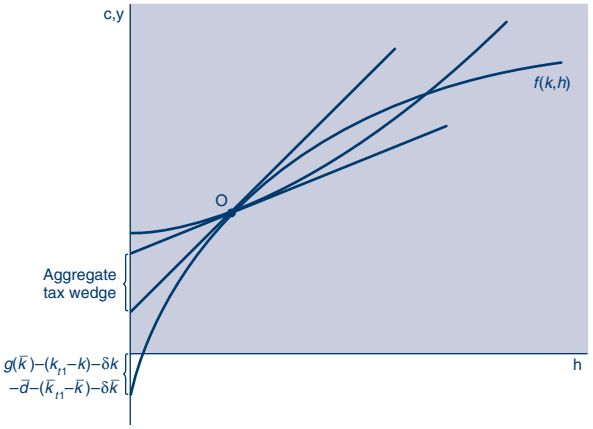
Since consumption in steady state is constant across time, the *MRS* between two adjacent consumptions only depends on the individual's impatience for early consumption:

$$(11) \qquad \rho = (1-t_r)\left[f_k\left(\frac{k}{h},1\right) - \delta\right].$$

Since the rate of time preference is the required rate of return to compensate for the individual's impatience, the *MRS* in steady state equals the constant ρ. Equation 11 determines the marginal product of private capital, and it also pegs the private capital–labor ratio to the rate of time preference.[12] Raising the tax rate on interest income reduces the after-tax marginal product of private capital below its long-run equilibrium level. To restore it to its long-run level, the steady-state marginal product of capital must rise, and the capital–labor ratio must, in turn, fall.

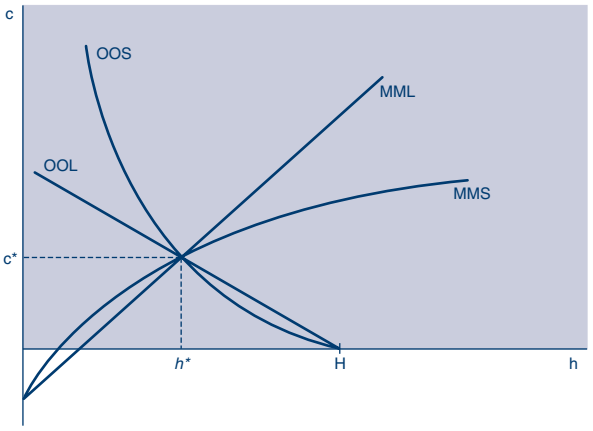
The market equilibrium condition, equation 9, determines the long-run market equilibrium

Figure 3
Combining Intratemporal Optima



relationship of consumption and labor for a given capital–labor ratio and for a given level of government expenditures. In the long run, equilibrium consumption is positively related to equilibrium employment. This is graphed as the line MML in Figure 4. Consumption and labor are linearly related because the capital–labor ratio is fixed. When the capital–labor ratio increases, labor is more productive at all levels of employment. This causes line MML to twist upward from its intercept. As will be discussed below, changing government expenditures causes a parallel shift of line MML.

Figure 4
Short- and Long-Run Equilibria



[12] *This is because of the homogeneity properties of the production function and because public capital enters separably. Thus, the capital–labor ratio is not affected by wage taxation and government consumption and investment. See footnote 20 on how the analysis changes when public capital is not separable in production.*

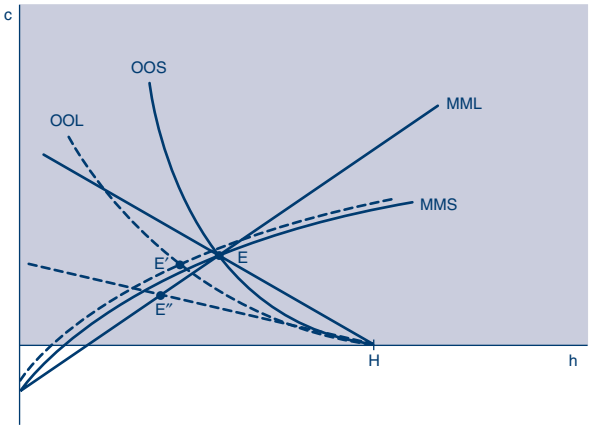
In the short run, the capital stock is fixed and the market equilibrium condition is given by equation 8. The short-run equilibrium relationship between consumption and labor is represented by line MMS. This line is just the parallel-shifted production function from Figure 3. Note that as labor increases beyond h^*, output will increase more in the long run than in the short run. This is because an increase in labor lowers the capital–labor ratio in the short run, which has a partially offsetting effect on output. In the long run, this partial offset does not occur because capital and labor move together.

Equation 10 determines the aggregate trade-off between private consumption and labor. One can use this equation to trace all intersections of the indifference and production functions in Figure 3 that are compatible with utility and profit maximization. In other words, one can trace all possible points O in Figure 3 for parallel shifts in the tangency lines for the production function and the indifference curves. Given the private capital–labor ratio, these points constitute the line OOL in Figure 4. Line OOL gives all the desired steady-state combinations of consumption and labor for a given wage rate. In essence, line OOL traces how consumption and labor respond to changes in wealth, holding relative after-tax prices constant.[13] For a given tax system, there are an infinite number of similar lines associated with different capital–labor ratios (or wage rates). The paths lying above and to the right of OOL are associated with higher after-tax wages or a higher capital–labor ratio. For a constant capital–labor ratio, a lower output tax or a lower consumption tax also causes OOL to shift up and to the right. Thus, shifts of line OOL represent substitution effects on labor and consumption.

When capital rather than the capital–labor ratio is held fixed, equation 10 gives the desired short-run combinations of labor and consumption. This is graphed as OOS in Figure 4. OOS is steeper than OOL, because as labor is reduced from h^* the capital–labor ratio and, hence, the wage rate, rises in the short-run. Households, therefore, require a larger compensation in terms of current consumption than in the long run when the wage rate is fixed.

In sum, the OO lines give desired combinations of labor and consumption, while the MM lines represents technologically feasible combinations. The intersection of the curves yields the overall equilibrium for the economy (in the short and long run).

Figure 5
Effects of a Higher Wage Tax



The effects of tax policies[14]

What happens when the government raises wage taxes? A permanent increase in wage taxes is the analytical counterpart to increasing payroll taxes. Wage taxes do not affect the long-run market equilibrium relationship. Thus, line MML is unchanged in Figure 5. Since the after-tax interest rate is pegged to the constant rate of time preference in the long-run, a wage tax does not alter the steady-state capital–labor ratio.

[13] *When preferences are homothetic, scaling consumption and leisure by the same scaling factor will leave the* MRS *unchanged. This implies that the* MRS *is constant along OOL and that OOL is a straight line.*

[14] *To isolate the effect of each fiscal policy instrument, I assume that the government uses lump-sum transfers to balance its budget when tax rates are increased. For the same reason, lump-sum taxes are used to finance increases in government expenditures.*

Since the capital–labor ratio does not change, the wage rate before taxes is unaffected. But since the after-tax wage rate received by households falls, households substitute away from work and consumption towards leisure. This is equivalent to a downward shift of OOL in Figure 5. Since OOL shifts down and the intersection of OOL and MML determines the long-run effect of the wage tax on consumption and labor, the long-run equilibrium moves from E to E″. Thus, consumption and labor fall in the long run. Because the capital–labor ratio is unchanged in the long run, raising the wage tax causes the capital stock to decline proportionately to the fall in labor. In turn, output will fall in the long run.

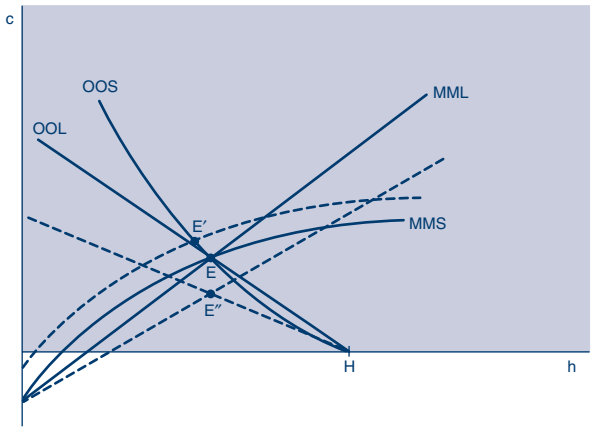
In the short run, capital is fixed, and line OOS shifts to the left. As households substitute away from labor, the short-run capital–labor ratio rises. This causes the wage rate before taxes to rise. Thus, the short-run fall in the after-tax wage rate is less than the long-run fall. The increase in the short-run capital–labor ratio also affects the market equilibrium line MMS given by equation 8. Since the capital–labor ratio is unchanged in the long run, investment must fall over time to return the capital–labor ratio to its original level. A reduction in investment tends to offset the necessary reduction in consumption, given that labor and output fall. For any level of labor (and output), a reduction of investment means that there is more output available for consumption. Thus, consumption increases according to equation 8, and MMS shifts upward in the short run. Assuming the effect on OOS dominates, the economy jumps from E to E′, and labor and consumption fall in the short run.

What happens when the government raises taxes on interest income? This tends to reduce the after-tax interest rate received by households for any given pretax interest rate. But since the after-tax interest rate is pegged in the long run, the pretax interest rate must rise. To accomplish, this the long-run capital–labor ratio falls in order to increase the marginal product of capital. In turn, a fall in the steady-state capital–labor ratio will affect lines MML and OOL. For any given level of labor, reducing the capital–labor ratio means that labor is less productive. This reduces long-run output and consumption. Thus, MML rotates down and to the right. At the same time, the after-tax wage rate falls with a reduction in the capital–labor ratio. Thus, households substitute away from work and consumption. This is equivalent to a leftward shift of OOL. Figure 6 shows how increasing the interest rate tax twists MML and OOL downward. This causes the equilibrium to move from E to E″. Consumption falls in the long run. Whether labor falls or rises is unclear and depends on how much OOL falls relative to MML. Nonetheless, for all reasonable parametrizations, capital and output will fall in the long run. Since the capital–labor ratio falls in the long run, investment will fall in the short run. Thus, MMS shifts up and the economy moves from E to E′ in the short run.

To summarize, increasing either factor tax will lower labor and output in the short run and increase the capital–labor ratio. But a wage tax will lower consumption in the short run, while an interest rate tax will raise consumption. In the long run, both taxes depress consumption and output. However, they affect labor and the capital–labor ratio differently. A wage tax leaves the capital–labor ratio unchanged and depresses labor. On the other hand, an interest rate tax lowers the capital–labor ratio and has an uncertain effect on labor.

A brief glance at the box titled "Equivalence of Permanent Tax Policies," shows how taxes on consumption and corporations are equivalent to the factor income taxes introduced in this article. In short, most taxes correspond to taxes on capital or labor. Ostensibly, having a personal and cor-

Figure 6
Effects of a Higher Interest Rate Tax



Equivalence of Permanent Tax Policies

One can easily expand the model by including household consumption taxes, t_c, that comprise excise and sales taxes. In this case, equation 1 expands to

$$\text{(A)} \qquad (1+t_c)c+(k_{+1}-k)=(1-t_w)wh + (1-t_r)rk+\bar{l}.$$

Additionally, various taxes can be levied on the firm so that after-tax profits are given by

$$\text{(B)} \qquad (1+t_o)y-(1+t_h)wh-(1+t_k)(r+\delta)k - (k_{+1}-k),$$

where t_o is a tax rate on the output of the firm. Also, t_h is a tax surcharge on firms' labor costs, such as contributions for social insurance. The term t_k is the tax surcharge on the rental payments of capital and adds to (or subtracts from) the cost of capital through alternative tax depreciation schedules, capital consumption allowances, and taxation and deductibility of dividends, debt, and capital gains.

In this case, the combined household and firm steady-state optimality conditions generalize to

$$\text{(C)} \quad MRS(c,H-h)=\left[\frac{(1-t_w)(1-t_o)}{(1+t_c)(1+t_h)}\right]f_h\left(\frac{k}{h},1\right),$$

$$\text{(D)} \qquad \rho=(1-t_r)\left[\frac{1+t_o}{1-t_k}f_k\left(\frac{k}{h},1\right)-\delta\right].$$

From the optimality conditions, one can show that the following taxes are equivalent, in the sense that their qualitative effects on aggregate consumption, investment, labor, and output (in the short run and long run) are the same. The equivalence relationships show that taxes on corporations imitate taxes on households by ultimately taxing labor and capital. It also can be shown that a consumption tax is equivalent to a tax on labor:

1. A tax on the wage income of households, t_w, is equivalent to a surcharge on the labor costs of firms, t_h.
2. A tax on the interest income of households, t_r, is equivalent to a surcharge on the capital costs of firms, t_k.
3. A (simple) income tax, t_y, is equivalent to taxing households' wage and interest incomes at the same rate—that is, $t_w = t_r$.
4. An output tax, t_o, is equivalent to taxing firms' wage and interest costs at the same rate—that is, $t_h = t_k$.
5. An output tax, t_o, is equivalent to a (simple) income tax, t_y.
6. An output tax, t_o, is equivalent to a consumption tax plus a tax on interest income—that is, $t_c = t_r$. Or, a consumption tax is equivalent to a sales tax with capital costs exempt.
7. A consumption tax, t_c, is equivalent to a tax on wage income, t_w.

porate income tax implies that tax rates on labor and capital are equal or that a "simple income tax" exists. This is misleading because of special tax considerations for capital, such as depreciation schedules, capital gains taxes and so on. In fact, there is evidence that tax rates on capital far exceed tax rates on labor.[15] Thus, it is natural to ask what are the effects of a reduction in interest rate taxes

[15] *Marginal tax rates have been estimated by a number of authors. For instance, Hansson's (1985) survey concludes that the labor tax rate lies between 0.2 and 0.3, while the capital tax rate is bounded above by 0.5. McGrattan (1991) estimates that the labor tax rate fell in the interval between 0.1 and 0.35, and the capital tax rate ranged between 0.3 and 0.6.*

and an increase in wage taxes. Such a scheme may be considered a variant of the investment-friendly restructuring of business taxes proposed by the presidential candidates.[16] From the analysis above, one sees that the short-run effect is to shift OOS leftward. However, the individual taxes affect short-run investment in opposite directions. Since the capital–labor ratio rises in the long run, it is likely that investment will increase in the short run and that the MMS will shift down. However, even if the effects on investment approximately cancel, consumption and labor will fall in the short run.

Line MML will shift up in the long run, because the long-run capital–labor ratio rises. Assuming that the different effects on line OOL approximately cancel, consumption will increase and labor will fall. Also, output will rise in the long run along with the capital–labor ratio. This exercise is intriguing, because it is possible to get a long-run expansionary effect simply by changing the tax mix from capital to labor taxation. However, the short-run economic costs of such policies may outweigh the long-run benefits.

The effects of spending policies

Suppose that defense spending falls permanently.[17] Since capital tax rates do not change, the capital-labor ratio is unaffected in the long run. Thus, the long-run market equilibrium relationship MML depends solely on the demand and supply effects of the change. Since defense spending does not enter the production function, there is only a demand effect. This means that more output is left for consumption than before the shock. For all levels of equilibrium labor, consumption rises. Thus, line MML shifts up in Figure 7, while line OOL is unaffected. Consequently, the long-run equilibrium moves from E to E″, with private consumption rising and labor falling. Also, since the long-run capital–labor ratio does not change, capital must fall proportionately to labor.

The short-run effects are qualitatively similar; only MMS shifts up. Private consumption will be crowded in and labor will fall because households feel wealthier. Since the capital–labor ratio remains unchanged in the long run, investment will fall. This reinforces the positive effect on private consumption. Since labor falls, output will fall, too.[18]

The effects of increased public investment differ from those of increased defense spending. Because of the separability of the production function, public investment does not affect the private capital–labor ratio. While higher public investment does not affect OOL, it has two effects on MML. Not only does public investment have a demand effect, it also has a supply effect on the market equilibrium condition. If the marginal product of public capital is greater than the depreciation rate, then the supply effect will dominate. Since this is likely, output increases relatively more than demand does, and consumption rises for all levels of labor. Thus, line MML shifts up in Figure 8. Therefore, labor, capital, and private output fall in the long run, while consumption and total output increase.

The short-run effect of public investment does not include a supply effect. This is because investment takes time to be productive. Thus, the demand effect governs the short-run market equilibrium relationship. For all levels of labor, higher investment means lower consumption. Thus, line MMS shifts down in the short run in Figure 8. This means that at the short-run equilibrium point E′,

[16] *Reducing the cost of capital can be accomplished by an investment tax credit or by reducing the capital gains tax. The cost of labor would rise if a tax for worker training were instituted, or employer health care costs were raised. Since consumption taxes and labor taxes are equivalent, one would get the same result by increasing sales taxes.*

[17] *This policy exercise was analyzed by Wynne (1991). He also considers the aggregate effects of military employment policies.*

[18] *What if government consumption enters private utility, as in footnote 5? In this case, the MRS is a function of composite, not private, consumption. Also, public consumption enters the market equilibrium condition just like defense expenditures. These two facts can be attached to the graphical analysis for defense spending.*

If government consumption falls, lines MMS and MML shift up just as they do with a reduction in defense spending. However, lines OOS and OOL will also shift down, because private consumption must rise to offset the fall of the MRS induced by public consumption. If public and private consumption are less than perfect substitutes, households will work more to raise output and to mitigate the negative effect on private consumption. In the short and long run, private consumption will rise, while the effect on labor is uncertain.

Figure 7
Effects of Lower Defense Spending

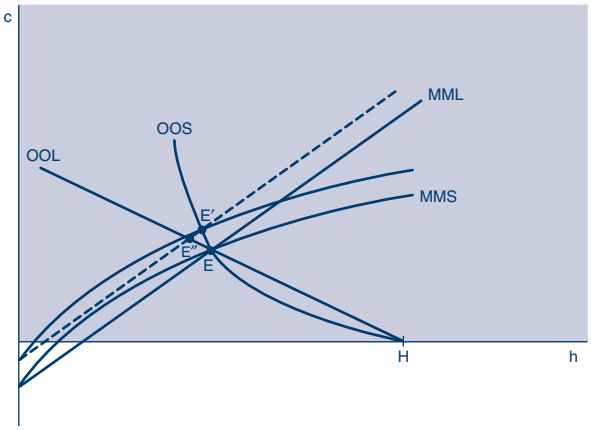
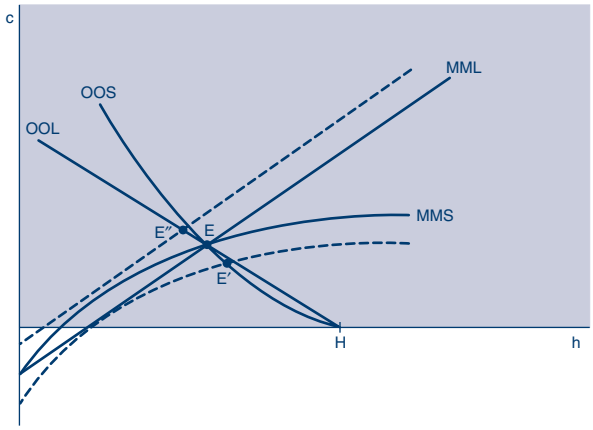


Figure 8
Effects of Higher Public Investment



labor is higher and consumption lower than at the point of departure, E. Over time, as the economy moves from E′ to E″, consumption will rise and labor fall.[19]

In sum, in the short run, more public investment tends to lower consumption and increase labor and output. In the long run, public investment raises consumption and output and lowers labor. A reduction of defense expenditures will, on the other hand, raise consumption and reduce labor and output in the long run and in the short run. Spending the peace dividend from reduced defense outlays on public investment is equivalent to increasing public investment and reducing defense spending by an equal amount. In this case, demand effects will cancel in the market equilibrium condition MMS. While there are no supply effects in the short run, in the long run there will be positive demand and supply effects on MML. Since the supply effect dominates, MML shifts leftward by more than if public investment were increased by itself. Thus, in the short run there is no effect on the aggregate variables. However, in the long run private consumption will rise and labor will fall. Since public output rises in the long run and private output falls, the effect on total output is indeterminate.[20]

Finally, what if the government reduces defense spending and legislates an investment-enhancing reduction in capital taxes? Briefly, in the short run there are no effects on OOS. There are offsetting

[19] *If public capital is not separable in production and production is constant-returns-to-scale in all inputs, then the public capital to private labor ratio enters equations 9 through 11. Thus, the private capital–labor ratio is not pegged by the constant rate of time preference in equation 11 and will adjust with changes of the public capital–labor ratio. The government can peg the private capital–labor ratio to the discount rate by varying the public capital–labor ratio (using lump-sum taxes to balance its budget). It then is free to pursue the policies discussed above with the same aggregate effects.*

If the government targets a higher public capital–labor ratio, the marginal product of private capital rises in the long run, raising the private capital–labor ratio. In the short run, public and private investment increase, causing MMS to shift down. Assuming that supply effects dominate demand effects, line MML will shift up. Line OOL shifts rightward because wages rise, while OOS remains unaffected. Thus, the graphical analysis resembles the case of increasing public investment and simultaneously reducing capital taxes.

[20] *What if (separable) public capital is raised and public consumption is reduced dollar for dollar? In this case, line OOS shifts up. Since labor rises in the short run and the capital–labor ratio falls, private investment will increase. Thus, MMS shifts down. Therefore, labor, investment, and output rise in the short run, while private consumption may rise or fall. Also, line MML will shift upwards because of the supply effect of public investment. At the same time, line OOL will shift down when public consumption is not separable. Thus, it follows that labor and output fall in the long run, but the effect on consumption is uncertain.*

Table 1
Summary of Policy Effects

Policy	Short-Run Effects					Long-Run Effects				
	Con-sumption	Labor	Capital–labor ratio	Invest-ment	Output	Con-sumption	Labor	Capital–labor ratio	Capital	Output
Higher labor tax	–	–	+	–	–	–	–	0	–	–
Higher capital tax	+	–	+	–	–	–	?	–	–	–
Higher labor tax and lower capital tax	–	–	+	–	–	+	–	+	+	+
Lower defense spending	+	–	+	–	–	+	–	0	–	–
Higher public investment	–	+	–	+	+	+	–	0	–	+
Lower defense spending and higher public investment	0	0	0	0	0	+	–	0	–	?
Lower defense spending and lower capital tax	?	?	?	?	?	+	–	+	+	?

effects on investment, so that the effects on MMS are unclear. In the long run, both MML and OOL will shift upward, except that the shift of MML will be magnified. Since the short-run effects depend on how MMS shifts, consumption will move in the opposite direction of labor (and output). In the long run, consumption rises, labor falls, and the effect on output is ambiguous.

Conclusion

In this article, I have developed a simple framework to analyze the effects of various fiscal policies. Abstracting from distributional considerations, this model is useful for looking at the short-run and long-run effects of various taxation and expenditure schemes. In particular, I contrast wage income taxation (or taxes on labor) with interest income taxation (or taxes on capital), and I contrast defense spending with government investment. The effects of the policy experiments are summarized in Table 1. These particular instruments are chosen because they figured prominently in the fiscal policy debate of 1992. Also, many fiscal policies can be described as a combination of these four instruments. For instance, it is shown that most corporate taxes are equivalent to personal income taxes in their effects on macroeconomic aggregates. This is because corporate and personal income taxes ultimately tax the inputs to production. This equivalence lies at the heart of economists' observation that the current tax system heavily taxes capital.

The model suggests that increases in taxes on inputs will depress output and consumption in the long run. While labor taxes tend to lower labor and capital in the long run, capital taxes lower capital but may raise or lower labor in the long run. The model also shows that a consumption tax is equivalent to a tax on labor. Thus, a differential change in factor taxes may have been implicit in some of the 1992 campaign proposals for a pro-investment restructuring of business taxes. Suppose that capital taxes are lowered and labor (or consumption) taxes raised such that the effect is neutral on government revenues. In this case, it

is likely that consumption, labor, and output will fall in the short run. In the long run, labor still may fall, but consumption and output will rise. Thus, it is possible that changing the tax mix will have expansionary long-run effects on the economy and still be revenue neutral. However, these long-run benefits must be weighed against their short-run costs.[21]

On the other hand, the model proposes that spending the peace dividend from reduced defense spending on public investment will yield long-run benefits and no short-run costs. A reduction in defense expenditures tends to increase consumption and reduce capital, labor, and output in the short and long run. By contrast, public investment will raise labor and output and lower consumption in the short run; it will reduce labor and raise consumption and output in the long run. Thus, if government investment increases and defense spending falls dollar for dollar, consumption, labor, and output are not affected in the short run, but in the long run, consumption rises and labor and private capital fall. Whether output rises depends on the output effects of shifting from private capital to public capital. The model also has implications for when the peace dividend is used to create a more investment-friendly business tax structure by reducing tax distortions on capital. In the short run, output may rise or fall; however, consumption and output (and labor) will move in opposite directions in the short run. In the long run, consumption and capital will rise while labor falls. Whether output rises depends on the output effects of shifting from labor to private capital.

Whether this last option is preferable to increasing public investment was a principle difference between the major contending fiscal policy platforms. However, it turns out that both options would be likely to have very similar qualitative outcomes in the long run. And they also appear to be similar to a shift from capital to labor (or consumption) taxes in their long-run effects. While these three policies have qualitatively similar long-run effects, their short-run effects are dissimilar. Increasing public investment by reducing defense spending dollar-for-dollar clearly dominates a differential tax change (from a labor tax to a capital tax) in the short run. Whether this policy also dominates a reduction of defense spending and capital taxes depends on whether output rises or falls. And since consumption will move opposite to output, the ranking of the short-run effects of the last two policies depends on whether the public puts a higher value on movements in consumption or output. Currently, the empirical testing of these models is an active area of research. This research will provide estimates of the short-run and long-run policy effects and help in deciding which policies are implemented.

[21] *Note that increasing the progressivity of the personal income tax by increasing taxes on the rich (and maybe lowering taxes on the middle class) is a capital tax in disguise. Because the share of capital income increases with income, taxing the rich taxes capital income (and reducing middle class taxes lowers labor taxes). Thus, increasing the progressivity of the income tax might offset the pro-investment business tax restructuring discussed above.*

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