R E V I E W

Vol. 71, No.6 November/December 1989

THE FEDERAL RESERVE BANK of ST. LOUIS

Federal Reserve Bank of St. Louis
Review
November/December 1989

In This Issue . . .

The merits and demerits of corporate takeovers, especially hostile ones, became one of the hottest topics of discussion and debate in the 1980s and will likely remain so in the 1990s. In recent years, motivated in part by concerns that shareholder interests have been ill-served by this activity, several bills have been introduced in Congress to restrict such takeovers.

In the first article in this *Review*, "The Cost of Restricting Corporate Takeovers: A Lesson From Switzerland," Werner Hermann and G.J. Santoni analyze the effects of recent changes in Swiss commercial practice on shareholder wealth. The authors examine Swiss stock market data to determine what happened when restrictions on the market for corporate control were relaxed. They demonstrate that Swiss shareholders actually benefited from the move to reduce restrictions on corporate takeover activity. Thus, current proposals to restrict corporate takeovers in the United States, the authors say, will likely adversely affect U.S. shareholders.

* * *

Nominal income targeting, which involves changing the money supply to counteract movements in nominal GNP, is attracting increasing attention, particularly among those who would like to establish some constraint on monetary policy actions. In the second article in this issue, "Understanding Nomimal GNP Targeting," Michael D. Bradley and Dennis W. Jansen analyze nominal income targeting from both a theoretical and a practical standpoint. The authors illustrate several desirable features of nominal income targeting, among which is its ability to stabilize output, in a simple macroeconomic model.

Bradley and Jansen point out, however, that ignorance of the correct equations, parameter values and lag structure that characterize the U.S. economy sharply reduces the appeal of any monetary policy procedures, including nominal income targeting, that requires responding to the current state of the economy.

* * *

Because its effects are so pervasive, virtually everyone is concerned about inflation. In the third article in this *Review*, "Do Price Indexes Tell Us About Inflation? A Review of the Issues," Keith M. Carlson discusses the broad issues involved in defining inflation and using U.S. price indexes to measure it.

The indexes are examined from two perspectives: that of the individual attempting to maximize his well-being, and that of the policymaker attempting to control inflation. The author concludes that, to measure and analyze inflation properly, more information is required than these conventional price indexes provide. A theoretical measure of price change would include the prices of assets, which serve as proxies for the prices of future consumption services. From a policymaker's perspective, the author concludes, no one price measure has performed consistently better than another since 1952 when compared with the Friedman measure of money relative to trend output.

* * *

Werner Hermann and G. J. Santoni

Werner Hermann, an economist at the Swiss National Bank, was a visiting scholar at the Federal Reserve Bank of St. Louis. G. J. Santoni is a professor of economics at Ball State University. *Santoni's research was supported by the George A. and Frances Ball Foundation. Scott Leitz provided research assistance.*

The Cost Of Restricting Corporate Takeovers: A Lesson From Switzerland

MANY PEOPLE in management, labor, banking and Congress are alarmed about the recent increase in corporate takeovers. These people believe that the risk of a takeover is detrimental to the efficient management of corporations and not in the long-run interests of the owners (see shaded insert on following page). As a result, they have advanced various proposals to restrict corporate takeovers.[1]

Others have a different view of takeovers, believing that restrictions of takeover activity will be harmful to shareholders' wealth. They argue that takeover activity is a simple manifestation of competition in the market for corporate control.[2] Furthermore, by inducing corporate management to weigh the effect of its decisions on the present value of the corporation (and, thus, share prices), this competition provides strong protection for the interests of all shareholders including those of "non-controlling" shareholders.[3] According to this view, the threat of takeovers is important to maintaining an efficient corporate sector.[4]

A recent change in Swiss commercial practice provides important new evidence about the consequences of restricting corporate takeovers. The Swiss Commercial Code in the past has allowed corporations to build effective barriers against takeovers. Many Swiss firms have taken advantage of this legal provision to protect themselves against foreign raiders. On November 17, 1988, Nestlé (by far the largest Swiss corporation) announced that it would allow foreign investors to buy a type of share that only Swiss citizens could hold until then. Since then, a foreign takeover of Nestlé has been possible, at least in principle.

Nestlé's announcement and the events surrounding it have important implications for U.S. proposals to restrict takeovers. This paper examines data on the share prices of Nestlé and

[1]These include restricting voting rights to those who have owned the stock for a minimum of one year, disallowing interest deductions from taxable income on certain types of bonds used to finance takeovers and a "sliding scale" capital gains tax rate that is lower the longer an asset is held before sale. In addition, there are at least five Senate and House panels that are planning to hold hearings on leveraged buyouts and other types of debt-financed takeovers. See Hershey (1988), Anders and Swartz (1988), Norris (1988) and Passell (1988).

[2]See Manne (1965), Manne and Ribstein (1988) and Jensen and Ruback (1983).

[3]See Manne (1965), p. 113.

[4]See Manne and Ribstein (1988), p. 29. Some have singled out an anti-takeover bill approved by the House Ways and Means Committee on October 15, 1987, as an important contributing factor to the stock market crash on October 19, 1987. See Ricks (1989).

Some Views On Hostile Takeovers

"You're going to have a bunch of highly leveraged companies that aren't going to be able to weather a financial storm."
J. L. Lanier Jr., C.E.O.
West Point—Pepperell Inc.

"If it made sense to put the company together for economic strength in the beginning, then it certainly makes no sense to break it apart."
John De Lorean,
former General Motors executive

"I have to wonder if there's some kind of structural imbalance in the financial markets if the same package of assets broken into pieces are worth twice what the market puts on them when all together."
John R. Hall, C.E.O.
Ashland Oil Inc.

"People are questioning a whole series of this kind of activity, particularly in the light of all the foreign investment in this country. They're questioning the theory that many people are so enamored with—the whole 'me now,' big-hit generation of 28-year-old millionaires on Wall Street who haven't contributed to the country's economy. And a hell of a lot of people resent that."
Phillip J. Dion, C.E.O.
Del Webb Corp.

"How could it possibly help the company to be that much in debt? How does it help the employees? How can the company progress, how can they do research and development?"
Gino Pala, C.E.O.
Dixon Ticonderoga Co.

"There is no question that the Committee on Ways and Means will be looking at leveraged buy outs and mergers and acquisitions—and do something about it."
Dan Rostenkowski, Chairman
Committee on Ways and Means

other Swiss firms around the November 1988 announcement date to analyze the effect of this sudden change in policy on shareholder wealth. If the data indicate that investors in Swiss stock generally benefited when restrictions against foreign takeovers were relaxed, current U.S. proposals to limit takeovers are likely to be counterproductive in protecting shareholder wealth.

STOCK PRICE FUNDAMENTALS

Since stock prices represent the market value of a firm, they play a significant role in the analysis of this paper. Therefore, it is important to understand how they are determined.

People value common stock for its expected return. Since investors may choose among broad categories of stock, the expected return on any particular stock must be equal to the expected return on other stocks of similar risk. For example, if a particular stock is expected to yield a relatively low return, investors will shun it, causing its price to fall and its expected return to rise until its yield is equal to that of similar stocks. The reverse holds for any stock with an expected return higher than other stocks of similar risk. An equilibrium exists when expected returns are equal across stocks with identical risk characteristics. The equilibrium return is called the required discount rate.

Equation 1 calculates the expected rate of return (r) from holding a share for one year assuming dividends (d) are paid at year-end:[5]

$$(1)\quad E_t\,(r_{t,t+1}) = (E_tP_{t+1} + E_td_{t+1} - P_t)/P_t.$$

Equation 1 says that the expected return at time t of holding a share of stock from t to t+1 is equal to the expected price of the stock at the end of the period (E_tP_{t+1}), plus the expected dividend (E_td_{t+1}), less the current price of the stock (P_t), all divided by the current price.

Equation 2 solves equation 1 for the current price by noting that the expected return equals the required discount rate (i) in equilibrium:

[5]See Brealey (1983), pp. 67-72, and Brealey and Myers (1988), pp. 43-58.

(2) $P_t = (E_tP_{t+1} + E_td_{t+1})/(1+i_t)$.

Equation 2 indicates that investors must forecast the price of the stock next period. What are the fundamentals of this price? In principle, the future price depends on the earnings of the company, dividend payments, and the required discount rate that investors expect to prevail over the life of the firm. If dividends are expected to grow at a constant annual rate (g) and the discount rate is constant, the calculation shown in equation 2 can be simplified as in equation 3:[6]

(3) $P_t = d_t(1+g)/(i-g)$.

Equation 3 gives a relatively simple solution for the current stock price. For example, suppose the current dividend is $.98, the required discount rate is 12 percent and the expected growth rate in dividends is 2 percent. Equation 3 indicates that a share of stock in this firm will trade at a price around $10[= $.98(1.02)/(.12 − .02)].

TAKEOVERS AND THE FUNDAMENTALS

Equation 3 is a useful summary of the fundamentals that determine stock prices. It indicates that stock prices change when one or more of the fundamentals change. Furthermore, it is useful in contrasting the views of the proponents and critics of takeovers.

Critics of takeovers believe that competition for the control of firms adversely affects the fundamentals. For example, they argue that takeovers increase tension between management, labor and government to the detriment of future earnings and dividends; or that increases in the target's debt-to-equity ratio that accompany many takeovers increases the risk (and the discount rate) associated with the firm's expected earning stream; or that takeover threats force management to concentrate too heavily on projects that promise increased earnings in the near term at the expense of long-term research and development.

Others argue that the threat of takeovers improves the fundamentals on net because they induce management to use the firm's resources in ways that generate higher returns for the owners. They point out that the interests of management and shareholders can diverge and that it is costly for shareholders to monitor management's decisions. In the absence of strong competition from alternative management teams, the firm's managers, acting in their own interests, can capture a portion of the stream of earnings that would otherwise accrue to the shareholders. This may come in the form of high management salaries, large expense accounts, plush offices, lengthy vacations and other forms of shirking. Shirking affects the distribution of earnings between the firm's management and its owners. Furthermore, it may lower the stream of earnings generated by the firm. The cost associated with this type of behavior, called "agency cost," lowers the expected stream of dividends that accrue to shareholders and is reflected in lower share prices.[7]

The reduction in share price due to agency costs is a measure of the capital gain that could be obtained from a successful raid. According to this argument, competition among alternative management teams in the market for corporate control assures that agency costs are kept to a minimum, resulting in higher share prices for firm owners.[8] Thus, this theory suggests that takeover activity raises stock prices while the one mentioned earlier implies the opposite.

What evidence is there to support either view? Data on U.S. takeovers suggests that they raise stock prices.[9] The recent changes in the Swiss stock market should make Swiss data particularly useful in adding to this body of evidence.

SWISS STOCK MARKET INSTITUTIONAL DETAILS

Registered, Bearer and Non-voting Shares

Swiss law allows corporations to issue several types of shares called bearer, registered and non-voting shares. Bearer shares are the equivalent of the typical common share issued by

[6]Brealey (1983), p. 69. The current price is defined by equation 3 only if the expected growth rate of dividends is less than the discount rate.

[7]See Manne (1965), Manne and Ribstein (1988) and Alchian (1977), pp. 227-58.

[8]See Manne (1965), p. 113, and Ruback (1988).

[9]See Jensen and Ruback (1983).

U.S. corporations. Ownership of a bearer share entitles the holder to the dividends and one vote at shareholder meetings. They can be transferred without restriction.

Registered shares differ from bearer shares in several important respects. For example, the purchase of a registered share entitles the buyer to dividends but does not grant the new owner the automatic right to vote at shareholder meetings. To obtain voting rights, the new owner must apply to be "registered" in the firm's book of shareholders. Until the new owner is registered, the voting right remains with the previous (and still registered) owner. Registration of the new owner, however, is not automatic. The corporate charter can summarily exclude certain investors from registration.[10] Furthermore, Swiss stockbrokers have declared publicly that they will refuse to exercise buy orders from clients that are unlikely to qualify for registration.[11] While registration is often restricted to Swiss citizens or institutions and, thus, can effectively prevent foreign takeovers of Swiss firms, this tool has been used to block Swiss raiders as well.[12]

A glance at the stock market page of a Swiss newspaper reveals that about a third of the Swiss corporations issue registered shares. Because these firms typically issue more registered shares than bearer shares, registered owners hold the controlling interest in the companies that issue both.[13] Coupled with the provisions regarding registration, this gives these Swiss firms iron-clad protection against hostile takeovers.

Besides registered and bearer shares, large companies issue securities that pay dividends but have no voting rights associated with them. Holders of these non-voting shares (participation certificates) have virtually the same rights as voting shareholders, apart from the right to vote.

Different Par Values

Dividend payments and the share of the firm's liquidation value that accrue to Swiss stockholders are proportional to the par value of the shares they hold. Both registered and bearer shares carry one vote. Swiss firms, however, are allowed to issue registered shares with lower par values than bearer shares. For example, let R be a registered share with a par value of $50 while B is a bearer share with a par value of $100. Both shares carry one vote but the expected stream of dividends generated by the registered share is one-half that of the bearer share. Other things the same, the registered share will trade at about one-half the price of the bearer share. Table 1 summarizes the participation rights of the different types of shares.

Table 1
Swiss Shares and Their Entitlements

	Participation	
Type of Share	Dividends	Voting
Bearer	Yes	Yes
Registered	Yes	Upon registration
Non-voting	Yes	No

NESTLING UP TO SHARE HOLDERS

To the surprise of many market participants, the common Swiss practice of discriminating against foreign investors was suddenly changed on November 17, 1988. Nestlé, the Swiss multinational foods group, decided to register shares of foreign investors. Nestlé had been repeatedly criticized for attempting to take over firms in countries outside Switzerland while being protected from foreign acquisition. In a release that accompanied the announcement, Nestlé's finance director explained that "there was a contradiction between being multinational in our behavior and national in our share control."[14]

[10]See Horner (1988) and Foreman (1988). In the 1930s, this restriction was used to prevent takeovers of Swiss firms by firms in Nazi Germany. See "Shareholders, Who Are They?" (1989).

[11]See Horner (1988), pp. 70-71, and Foreman (1988).

[12]See Dullforce (August 9, 1988) and Wicks (August 2, 1988), who report on the takeover battle for La Suisse, a Swiss insurance company. In that case, the highest Swiss bidder for La Suisse withdrew his offer after the La Suisse board announced that it would refuse to register the bidder's shares.

[13]See "Shareholders, Who Are They?" (1989). For the number of shares issued of each type, see Swiss Bank Corporation, (1987).

Because of Nestlé's relative size, its decision was viewed as extremely important by market participants.[15] Since then, several other Swiss firms have made similar announcements.[16] Furthermore, the Swiss parliament is currently considering revisions to the commercial code that would make Swiss firms more accessible to outsiders. In part, such revisions have been prompted by Swiss shareholders who claim that they are adversely affected by anti-takeover rules. On the other hand, some Swiss citizens believe that hostile takeovers could harm Swiss companies and that management should be protected from raiders. Although the outcome of this debate is uncertain, the decision by Nestlé and other Swiss firms to liberalize shareholder registration marks a significant step in changing Swiss commercial practices regarding corporate takeovers.

The theory of the market for corporate control suggests that impediments to takeovers are costly, which means that they reduce shareholder wealth. According to this theory, one consequence of reducing impediments to takeovers is that the capitalized value of the firm increases. To test this, data on Nestlé's share prices before and after November 1988 are examined. Since Nestlé's decision is viewed as having important consequences on the entire Swiss stock market, share price data on 44 other firms traded on the Zurich exchange are examined as well.[17]

THE SWISS EVIDENCE

To determine the effect of the loosening of voting restrictions on corporate shares in Switzerland, daily closing prices are analyzed at three points in time: the last trading days in December 1985, July 1988 and December 1988. The July 1988 date leads Nestlé's announcement by about three months to minimize the possibility that advance information about the forthcoming announcement might affect prices. The December 1988 date is the month immediately following the announcement month. The reason for choosing the December 1985 date is discussed below. The sample consists of nine firms that issue only bearer and non-voting shares, 21 firms that issue all three types of shares and 15 that issue only registered and bearer shares. A list of the firms appears in the appendix. The data are adjusted for differences in par values between different share types of the same company.

Did Registered Shares Trade at a Discount to Bearer Shares?

The first question examined is whether registered shares typically traded at a discount to bearer and non-voting shares of the same firm before November 1988.[18] Table 2 shows the ratios of the prices of registered to bearer and registered to non-voting shares for the same firm at three points in time: December 1985, July 1988 and December 1988.

The 36 firms in this sample differ in several respects. Some issue non-voting shares; others do not. In addition, some of the firms in the sample issue registered and bearer shares with the same par values while others issue these shares with different par values. Table 2 examines data on the price ratios while controlling for these differences.

Panel A of table 2 shows the mean of the ratio of registered to bearer share prices for the 21 companies that issue all three types of shares. The data are prices for the close of the last trading day of the month. The null hypothesis that the mean of the price ratios is one is rejected at a 5 percent significance level for the two dates before November 1988 but not for the December 1988 prices. The ratios for the December 1985 and July 1988 dates are indistinguishable in a statistical sense, suggesting

---

[14]A practical motivation for the decision was suggested by William Dullforce who commented that "Nestle's access to capital markets was restricted by the differentiation between registered and bearer shares." See Dullforce (November 18, 1988).

[15]The value of Nestle shares account for about 10 percent of the total Swiss stock market. See "Shareholders, Who Are They?" (1989), p. 69.

[16]The most recent firm to make a similar announcement is Jacobs Suchard, a coffee and chocolate concern. See Wicks (June 22, 1988).

[17]The Zurich stock exchange is the largest in Switzerland. More than 400 Swiss and foreign companies are listed on this exchange along with a much larger number of bonds.

[18]Some have argued that tax considerations and differential transaction costs imply that registered shares will sell at a discount to bearer shares. Since these factors did not change during the period analyzed, however, they cannot explain significant changes in relative share prices associated with Nestle's decision to allow foreigners to purchase its registered shares.

Table 2
Price of Registered Relative to Bearer Shares For Selected Months

Panel A: Firms Issuing All Three Share Types With the Same Par Values

	Dates		
	12/85	7/88	12/88
Mean	.770*	.798*	.960
t-score	5.22	3.75	1.47
N = 21			

Panel B: Firms Issuing Only Registered and Bearer Shares With Different Par Values[1]

	Dates		
	12/85	7/88	12/88
Mean	.859*	.890*	.962
t-score	2.60	2.86	.98
N = 10			

Panel C: Firms Issuing Only Registered and Bearer Shares With the Same Par Values

	Dates		
	12/85	7/88	12/88
Mean	.767*	.799*	.870*
t-score	5.66	5.10	3.53
N = 5			

* Significantly different from 1.0 at the 5 percent level.

[1] Prices adjusted for differences in par values.

that the discount on registered shares prevailed long before Nestlé's announcement.[19] This discount vanished, however, by December 1988.

The panel B data differs from the panel A data in two respects. The price ratios in panel B cover firms that issue only registered and bearer shares (no non-voting shares). Furthermore, the par values of each firm's registered shares are lower than the par values of the bearer shares for the firms in this panel. Since the stockholders of Swiss firms share dividends in proportion to the par values of the shares they hold, registered shares with lower par values than bearer shares should sell at a discount to bearer shares regardless of ownership restrictions on registered shares. To control for this "par value" effect, the registered share prices of the panel B firms are adjusted for differences in the par values.

The results shown in panel B are similar to the panel A results. The mean of the ratios of registered to bearer share prices is significantly less than one before November 1988 but is statistically indistinguishable from one for the December 1988 data.

The data in panel C cover firms issuing only registered and bearer shares with the same par values. The results shown are similar to the panel A and B results for data before November 1988. The result for the December 1988 data differs, however. While the ratio of registered to bearer share prices is numerically higher for the December 1988 data than it was previously, it still is significantly less than one.

The Increase In Nestlé's Market Value

Table 3 shows the change in the market value of Nestlé shares from the end of July 1988 to the end of December 1988. As shown, the market value of Nestlé increased by almost 22 percent subsequent to its November policy change. Of course, this figure may over- or understate the change in value due to the policy change because other factors that affect stock prices may have changed.

To control for this, table 4 shows the percentage changes in the prices of bearer and non-voting shares for the firms in our sample that do not issue registered shares. Since the Nestlé announcement pertained only to the treatment of registered shareholders, it is unlikely that the announcement would affect the share prices of firms that issue no registered shares. Changes in the prices of these firms between July and December 1988 can be used to proxy the effect of changes in other factors on Swiss stock prices.

[19] The discount is present in data extending back to December 1975.

Table 3

The Change in the Market Value of Nestle: July 1988-December 1988

Panel A: End of July 1988

Type of share	Price (in SFr)	Number of shares outstanding	Market value (millions of SFr)
Non-voting	1,315	1,000,000	1,315.00
Bearer	8,550	1,073,000	9,174.15
Registered	4,150	2,227,000	9,242.05
Market Value July 1988			19,731.20

Panel B: End of December 1988

Type of share	Price (in SFr)	Number of shares outstanding	Market value (millions of SFr)
Non-voting	1,320	1,000,000	1,320.00
Bearer	7,240	1,073,000	7,768.52
Registered	6,710	2,227,000	14,943.17
Market Value December 1988			24,031.69

Change in Market Value (millions of SFr) = 4,300.49

Percentage Change = 21.80%

Table 4

A Proxy For The Effect Of Other Factors (changes in the share prices of firms that issue no registered shares)

Type of Share	Average percent change 7/88—12/88	t-score
Bearer	−7.97%	1.88
Non-voting	−9.20	2.00
N = 9		

The data in table 4 indicate that the share prices of these firms did not rise from July to December 1988. While the point estimates of the average percentage change are negative in both cases, they are not significantly different from zero. Thus, these data suggest that other general influences did not raise or lower Swiss stock prices from July to December 1988. Consequently, the 22 percent increase in the market value of Nestlé can be taken as a "ball park" estimate of the rise in value associated with its change in registration policy.

The Nestlé Announcement and the Share Prices of Other Firms

The data in table 2 suggest that the ratio of registered to bearer share prices rose from July to December 1988 for the 36 firms that issue both types of shares. The data in table 5 show that the increase in this ratio resulted from a significant increase in the price of registered shares rather than from a decline in the price of bearer shares. This is important in evaluating whether the change in policy actually augments the shareholders' wealth. Any change that reduces the differences between the share types will cause their prices to converge even though stockholder wealth may not increase. For example, if the share prices converge because bearer and non-voting share prices generally decline while registered share prices remain unchanged, aggregate stockholder wealth will fall. If registered share prices increase while other

Table 5

Percentage Changes In Share Prices: July—December 1988

Type of share[1]	Average percent change 7/88—12/88	t-score	N
Registered	14.95%*	5.44	36
Bearer	–1.79	.71	36
Non-voting	.13	.03	21

* Significantly different from zero at the 5 percent level.

[1] Twenty-one of the 36 firms in this sample issue all three types of shares. Fifteen of the firms issue only registered and bearer shares.

share prices are constant, however, aggregate wealth will increase.

The data in table 5 are consistent with the second case. Registered share prices increased by about 15 percent from July to December 1988 while changes in the prices of bearer and non-voting shares are not significantly different from zero. Again, the table 4 data suggest that the increase in registered share prices is not due solely to other factors.

CONCLUSION

Recent experience with corporate takeovers has raised concerns that the capital of corporate shareholders is being held hostage by Wall Street power brokers. Accordingly, various reforms designed to reduce takeover activity have been proposed.

This paper examines an economic theory that treats the control of a firm as a valuable asset. The theory suggests that takeovers represent trades of this asset in a market for corporate control and that such market competition provides strong protection for the interests of shareholders.

Data on the Swiss stock market are analyzed to determine whether restricting the market for corporate control affects stockholder wealth. Until recently, ownership restrictions on Swiss registered shares had prevented foreign citizens from competing for control of many Swiss firms. These restrictions were relaxed in November 1988. Data analyzed in this paper suggest that the registered share prices of firms rose by about 15 percent while the prices of bearer and non-voting shares were roughly constant following the relaxation. The data suggest that restricting competition in the market on corporate control can have serious adverse consequences on the wealth of shareholders. Since recent proposals to reform the takeover market in the United States intend to restrict this activity, they are likely to be counterproductive in protecting shareholder capital.

REFERENCES

Alchian, Armen. *Economic Forces at Work* (Liberty Press, 1977).

Anders, George, and Steve Swartz. "Some Big Firms to Break Up Stock into New Securities," *Wall Street Journal*, December 5, 1988.

Brealey, R. A. *An Introduction to Risk and Return from Common Stocks* (The MIT Press, 1983).

Brealey, Richard, and Stewart Myers. *Principles of Corporate Finance* (McGraw Hill, 1988).

Burrough, Brian. "Circus-Like Takeover Contest for RJR Nabisco Inc. Brings Forth 2 New Bids of More Than $108 a Share," *Wall Street Journal*, December 1, 1988.

"CEOs React to RJR - and Ross Johnson." *Wall Street Journal*, December 2, 1988.

Dullforce, William. "Swiss Life Wins Battle for La Suisse," *Financial Times*, August 9, 1988.

_____ . "Nestlé to End Foreign Shares Discrimination," *Financial Times*, November 18, 1988.

_____ . "Nestlé Breaks Market Mould," *Financial Times*, November 22, 1988.

Foreman, Craig. "Nestlé Copycat Fears Cloud Swiss Stocks," *Wall Street Journal*, November 21, 1988.

Grossman, Sanford J., and Oliver D. Hart. "One Share-One Vote and the Market for Corporate Control," *Journal of Financial Economics* (January/March 1988), pp. 175-202.

Hershey, Robert D. Jr. "Congress Is Moving Closer to Weighing Buyout Curbs," *New York Times*, December 5, 1988.

Horner, Melchior R. "The Value of the Corporate Voting Right: Evidence from Switzerland," *Journal of Banking and Finance* (v. 12, 1988) pp. 69-83.

"Japan's Bias Against Domestic Mergers May Become Trade Issue, Tokyo Fears," *Wall Street Journal*, December 1, 1988.

Jarrell, Gregg A., and Annette B. Poulson. "Dual Class Recapitalizations As Antitakeover Mechanisms: The Recent Evidence," *Journal of Financial Economics* (January/March 1988), pp. 129-52.

Jensen, Michael C., and Richard S. Ruback. "The Market for Corporate Control: The Scientific Evidence," *Journal of Financial Economics* (April 1983), pp. 5-50.

Jensen, Michael C., and Jerold B. Warner. "The Distribution of Power Among Corporate Managers, Shareholders and Directors," *Journal of Financial Economics* (January/March 1988), pp. 3-24.

Manne, Henry G. "Mergers and the Market for Corporate Control," *Journal of Political Economy* (April 1965), pp. 110-20.

Manne, Henry G., and Larry E. Ribstein. "The SEC v. the American Shareholder," *National Review* (November 25, 1988), pp. 26-29.

Norris, Floyd. "A New Defense in Hostile Bids," *New York Times*, December 1, 1988.

Passell, Peter. "How to Defuse the Buyout Bomb," *New York Times*, December 7, 1988.

Ricks, Thomas E. "SEC Staffers Link '87 Crash to House Panel," *Wall Street Journal*, May 4, 1989.

Ruback, Richard S. "Coercive Dual-Class Exchange Offers," *Journal of Financial Economics* (January/March 1988), pp. 153-73.

"Shareholders, Who Are They?" *The Economist* (January 28, 1989), p. 69.

Stulz, Rene' M. "Managerial Control of Voting Rights: Financing Policies and the Market for Corporate Control," *Journal of Financial Economics* (January/March 1988), pp. 25-54.

Swiss Bank Corporation. *Handbuch der Schweizer Aktien* (1987).

Wicks, John. "Suchard Lets Foreigners Own Registered Shares," *Financial Times*, June 22, 1988.

_____ . "Unprecedented Battle of La Suisse Suitors," *Financial Times*, August 2, 1988.

"Will Others Follow RJR as it Pioneers Megadeal Frontier?" *Wall Street Journal,* December 2, 1988.

Appendix

Firms Included in the Tests

	Types of Shares Issued				Types of Shares Issued		
Firm	**Registered**	**Bearer**	**Non-voting**	**Firm**	**Registered**	**Bearer**	**Non-voting**
Elekrowatt		/	/	Sandoz	/	/	/
Fortuna		/	/	Schindler	/	/	/
Gotthard Bank		/	/	Swiss Bank			
Interdiscount		/	/	Corporation	/	/	/
Pirelli		/	/	Schweizer Rueck	/	/	/
VP Bank Vaduz		/	/	Union Bank of			
Walter Rentsch		/	/	Switzerland	/	/	/
Zuercher				Zurich Insurance	/	/	/
Ziegeleien		/	/	Globus	/	/	/
Zellweger		/	/				
				Accu-Oerlikon	/	/	
Allusuisse	/	/	/	Charmilles	/	/	
B.S.I.	/	/	/	Credit Suisse	/	/	
Bank Leu	/	/	/	Crossair	/	/	
Bobst	/	/	/	Frisco Findus	/	/	
Brown Boveri	/	/	/	Hermes	/	/	
Buehrle	/	/	/	Hero	/	/	
Ciba Geigy	/	/	/	Huerlimann	/	/	
Feldschloesschen	/	/	/	Mikron	/	/	
Georg Fischer	/	/	/	Usego	/	/	
Haldengut	/	/	/	Eichhof	/	/	
Jacobs Suchard	/	/	/	Holzstoff	/	/	
Konsumverein				Hypo Brugg	/	/	
Zurich	/	/	/	Sibra Holding	/	/	
Moevenpick	/	/	/	Swissair	/	/	
Nestle	/	/	/				

Keith M. Carlson

Keith M. Carlson is an assistant vice president at the Federal Reserve Bank of St. Louis. Thomas A. Pollmann provided research assistance.

Do Price Indexes Tell Us About Inflation? A Review of the Issues

BECAUSE its effects are so pervasive, virtually everyone is concerned about inflation. While understanding the concept of inflation seems to be easy enough, finding a meaningful *measure* of it is much more difficult than it might appear. For us as consumers and citizens, to understand how inflation is defined and the extent to which the commonly used price indexes actually measure it is clearly important.

This article describes the broad issues involved in defining inflation, then examines how useful the commonly used U.S. price indexes are in interpreting and understanding it.

INFLATION: DEFINITIONS AND CONCEPTS

Because there is substantial controversy about precisely what inflation is, a variety of definitions of inflation have cropped up over the years.[1] Definitions of inflation generally fall into two classifications: descriptive ones, which focus on the symptoms of inflation, and causal ones, which focus on the reasons for inflation. A typical descriptive definition of inflation is a "continuous rise in the general level of prices." A typical causal definition is "too much money chasing too few goods." While other variations of these definitions could be cited, these two provide a point of departure for our analysis.

The "continuous" part of the descriptive definition refers to the sustained nature of the increases as opposed to temporary short-term movements in prices (for example, the effects of a drought), or one-time jumps in the price level (for example, resulting from an increase in an excise tax). In recent years, short-term price movements have reflected primarily price volatility in the markets for energy and food. The "general" part of the descriptive definition refers to the average behavior of prices as opposed to movements in the prices of individual commodities or services. As Alchian and Klein (1973) indicate, a general measure of inflation should be based on the prices of *all present and future* consumption services.[2] Their theoretical measure of inflation is defined as the change in the nominal cost of achieving a given level of well-being over time, or what could be termed loosely as changes in the cost of living.[3]

[1]For a general discussion of inflation, particularly its effects, see the section on "Inflation: Impact and Measurement" in Alchian (1977).

[2]Alchian and Klein (1973).

[3]To avoid confusion with the consumer price index, which is sometimes referred to as a measure of the cost of living, Alchian and Klein refer to their measure as "the cost of life."

The causal definition of inflation—too much money chasing too few goods—is a carryover from the writings of nineteenth-century economists who defined inflation as a continuous decline in the purchasing power of money.[4] Money is accorded a causal role because it serves as the medium of exchange. Friedman refines the causal definition by stating that "inflation is always and everywhere a monetary phenomenon . . . and can be produced only by a more rapid increase in the quantity of money than in output."[5]

This discussion suggests that the important aspects of inflation, properly defined and measured, are its broad and continuous nature and its monetary underpinnings. A key question that follows from combining the descriptive and causal aspects of inflation is to what extent the U.S. price indexes reflect these aspects.

Measuring the Cost of Living

Since inflation refers to changes in the general level of prices, it is useful to examine the measurement of the cost of living. A theoretical measure of the cost of living, like the one proposed by Alchian and Klein, is based on a long-term goal of maximizing economic well-being. Individuals (or society) decide how to maximize their well-being in terms of both current and future consumption; this means that the prices of both current and future consumption of goods and services must enter into the cost of achieving a level of economic well-being. (For a numerical example, see the shaded insert on the following page.) As Alchian and Klein point out, however, because separate futures markets exist for only a small number of commodities, price quotations for future consumption goods and services are generally not available. Fortunately, asset prices, which are the prices for the *sources* of future consumption services, provide a good proxy and are readily available.

Our theoretical measure of the cost of living should include all asset prices that yield present and future consumption services. Thus, such a measure would include the prices of both new and used cars, new and used appliances and furniture and asset prices that yield a monetary (pecuniary) return, like financial assets (stocks, bonds, savings accounts) and land.

The asset prices to be considered for this measure would not necessarily be limited to assets actually held by individuals because the asset combination that would yield the desired consumption pattern might differ from the assets that are actually held. The objective underlying the construction of this measure is to determine the money cost of achieving the individuals' maximum level of well-being.

Table 1 provides a list of the major components of household net worth for selected years since World War II. Although net worth has changed little relative to personal consumption since 1952, its composition has changed substantially. Tangible assets, in particular, land, now constitute a larger portion of net worth than in 1952. Households are now net debtors with respect to credit market instruments; they were net creditors in 1952. Also, holdings of equity in noncorporate business are now much less important relative to total net worth than they were in 1952. To measure the theoretical cost of living, however, we must examine changes in the prices of these diverse components of net worth.

Table 2 summarizes U.S. trends in prices of current consumption goods and services, along with those for selected assets for selected periods from 1952-88.[6] For the full period, prices of both common stock and land have increased more than consumer prices. For the shorter periods, which range from six to 13 years in length, a theoretical measure of price change including asset prices would imply substantially different effects on the cost of maintaining an individual's well-being than implied by considering only prices of current consumption. The extent of these effects, of course, would depend on the individual's preferences for current vs. future consumption.

A theoretical measure of the cost of living, as defined by Alchian and Klein, provides a basis for measuring inflation primarily as viewed by individuals. Changes in that measured cost of living correspond to the "general" part of the descriptive definition of inflation. The theoretical measure also provides a standard for comparison in evaluating the price indexes that are

[4]Bronfenbrenner (1968) and Allen (1975).

[5]Friedman (1966), p. 25.

[6]The periods shown correspond for the most part with changes in the rate of increase of consumer prices. It will be shown later that they also correspond to marked and sustained changes in the growth of money relative to output.

A Numerical Example of Theoretical (Alchian-Klein) Cost-of-Living Index

Suppose that an individual is achieving a certain level of well-being by allocating his income of $1,000 as follows:

Initial situation:

	Price	Quantity	Price x quantity
Present consumption	$ 4	159.6	$ 638
Future consumption	20	18.1	362
		Total	$1,000

Present consumption includes units purchased of food, clothing, shelter, etc., and future consumption includes allocations to common stocks, bonds, etc. Suppose that the prices of both present and future consumption change, but income is unchanged at $1,000. The individual responds, maximizing his well-being by shifting his allocation as follows:

Changed situation:

	Price	Quantity	Price x quantity
Present consumption	$ 5	126.4	$ 632
Future consumption	30	12.3	368
		Total	$1,000

With the prices of present and future consumption goods both rising, although by different amounts, the individual has to adjust his allocation. Exactly how much the quantity purchased of each good changes depends on the preference of the individual.

The price of present consumption goods and services has risen by 25 percent and future consumption goods and services by 50 percent, and clearly the individual's well-being has declined. How much have average prices increased? The theoretical price index asks what the money cost was of achieving the level of well-being that was achieved initially. Given the changed relative price structure ($5/$30 instead of $4/$20), assume that the individual could achieve his previous well-being with present consumption of goods and services of 171.5 units and future consumption of goods and services of 16.3 units. The money cost in the second period is

$$\$5(171.5) + \$30(16.3) = \$1,347.$$

The index of the money cost of achieving a level of well-being has increased by 35 percent ((1347/1000)-1)x100. If the individual's wealthholdings actually increased from one situation to the next, then that increase could be compared with the change in the money cost of achieving a level of well-being.

used in the United States. Left unexamined, however, is the "continuous" part of the definition. Presumably, an individual is concerned with changes in the cost of living regardless where they came from or whether they are continuous.[7] Policymakers, on the other hand, though concerned with movements in the general level of prices, have to differentiate between movements of prices that are continuing and those that are temporary (or short term). To gain an understanding of the continuous aspect of inflation, it is helpful to turn to the causal definition of inflation—"too much money chasing too few goods."

Monetary Inflation

Policymakers are concerned about inflation because one of their goals is to control it. This means they must use measures of price movements in such a way that the inflationary effects of their actions are readily identifiable. This might mean that the price measure most relevant to them differs from that most relevant to individuals.

Singled out for emphasis here is the causal definition of inflation that stresses the role of

[7]This is not to say that individuals are oblivious to the source of price change. Rather than complicate the analysis by introducing expectations, the analysis focuses on measuring the change in the money cost of maintaining individuals' well-being, that is, measuring what happened to prices rather than what is expected to happen.

Table 1

Distribution of Household Net Worth (dollar amounts in billions)[1]

	1988		1972		1952	
	Amount	Percent of total	Amount	Percent of total	Amount	Percent of total
Net worth	$15,446.6	100.0%	$3,853.3	100.0%	$1,102.2	100.0%
Tangible assets	6,538.4	42.3	1,411.8	36.6	373.7	33.9
Reproducible assets	5,203.9	33.7	1,217.7	31.6	337.1	30.6
Residential structures	3,067.3	19.9	704.2	18.3	187.3	17.0
Nonprofit plant & equipment	290.4	1.9	88.8	2.3	15.8	1.4
Consumer durables	1,846.2	12.0	424.7	11.0	134.0	12.2
Land	1,334.5	8.6	194.1	5.0	36.6	3.3
Total net financial assets	8,908.2	57.7	2,441.5	63.4	728.5	66.1
Deposits & credit market instruments	1,251.8	8.1	367.7	9.5	156.2	14.2
Checkable deposits & currency	515.7	3.3	142.4	3.7	62.3	5.7
Other time & savings deposits & MMF shares	2,525.3	16.3	563.7	14.6	79.8	7.2
Credit market instruments	−1,789.2	−11.6	−338.4	−8.8	14.1	1.3
Corporate equities plus net security credit	2,217.8	14.4	905.9	23.5	168.6	15.3
Life insurance & pension fund reserves	2,866.0	18.6	469.2	12.2	92.1	8.4
Equity in noncorporate business	2,373.8	15.4	667.4	17.3	301.6	27.4
Miscellaneous assets	198.8	1.3	31.3	0.8	10.0	0.9
Memo:						
Personal consumption expenditures (flow during the year)	$3,227.5	20.9%	$757.6	19.7%	$219.1	19.9%

[1] Year-end outstandings

SOURCES: Federal Reserve Flow of Funds and U.S. Department of Commerce

Table 2

Rates of Change for Prices of Current Consumption and Selected Assets

	Full period	Average rate of change Subperiods			
	1952-88	1982-88	1972-82	1965-72	1952-65
Consumer prices, all items	4.2%	3.5%	8.7%	4.1%	1.3%
Common stock prices	6.8	13.8	1.3	3.5	9.9
Land prices	8.3	4.8	14.5	6.2	6.4
Home prices					
New	N.A.	8.7	10.8	4.9	N.A.
Existing	N.A.	5.8	10.6	N.A.	N.A.

monetary forces.[8] As Friedman's research indicates, the continuous aspect of inflation is attributable primarily to growth in the quantity of money relative to output. His preferred measure of money, based on extensive research, is M2, and his measure of output is "trend real GNP." The use of trend real GNP permits the influence of other slow-changing factors to come into play. Such factors include changes in the quantity and quality of the labor force (or population), capital formation and technological changes.

From this causal view of inflation, policymakers would be interested in a price measure that reflects movements, probably with a lag, in the money-output measure.[9] The previous discussion of the descriptive definition of inflation suggests that policymakers might prefer a measure of price change that excludes the influences of temporary factors.

USING THE U.S. PRICE INDEXES TO MEASURE INFLATION

The U.S. price measurement system consists primarily of three sets of price indexes: the consumer price indexes, the producer price indexes and the deflators implicit in the GNP accounts.[10] (For a basic review of index numbers, see the shaded insert at right.) Each month, announcements about the latest readings of these indexes are made. The consumer and producer price indexes are prepared monthly; the implicit deflators are prepared only quarterly, although revisions are announced monthly. This section summarizes the origins of each index, as well as their coverage, uses and limitations, and concludes with an evaluation of the cost of living in light of the theoretical (Alchian-Klein) definition. The following section examines the indexes in the context of Friedman's causal definition of inflation.

The Consumer Price Index

The consumer price index (CPI), perhaps the best-known price index available for the United States, is a measure of price change for a fixed market basket of goods and services purchased by urban consumers.[11] The CPI is familiar to almost everyone because:

(1) it measures prices that consumers can relate to easily in their everyday purchases;
(2) it is available each month, announced with a short lag and receives substantial coverage by the media;
(3) it provides considerable detail on components of the index and geographical differences in prices; and
(4) its long historical record provides perspective on similar price movements in the past.

History—The consumer price index was developed during World War I in an attempt to arrive at a fair wage scale for workers in shipbuilding yards. Initially, expenditure data were gathered for wage-earner families in 92 cities while price data were gathered for retail stores in 32 cities; in 1919, "cost-of-living" indexes were published semiannually for these 32 cities. A national index was published in 1921 with data compiled back to 1913. Quarterly indexes were published in 1935 and monthly indexes were initiated in 1940.

The first expenditure survey covered the years 1917-19, followed by surveys for 1934-36, 1947-49, 1950, 1960-61, 1972-73 and 1982-84. The purpose of these surveys is to update the weights assigned to particular items in the consumer's budget.[12] Table 3 shows how the weights have changed over the years, reflecting the changing patterns of consumer spending.

The CPI, with its updated expenditure surveys, is a "shifting-weight" index. This means that each time a new survey is conducted, the weights used to compute the index are changed; the past data, however, are not revised. Thus, the CPI data reflect changing weights and different measurement procedures over time. This

[8]For a general discussion of alternative theories of inflation, see Frisch (1983).

[9]This reasoning is somewhat circular. The point to be emphasized here is that prices have to be monitored continuously by policymakers to determine the appropriateness of their policy indicator.

[10]For an alternative discussion of U.S. price indexes, see Webb and Willemse (1989).

[11]Since 1978, there have been two CPIs—CPI-U and CPI-W. CPI-U is for all urban consumers, covering about 80 percent of the population. CPI-W is for urban wage earners and clerical earners which covers about 45 percent of the population. Unless denoted otherwise, the CPI-U measure is the one used in this article.

[12]The Labor Department also changes the reference base period from time to time, that is, the base year that is called 100. The choice of the base year, which, incidentally, need not be the same as the year of the expenditure survey, is of no particular significance other than to provide the user of the index with a point of reference.

Index Numbers: Some Basics

An index number is a measure of something of interest relative to a specific standard for comparison. The simple price index, for example, could be a comparison of the price of a particular commodity with its price in a base year or, at a given time, a comparison with its price in a particular geographical area. Major U.S. price indexes combine many prices in such a way that the index number measures the weighted average price change over time.[1]

An Example

The problems inherent in the construction and application of an index number can be enumerated with a simple example. Suppose we are interested in constructing an index of prices received by U.S. farmers for their major crops in 1986 compared with 1982. The basic data are:

	Prices (dollars/bushel)		Quantities (millions of bushels)	
	1982	1986	1982	1986
Wheat	$3.55	$2.34	2765	2087
Oats	1.49	1.16	593	385
Soybeans	5.69	4.65	2190	2007
Corn	2.68	1.49	8235	8253

One method would be to add the four prices for 1986, divide by 4 and compare this with a simple average for 1982. This procedure would ignore the relative importance of the different commodities in the production mix. A more reasonable method would be to allow for this relative importance.

One way to measure relative importance is to consider quantities, for example, the bushels of each commodity relative to total bushels. The weighted average of price relatives would be as follows:

	Price relative (P_{1986}/P_{1982})	Relative importance*
Wheat	0.66	0.20
Oats	0.78	0.04
Soybeans	0.82	0.16
Corn	0.56	0.60

* Proportion of total bushels in 1982

The price relative is simply the 1986 price divided by the 1982 price. In other words, prices of commodities in 1982 serve as a base year, where $P_{1982} = 1.00$. To get the weighted index, multiply each price relative by its relative importance and sum to obtain 0.63. The result is an index (with 1982 = 1.00) of major crop prices in 1986 relative to 1982 using 1982 production as weights.

Fixed-Weight Formulas

Most price indexes use fixed-weight formulas. The two most common are:

$$I^L_{01} = \frac{\Sigma\, p_1\, q_0}{\Sigma\, p_0\, q_0} \text{ and } I^P_{01} = \frac{\Sigma\, p_1\, q_1}{\Sigma\, p_0\, q_1}.$$

The first formula uses the quantities, q, in period 0 as weights; the price index in period 1 relative to period 0 is labeled I^L_{01} where "L" denotes a Laspeyres-type index. It compares a hypothetical expenditures (or sales) total ($\Sigma\, p_1\, q_0$) with actual expenditures ($\Sigma\, p_0\, q_0$) in the base period. The second formula is the same except that the quantities in period 1 are used as weights; this is called a Paasche-type index. For this index, actual expenditures in period 1 are compared with a hypothetical total in period 0. The objective is the same for both: to isolate the change in prices when expenditures or sales change from one period to the next. Holding the quantities fixed means that an identical basket of goods and services is being priced in successive periods. Alternatively, the "standard of living," or consumer welfare, is being held constant between the two periods.

Substitution Bias

Price indexes are constructed mainly because all prices do not move proportionately. Because of disproportionate change, the fixed-weight indexes are subject to substitution bias. This bias occurs because an identical market basket is being used to weight the importance of prices. When substitution among goods is possible, however, consumers will buy more of those goods whose prices rise most slowly, or fall in relative terms, and less of those goods whose prices rise most rapidly. In other words, given the new prices, there is a different market basket that would leave the consumer's level of well-being constant, or, as explained in the principles of

economics, "on the same indifference curve." If such an index were constructed, it would measure the change in the "true cost of living." The Laspeyres index tends to assign too much weight to those goods whose prices rise most rapidly, while the Paasche index assigns too little weight to those goods. Thus, these indexes, when computed for consumers, are measures of average change in prices for goods and services purchased for family living and technically not cost-of-living indexes because they do not hold the standard of living constant.

Although the direction of bias in the fixed-weight indexes is generally known, its magnitude is not. Triplett surveys some empirical work on the bias in cost-of-living indexes and reports that "the empirical results indicate merely that the bias is small enough that it can probably be neglected as a matter of practical importance, whether the index is to be used for escalation of income payments, or as a macroeconomic policy indicator."[2]

Annual Rates of Change: Converting a Price Index to an Inflation Measure

Following the movements of a price index (or any economic time series) is facilitated by calculating annual rates of change. In this way, all movements of the index, regardless of the time interval, are converted to a standardized period of one year.

For monthly data, the formula for a compounded annual rate of change is:

$$CAR_{0,t} = \left\{ \left(\frac{I_t}{I_0} \right)^{12/t} - 1 \right\} \times 100,$$

where $CAR_{0,t}$ is the compounded annual rate of change of the index (I) from month 0 to month t. It is the percent change that would occur if the change from 0 to t were maintained for 12 months.

For quarterly data, the formula is:

$$CAR_{0,t} = \left\{ \left(\frac{I_t}{I_0} \right)^{4/t} - 1 \right\} \times 100,$$

where t is the number of quarters in the interval.

For annual data, the formula is:

$$CAR_{0,t} = \left\{ \left(\frac{I_t}{I_0} \right)^{1/t} - 1 \right\} \times 100,$$

where t is the number of years in the interval.

[1]For an overview of the early literature on price measurement and index number theory in general, see Diewert (1988).

[2]Triplett (1975), p. 28.

procedure is followed primarily to avoid legal problems that might arise because of contracts that use the CPI as a basis for wage or price escalation.

Coverage—The CPI is derived from a sample of prices of essentially everything that consumers purchase for day-to-day living. Among these are prices of food, clothing, shelter, transportation, medical care, entertainment and personal care. Sales, excise and real estate taxes are also included, but income and Social Security taxes are not. The weights and composition of the index are currently based on the Survey of Consumer Expenditures for 1982-84. Table 4 summarizes the coverage and weights for CPI-U in 1988.

Uses and limitations—The CPI is commonly used as a measure of the cost of living and, relatedly, as an index to deflate income payments or other contracts involving monetary payment. As pointed out in the shaded insert on index numbers, the CPI is only approximate and might not be appropriate for a particular consumer whose expenditure pattern differs from the typical urban consumer. It is commonly used, however, because it is readily available and understandable.

The CPI is also used to deflate time series of nominal data so that they can be interpreted in real terms. Nominal data series mean little without accompanying information on price changes. Dividing the nominal data by a price

Table 3

Percent Distribution of CPI Market Basket for Wage Earners and Clerical Workers (selected years)

Major group	1935-39	1952	1963	1972-73	1988
Food and beverages	35.4%	32.2%	25.2%	20.4%	19.6%
Housing	33.7	33.6	34.9	39.8	39.8
Apparel	11.0	9.4	10.6	7.0	6.4
Transportation	8.1	11.3	14.0	19.8	19.1
Medical care	4.1	4.8	5.7	4.2	5.1
Entertainment	2.8	4.3	3.9	4.3	4.1
Other goods and services	4.9	4.8	5.7	4.5	5.9

Table 4

Consumer Price Indexes by Commodity and Service Group

	1988 index* (1982 – 84 = 100)	Relative importance (December 1988)
All items	118.3 (122.6)	100.0%
Commodities	111.5 (114.9)	45.3
Food and beverages	118.2 (121.5)	17.7
Commodities less food and beverages	107.3 (110.7)	27.6
Nondurables less food and beverages	105.2 (107.0)	15.9
Apparel commodities	113.7 (115.7)	5.8
Other	103.2 (104.9)	10.2
Durables	110.4 (116.1)	11.6
Services	125.7 (130.9)	54.7
Rent or shelter	N.A. (132.0)	27.2
Household services less rent	N.A. (115.3)	9.3
Transportation services	128.0 (133.2)	6.7
Medical care services	138.3 (149.4)	4.8
Other services	132.6 (141.8)	6.7

* Figures in parentheses are 1988 index converted to 1982 = 100.

index, which equals 1.0 in the base period, yields a deflated series in base-year prices. For example, personal income divided by a consumer price index provides a measure of real personal income. If this measure rises over time, it is usually interpreted as a rise in the standard of living. Other economic series that are commonly deflated with the CPI are retail sales, measures of earnings and consumption components of the gross national product.

The two most commonly heard criticisms leveled against the CPI are that (1) it is a fixed-weight index and (2) it does not capture quality changes of consumer goods accurately.[13] The fixed-weight criticism focuses on the substitution bias that is inherent in its construction. Those goods whose prices increase the most are purchased in smaller quantities, and those that rise the least are purchased in larger quantities. (See the shaded insert on page 14 for a

[13]For a survey of the validity and accuracy of price indexes, see Triplett (1975).

numerical example of the cost-of-living index.)[14] It is unclear, however, given the U.S. price experience, that this bias is serious enough to distort the index for the purposes of most users.

The second criticism about quality measurement is relevant because, in the face of rapidly changing technology and tastes, the methods of adjustment will always be subject to criticism. While the CPI's construction does adjust for quality change, some analysts have found the adjustment too large for some goods.[15]

Evaluation—The CPI covers the prices of current consumption goods and services only; these goods constitute only a portion of an individual's wealth. Thus, implicit in the CPI's construction is that economic well-being depends primarily on current, not future, consumption. If an individual's well-being depends on his holdings of wealth, however, asset prices should be included, because they serve as a proxy for the prices of future consumption goods and services.

The prices of some newly produced assets, like household furnishings, other consumer durables and new cars, are included in the CPI. But uses of consumer savings, like purchases of stocks, bonds and real estate, are not included. In fact, Alchian and Klein argue that the CPI was more accurate as a price index before 1983 when the price of new housing was included.[16] Since 1983, a rental equivalence measure of shelter costs has been used. This measure is an estimate of the cost of renting housing equal to those provided by owner-occupied housing.

The Producer Price Index

Another well-known U.S. price index is the producer price index (PPI), which measures average changes in prices received in primary markets by producers of commodities in all stages of processing. While the CPI is a measure of prices paid by consumers in the final commercial transaction, the PPI is a measure of prices received by producers in the first commercial transaction.

History—The PPI is one of the oldest economic time series compiled by the federal government. Known as the wholesale price index until 1978, the index originated in an effort to investigate the effect of tariff laws on trade, domestic production and prices of agricultural and manufactured goods. The series, first published in 1902, is available from 1890 to the present time.

The index initially was a simple unweighted average of the prices of about 250 commodities. A system for weighting was introduced in 1914, and other major changes were introduced in 1952, 1967 and 1978. Such changes primarily expanded the samples of commodities. By 1987, the index covered more than 3,000 commodities.

In 1978, the analytical focus was shifted from a classification by commodity (there are two major classifications: farm products and processed foods, and feeds and industrial commodities) to one based on stage-of-processing, that is, degree of fabrication (finished goods, intermediate goods and crude materials). The commodities framework had organized products by similarity of end use or material composition and, as a result, reflected many stages of processing. Although still published, this classification has been de-emphasized because of the possibility of counting price changes more than once through several stages of processing.[17] The stage-of-processing classification is an improved measure of price change.

---

[14]For example, energy prices rose at an annual rate of 12.9 percent between 1972-73 and 1982-84, compared with a rate of increase of 8.4 percent for the all-items CPI. Although the weight for energy products in the consumer's market basket changed from 8.6 percent in 1972-73 to 7.4 percent in 1982-84, the CPI from January 1978 through 1987 was calculated using the 1972-73 weights. This is just one example of substitution bias.

[15]Triplett (1975), pp. 30-48. The objective in constructing a price index is to compare prices of goods of constant quality. Triplett reviews studies of this problem, focusing on automobiles, household appliances and medical care services.

The Labor Department uses several methods of adjusting for quality change. The usual method is to collect data from companies on costs involved in connection with the quality change. For example, if the selling price of a new model car increases by $500 and companies report that $200 of that increase is attributable to government-mandated safety equipment, the price increase is estimated at $300. For further discussion, see Bureau of Labor Statistics (1988), p. 127.

[16]Alchian and Klein (1973), p. 178.

[17]The Bureau of Labor Statistics (1982) example is that, according to the commodity classification, if the price of cotton were to rise and be passed through to producers of cotton yarn, then to cotton fabric, and finally to shirts, the initial price increase would have been recorded four times. If prices were increasing at the same rate at all stages, there would be no major distortion. Otherwise, multiple counting can provide biased and misleading results.

Table 5

Producer Price Indexes by Stage of Processing

	1988 index (1982 = 100)	Relative importance (December 1988)
Finished goods	108.0	100.0
Finished consumer goods	106.2	74.2
Finished consumer foods	112.6	25.8
Finished consumer goods, excluding foods	103.1	48.4
Nondurable goods less food	97.3	32.8
Durable goods	113.7	15.6
Capital equipment	114.3	25.8
Intermediate materials, supplies and components	107.1	100.0
Materials and components for manufacturing	113.2	50.9
Materials for food manufacturing	105.9	3.3
Materials for nondurables manufacturing	112.9	16.3
Materials for durable manufacturing	118.8	12.1
Components for manufacturing	112.3	19.2
Materials and components for construction	116.1	12.7
Processed fuels and lubricants	71.3	11.3
Containers	120.1	4.2
Supplies	113.7	21.0
Crude materials for further processing	95.9	100.0
Foodstuffs and feedstuffs	106.0	43.8
Crude nonfood materials	85.5	56.2

Coverage—The coverage of the PPI differs from the CPI (compare tables 4 and 5). Producer price indexes do not reflect changes in prices for services, housing and used cars, all of which are in the consumer price index. Producer price indexes measure changes in capital equipment and materials purchased by businesses but not by consumers. In addition, for the most part, the PPI is not available on a regional basis.

In the preparation of stage-of-processing price indexes, products are categorized by degree of fabrication—finished goods, intermediate materials, supplies and components, and crude materials for further processing. Finished goods are commodities that are ready for sale to final user, whether it is the consumer or a business. Intermediate materials, supplies and components are commodities that have been processed but require further processing. Crude materials are products entering the market for the first time.

A fixed-weight procedure is used in calculating the PPI. Weights are based on the total net selling value of commodities flowing into primary markets. They are based on values of shipments in the 1982 economic censuses.

Uses and limitations—The PPI is often interpreted as an indicator of inflation, with the stage-of-processing framework supposedly facilitating the analysis of the inflation transmission process. For example, the news media treat movements in the PPI as predictors of future movements in the CPI. Generally, however, the coverage of the CPI and the PPI differ so much

that the relationship between them is tenuous.[18] For example, the PPI includes no services, while services receive a weight of about one-half in the CPI. In addition, the PPI excludes prices of imported goods which are included in the CPI.

The PPI index is used as a deflator for certain economic time series to obtain estimates of physical volume. These series relate to specific producer activities like inventories, sales, shipments and capital equipment purchases. According to the Department of Labor, the PPI is used in the private sector for industry analyses since it is the only index available that is consistent with the Census Bureau's Standard Industrial Classification (SIC) code. It is also used as an escalator in sales contracts.

Evaluation—The coverage of the PPI is even more limited than that of the CPI. It does not cover retail transactions or services; instead, it covers only newly produced goods and captures only the price of the first transaction. The chief defect of the PPI, according to the Department of Labor, is that it has been formulated in an *ad hoc* fashion, not corresponding to any underlying theoretical construct.[19] Although this theoretical deficiency has been corrected to some extent, since the PPI focuses on prices paid by producers of goods, it still is unclear whose well-being is really being measured with the PPI.[20]

The GNP Implicit Price Deflator

The most general measure of prices for the U.S. economy is the GNP implicit price deflator. Included are the prices of consumption, investment, government services and net exports. In contrast to the CPI and the PPI, it is released quarterly; these quarterly data are revised monthly, however, as information becomes available.

In general, the procedure for obtaining the GNP deflator is as follows:

(1) divide detailed components of current dollar GNP by the price index corresponding to the component of spending;
(2) sum these deflated spending components to obtain an estimate of constant dollar, or real, GNP; then
(3) divide the estimate of current dollar GNP by the estimate of real GNP to obtain the estimate of the GNP implicit price deflator.

The price indexes are obtained from many sources, including the Bureau of Labor Statistics, Census Bureau, Department of Agriculture and the Interstate Commerce Commission. The implicit deflator that results from the procedure described above is a weighted average of the component price indexes, where the weighting is determined by the composition of constant-dollar GNP. Since this composition changes from one period to the next, movements in the implicit price deflator reflect changes in GNP composition as well as prices.[21]

To avoid problems associated with changing GNP composition, the Commerce Department also prepares fixed-weight price indexes for GNP and its components; these reflect price changes alone. Currently, the weights used for the fixed-weight price indexes are based on the composition of output in 1982 (see table 6).

History—The mobilization for World War II and its aftermath was primarily responsible for the development of the GNP accounts. As Ruggles points out, "The central questions posed by the war were how much defense output could be produced and what impact defense production would have upon the economy as a whole."[22] Concern with real output meant that deflators had to be developed. The GNP deflator, as it is currently known, was initially published in 1951, although there were implicit measures of GNP prices as early as 1942.

---

[18]Coverage of the PPI differs substantially from that for the CPI. The relative importance (weighting) of various components in 1988 are as follows:

		Producer prices		
	Consumer prices	Finished goods	Intermediate materials	Crude materials
Food	16.2%	25.8%	5.2%	43.8%
Energy	7.3	8.8	11.4	36.9
Less food and energy	76.5	65.3	83.4	19.3
Services	50.8	0.0	0.0	0.0
Commodities	25.7	65.3	83.4	19.3

Moore (1983), pp. 172-73, concludes that the value of the PPI in predicting the CPI is poor.

[19]Bureau of Labor Statistics (1982), p. 51.

[20]See Bureau of Labor Statistics (1986) for discussion of theoretical considerations.

[21]For an example illustrating the effect of changing GNP composition, see Bureau of Economic Analysis (1985), p. 6. It concludes that the GNP implicit deflator "can give misleading signals of price change, and therefore its use as a measure of price change should be avoided."

[22]Ruggles (1983), p. 17.

Table 6

GNP Implicit Price Deflators by Major Type of Product

	1988 deflator (1982 = 1.00)	Constant dollar weight
GNP	1.217	100.0%
Goods	1.100	44.1
Personal consumption	1.144	32.8
Business investment	0.972	10.3
Federal purchases	0.960	2.4
State and local purchases	1.027	1.9
Net exports		−3.2
Exports	0.942	
Imports	0.956	
Services	1.335	46.4
Personal consumption	1.348	32.1
Federal purchases	1.241	5.5
State and local purchases	1.363	8.1
Net exports		0.7
Exports	1.212	
Imports	1.218	
Structures	1.182	9.5
Residential investment	1.196	4.8
Nonresidential investment	1.148	3.0
Federal purchases	1.218	0.3
State and local purchases	1.200	1.4

Uses and limitations—The GNP deflator was not designed as a price index, because it reflects changes in the composition of GNP, as well as prices. The fixed-weight deflator is designed as a measure of price change. The differences between the GNP deflator and the fixed-weight index can be significant over either short or long periods, if there are large changes in GNP composition.

GNP-based deflators are useful primarily to government policymakers and academicians because they provide a measure of price change for the economy as a whole. Foreign and domestic investors, as well as the general public, also find them of interest because they have been used as a measure of the success or failure of macroeconomic policy.

Evaluation—Of the three major U.S. price indexes, the GNP deflator has the broadest coverage: its covers all currently produced goods and services. Compared with our theoretical measure of well-being, the GNP price indexes are subject to the same criticism as were the CPI and the PPI because the prices of existing assets and financial assets are excluded. However, the GNP price indexes include prices of newly produced tangible assets; if their prices and prices of existing assets move together, the GNP price index might contain reliable information about the prices of future consumption goods and services. Generally, however, the usefulness of the deflator to individuals in assessing changes in their well-being is questionable because the deflator reflects many prices that are of only marginal interest to the individual. Examples are business investment, government purchases and exports. The exclusion of financial and existing assets also indicates that the deflator is limited in coverage compared with the theoretical measure discussed above.

Summary and References

The features associated with the major U.S. price indexes are summarized in table 7. For additional details on these indexes including their construction, the reader is referred to the *BLS Handbook of Methods* for the CPI and the PPI and the July 1987 *Survey of Current Business* for the GNP deflator. These also contain extensive references for even further detail.[23]

[23]Another useful reference, although dated, is Backman and Gainsbrugh (1966).

Table 7

Measures of U.S. Prices

	Consumer Price Index	Producer Price Index	Implicit Price Deflator
Basic description	Measure of price change for a fixed market basket of goods and services purchased by all urban consumers	Measure of average change in prices received in primary markets by producers of commodities in all stages of processing	Weighted average of the detailed price indexes used in the deflation of GNP, where weights are composition of constant-dollar output
Source	Bureau of Labor Statistics, U.S. Dept. of Labor	Bureau of Labor Statistics, U.S. Dept. of Labor	Bureau of Economic Analysis, U.S. Dept. of Commerce
Frequency	Monthly, released about the 20th day of the following month	Monthly, released about the 10th day of the following month	Quarterly, first estimate released about the 20th day of the following quarter
Publication	Summary data from the Consumer Price Index news release and *Monthly Labor Review*	Summary data from the Producer Price Index news release and *Monthly Labor Review*	Gross National Product news release and *Survey of Current Business*
Base year	1982-84 = 100	1982 = 100	1982 = 100
Weighting	Derived from Consumer Expenditure Survey for 1982-84	Derived from net selling value of all commodities. Weights based on 1982 economic censuses.	Composition of constant-dollar output in current period (fixed-weight deflators use composition of output in 1982)
Revisions	The not seasonally adjusted CPI is never revised. Seasonally adjusted CPI is revised each January.	Data for four months earlier are revised each month, and seasonally adjusted estimates are revised each January.	Each quarter's estimates are revised for two successive months and again for previous three years in July.
Historical data	Monthly to Jan. 1913	Monthly to Jan. 1890. Prior to 1978, called wholesale price index	Quarterly to 1946 and annually to 1929

INFLATION MEASUREMENT AND MONETARY INFLATION

The discussion thus far has focused on the U.S. price indexes as measures of changes in the cost of maintaining an individual's level of well-being. Although policymakers are interested in movements in the general level of prices, they are also interested in the composition of the price change. In particular, policymakers focus on that portion of inflation that is related to their actions in stabilizing economic activity. Most of the better-known measures of price change reflect both policy-induced inflation as well as relative price changes caused by sectoral shifts in supply or demand (for example, the effects of drought and supply cutbacks by oil cartels). Policymakers have to be able to identify the sources of price movements in order to control inflation. This involves formulating a causal definition of inflation and testing it empirically.

The particular definition chosen here is that inflation is a monetary phenomenon. To assess the usefulness of the price indexes to policymakers, one must adopt a specific measure of monetary action. While several measures are available, only the monetary measure preferred by Friedman is examined here. The Friedman measure is the ratio of the M2 money stock relative to trend real GNP.[24] His choice of measure is based on the quantity theory of money as well as extensive empirical research.[25] The presumption is that M2 can be controlled by the monetary authority and that trend output changes only slowly in response to such factors as population change and the rate of productivity advance. Consequently, policy-induced inflation is related to the growth rate of M2.[26]

By examining the U.S. price indexes in comparison with the money-output measure, we are asking which index provides the best information about policy-induced inflation or disinflation. Since the money-output measure is an empirical generalization, one must continuously monitor its performance as a policy guide. Because the general level of price change reflects both temporary relative price movements and the effects of policy with a lag, the relationship between the indexes and the money-output measure must be scrutinized carefully.

U.S. Price Indexes and the Money-Output Measure

The performance of each of the major U.S. price indexes in comparison with the money-output measure is summarized in figure 1. The causal definition of inflation indicates that the focus should be on general trends of different measures rather than year-to-year movements. A casual analysis of figure 1 suggests that, while there is generally a positive relationship between each price index and the money-output measure, these measures diverge considerably at times.

Recalling that these indexes include the influence of temporary factors, which might mask the movement of policy-induced inflation, two "special" indexes are charted in figure 2 along with the money-output measure. The fixed-weight deflator was mentioned previously as a better measure of price change than the GNP deflator, although it includes the influence of temporary factors. The other measure charted in figure 2 is consumer prices excluding the prices of food and energy. This index is prepared by the Department of Labor, and some analysts have suggested that it could be used as a measure of policy-induced inflation.[27] Comparing figure 2 with figure 1, it is not immediately obvious that these special indexes provide better information to policymakers about their contribution to inflation.

Because there is a general similarity of upward movement in all of the indexes, it is not possible to discern if the relationship between a particular price measure and the money-output measure is superior to the others. Also, the figures do not allow for a presumed lag from money to prices. Friedman and other economists generally agree that money affects prices with a long, and possibly variable, lag.[28] These issues can be investigated by examining in detail the rates of change of the different measures. Using rates of change permits a more rigorous analysis of the strength of the relationship between an index and the money-output measure.

Table 8 summarizes the results of a correlation analysis. The rates of change of each price index were lagged behind the money-output measure from zero to four years. For the contemporaneous (no lag) and one-year lag, the correlation coefficients were not statistically significant from zero. When the money-output measure was lagged two or three years, the correlation coefficient was significant for all of the price measures. For the four-year lag, all coefficients were significant except for producer prices. The lagged effect of money to prices is clear, but whether the most highly correlated lagged relationship is two, three or four years is not. The *differences* in the significant correlation coefficients for a given price measure across the different lag lengths were not significant.

The question of whether one price measure is consistently related more closely with the money-output measure is not answered by this

[24]M2 includes mainly currency held by the nonbank public, demand deposits, other checkable deposits, money market deposit accounts and savings and small time deposits.

[25]Friedman and Schwartz (1963, 1982). See also Hallman, Porter and Small (1989).

[26]This relationship is simple to understand because the velocity (turnover) of M2 has shown little trend over the years.

[27]Eckstein (1980) and Gordon (1987).

[28]Friedman and Schwartz (1982), and Friedman (1989).

Figure 1
Money (M2) Relative to Trend Output and U.S. Price Measures

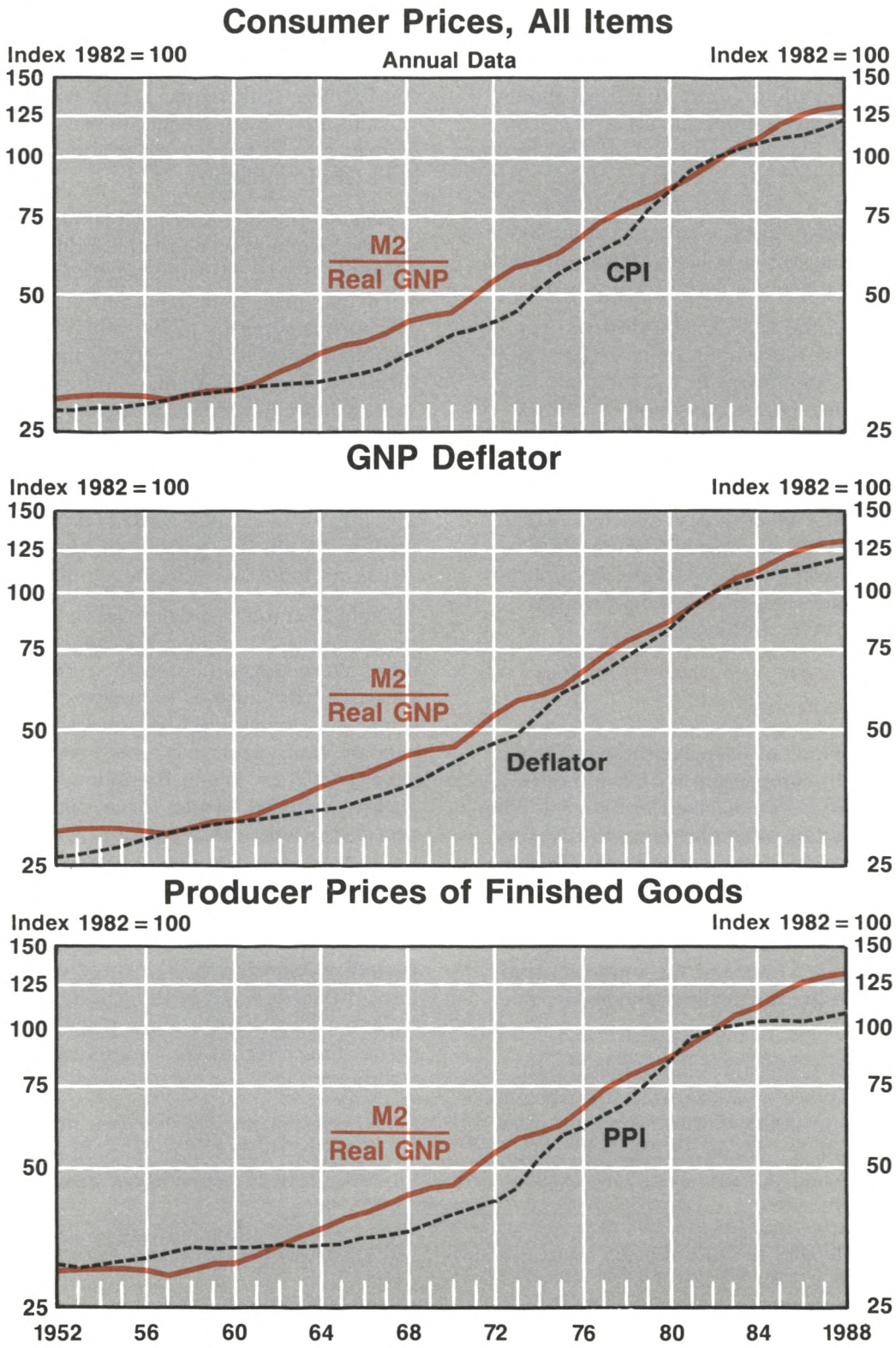


Figure 2
Money (M2) Relative to Trend Output and Alternative Price Measures

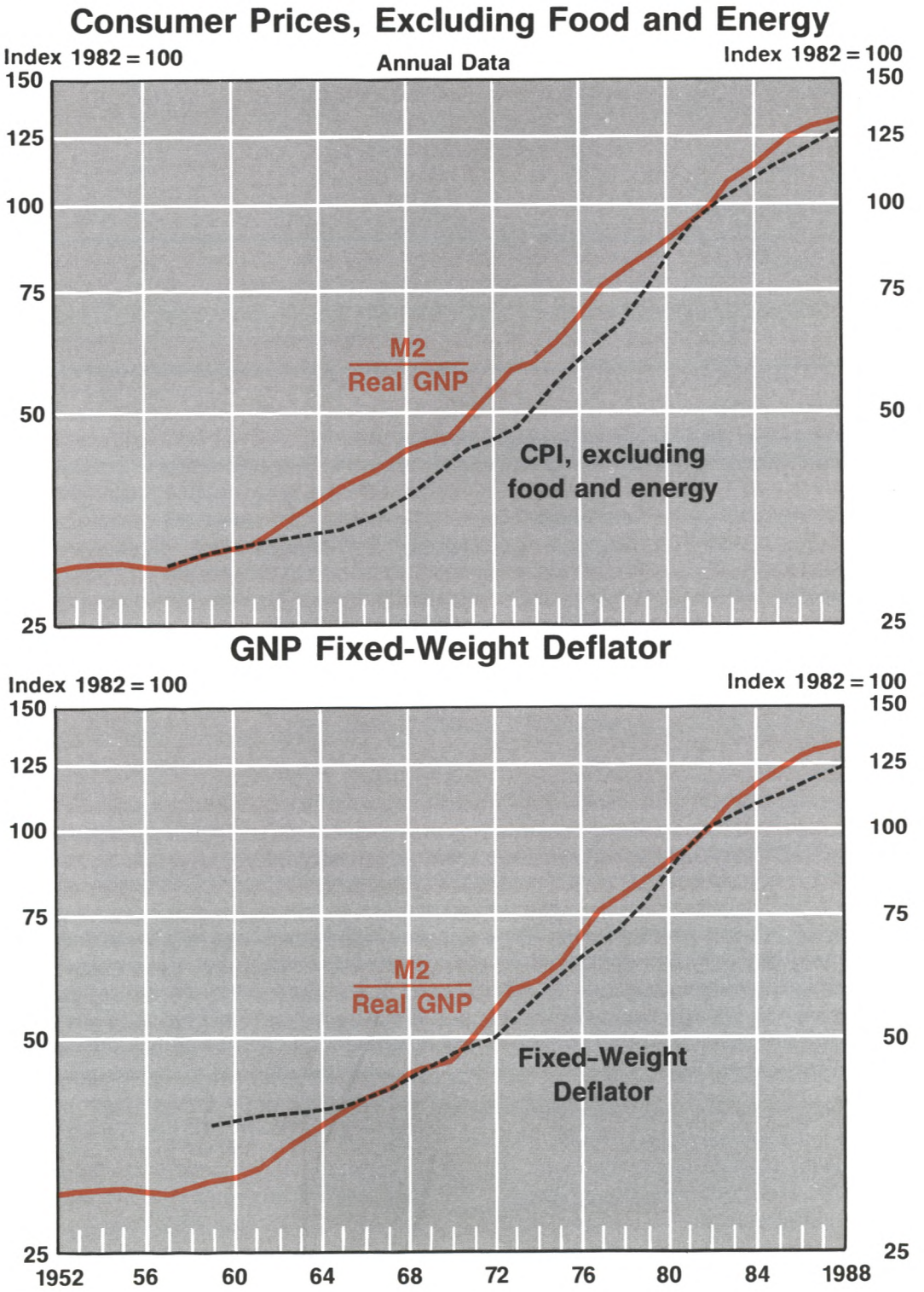


Table 8
Correlation of Price Indexes with Money-Output Index (1960-88)

Rates of change	Money (M2) minus trend growth of GNP				
	No lag	1-year lag	2-year lag	3-year lag	4-year lag
Consumer prices, all items	.10	.25	.54*	.62*	.50*
Consumer prices, excluding food and energy	.14	.19	.46*	.70*	.63*
GNP deflator	.27	.29	.48*	.57*	.52*
GNP fixed-weight deflator	.21	.31	.56*	.65*	.60*
Producer prices of finished goods	.09	.29	.56*	.52*	.32

*Significant at 5 percent level

Table 9
Rates of Change of Money and U.S. Prices

	Full period	Average rate of change subperiods			
	1952-88	1982-88	1972-82	1965-72	1952-65
Money (M2) relative to trend output	4.3%	5.0%	6.2%	4.8%	2.1%
Consumer prices, all items	4.2	3.5	8.7	4.1	1.3
Consumer prices, excluding food and energy	N.A.	4.3	8.1	4.3	N.A.
GNP deflator	4.4	3.3	8.0	4.7	2.2
GNP fixed-weight deflator	N.A.	3.7	7.1	3.3	N.A.
Producer prices of finished goods	3.6	1.3	9.1	2.9	0.8

analysis. For the three- and four-year lag, consumer prices, excluding food and energy, and the GNP fixed-weight deflator appear to be the most highly correlated, but the closeness of fit is not significantly different from that for the other measures for a given lag.

Another way of examining these alternative price measures is to compare their trends for the 1952-88 period. Table 9 summarizes the movements of the same price measures shown in table 8. The subperiods are the same as in table 2 and conform with periods of marked and sustained change in the growth of money relative to output. For the full period, 1952-88, all of the price measures for which data are available conform closely with the rate of change of the money-output measure. The possible exception is producer prices, which increased at a 3.6 percent average rate compared with a 4.3 percent rate for money-output.

An examination of rates of change indicates that, without exception, accelerations and decelerations in the money-output measure were accompanied by movements in the same

direction for each of the price measures. The rates of change of the price measures were more closely associated with the money-output measure in the two earliest periods than in the 1972-88 period. This generally reflects volatile movements in the prices of energy and agricultural products during the 1970s and 1980s. These sharp movements in relative prices can produce rates of change that differ for periods as long as 10 years from those for the money-output measure. They tend to cancel over longer periods, however, as shown by the rates of change for the full period.

Comparing each price measure with the money-output measure does not indicate a clear superiority of one measure over another, although producer prices have shown the largest average absolute deviation. For the subperiods chosen, there is not enough information to draw a definite conclusion. For each of the subperiods in the 1965-88 period, however, the consumer price measure excluding food and energy appears to conform more closely to movements in the money-output measure than does consumer prices for all items. Similarly, the fixed-weight deflator has accompanied movements in the money-output measure more closely than the GNP deflator during the 1972-88 period.

CONCLUSIONS

Because inflation is a vital concern in making economic decisions, it is important to understand the price indexes used to measure it. Consumers, businesses and governments need to understand changes in price trends so they can make rational economic decisions. Policymakers, in particular, must be keenly aware of price trends so they can take appropriate actions. This article described these indexes and analyzed them to determine what they tell us about inflation. The indexes were examined from two perspectives: that of the individual, attempting to maximize his well-being, and that of the policymaker, attempting to control inflation.

For the United States, there are three major price indexes: the consumer price index, the producer price index and the GNP implicit price deflator. To measure and analyze inflation properly, more information is required than these conventional price indexes provide. The price system encompasses many more markets than those for currently produced goods and services. A theoretical measure of price change would include, for example, prices of common stock, real estate, land, etc. Although no such broad measure of price change is available, the concept is useful for decisionmakers.

A broad theoretical price measure should be of interest to policymakers, but their focus is generally on the causes of inflation. In particular, their interest is in discovering the composition of price change and identifying the portion associated with policy actions. Using the Friedman monetary measure of money relative to trend output as a standard for comparison, we found that, with the possible exception of producer prices, all of the well-known measures of price change were closely related to his measure when examined over the full period since 1952. The lag between money growth and inflation was confirmed, although we could not be precise about the length of the lag. Although less closely related than over the full period, all the price measures that were examined moved with marked and sustained changes in the growth rate of money relative to output. No price measure, however, performed consistently better than another from one period to the next.

REFERENCES

Alchian, Armen A. *Economic Forces at Work* (Liberty Press, 1977).

Alchian, Armen A., and Benjamin Klein. "On a Correct Measure of Inflation," *Journal of Money, Credit and Banking* (February 1973), pp. 173-91.

Allen, Roy G. D. *Index Numbers in Theory and Practice* (Aldine Publishing Company, 1975).

Backman, Jules, and Martin R. Gainsbrugh. *Inflation and the Price Indexes*, Materials Submitted to the Subcommittee on Economic Statistics of the Joint Economic Committee of the Congress of the United States (U.S. Government Printing Office, July 1966).

Bronfenbrenner, Martin. "Inflation and Deflation," *International Encyclopedia of the Social Sciences*, Vol. 7 (Macmillan and The Free Press, 1968), pp. 289-300.

Bureau of Economic Analysis, U.S. Department of Commerce. *Survey of Current Business* (GPO, May 1985 and July 1987).

Bureau of Labor Statistics, U.S. Department of Labor. *BLS Handbook of Methods*, Bulletin 2285 (GPO, April 1988).

_____. *Producer Price Measurement: Concepts and Methods* (June 1986).

_____. *BLS Handbook of Methods*, Volume 1, Bulletin 2134-1 (GPO, December 1982).

Diewert, W. Erwin. *The Early History of Price Index Research*, Working Paper No. 2713 (National Bureau of Economic Research, September 1988).

Eckstein, Otto. *Tax Policy and Core Inflation*, A Study Prepared for the Use of the Joint Economic Committee of the Congress of the United States (GPO, April 10, 1980).

Friedman, Milton. "Whither Inflation?" *Wall Street Journal*, July 5, 1989.

_____. "What Price Guideposts?" in George P. Schultz and Robert Z. Aliber, eds., *Guidelines, Informal Controls, and the Market Place* (University of Chicago Press, 1966), pp. 17-39.

Friedman, Milton, and Anna J. Schwartz. *Monetary Trends in the United States and the United Kingdom* (University of Chicago Press, 1982).

_____. *A Monetary History of the United States, 1867-1960* (Princeton University Press, 1963).

Frisch, Helmut. *Theories of Inflation* (Cambridge University Press, 1983).

Gordon, Robert J. *Macroeconomics*, 4th ed. (Little, Brown and Co., 1987).

Hallman, Jeffrey J., Richard D. Porter, and David H. Small. *M2 Per Unit of Potential GNP as an Anchor for the Price Level*, Staff Study 157 (Board of Governors of the Federal Reserve System, April 1989).

Moore, Geoffrey H. *Business Cycles, Inflation, and Forecasting*, 2nd ed. (Ballinger, 1983).

Ruggles, Richard. "The United States National Income Accounts, 1947-1977: Their Conceptual Basis and Evolution," in Murray F. Foss, ed., *The U.S. National Income and Product Accounts: Selected Topics* (The University of Chicago Press, 1983), pp. 15-105.

Triplett, Jack E. "The Measurement of Inflation: A Survey of Research on the Accuracy of Price Indexes," in Paul H. Earl, ed., *Analysis of Inflation* (Lexington, 1975), pp. 19-82.

Webb, Roy H., and Rob Willemse. "Macroeconomic Price Indexes," Federal Reserve Bank of Richmond *Economic Review* (July/August 1989), pp. 22-32.

Michael D. Bradley and Dennis W. Jansen

Michael D. Bradley is an associate professor of economics at The George Washington University. Dennis W. Jansen, an associate professor of economics at Texas A & M University, was a visiting scholar at the Federal Reserve Bank of St. Louis. *Lora Holman provided research assistance. The authors would like to thank Geoffrey Wood for his helpful comments.*

Understanding Nominal GNP Targeting

THROUGHOUT 1989, popular wisdom held that the U.S. monetary authority was faced with a daunting policy task: it should not permit too much money growth and cause prices to rise too rapidly, but it should not allow too little money growth and cause the economy to tip into recession as real output would fall. Sympathy for monetary policymakers, however, is not necessarily widespread among economists. Many economists deny that the tradeoff between inflation and output growth exists in the long run. Moreover, even those who grudgingly agree that the tradeoff may exist in the short run contend that monetary policymakers create problems for themselves by attempting to exploit the possible output-inflation tradeoff.

What alternative policy guidelines exist? Among a variety of alternatives, there has been recent emphasis on something called nominal income targeting.[1] Using this approach, the monetary authority would ignore the presumed trade-off between inflation and real output growth; instead, it would simply adjust money stock growth to achieve some targeted level or growth rate in nominal GNP. In this paper, we examine this policy alternative. We first make the theoretical case favoring nominal GNP targeting. Given this theory, we then turn to the practical aspects of targeting nominal GNP.

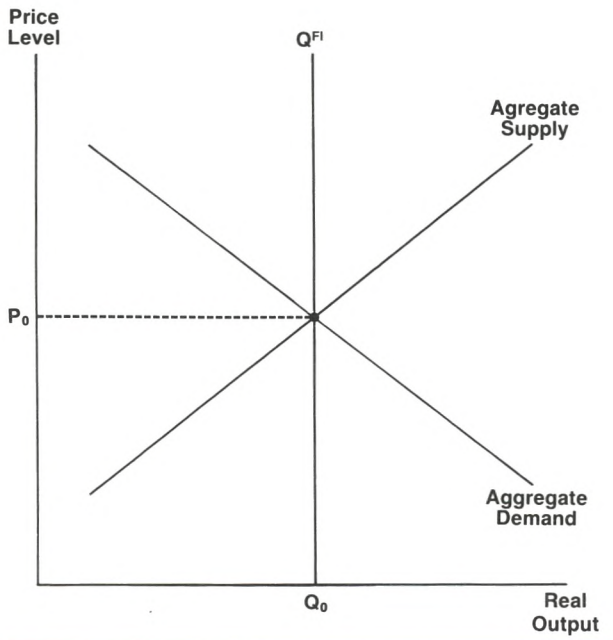
TARGETING NOMINAL GNP: THE THEORY

In this section, we set out the theoretical case favoring nominal GNP targeting. In doing so, we abstract from technical and operational problems and focus instead on the implications of nominal GNP targeting for stabilizing price and output within a widely used macroeconomic model. Later we will return to the issue of how to actually set up and utilize nominal GNP targeting.

Naturally, the economic implications of alternative monetary policies depend to a large extent on the macroeconomic framework being used for the analysis. We employ a particular version of what is perhaps the most widely used framework for analyzing macroeconomic

[1]See McCallum (1987), McNees (1987), Carlson (1988) or Kahn (1988) for examples of policy-oriented discussions of nominal GNP targeting.

Figure 1



fluctuations, the textbook aggregate supply-demand model.

A Stochastic Aggregate Supply-Demand Model

A graphical representation of the textbook aggregate demand-supply model is given in figure 1. This model specifies that the aggregate price level (P) and the level of real output (Q) are set by the intersection of the aggregate supply and demand curves. As figure 1 shows, the aggregate demand curve slopes downward; that is, there is an inverse relationship between the aggregate price level and the demand for real output. This inverse relationship can arise for either of two reasons. As the price level rises, the purchasing power of money balances declines, reducing wealth and hence reducing the quantity of consumption goods demanded. In addition, the higher price level leads to an increase in the quantity of nominal money demanded because the higher prices require larger average money balances to purchase the same real quantity of goods and services. Increased money demand bids up the interest rate, and higher interest rates imply less consumption and investment spending.[2]

The aggregate supply curve slopes upward in figure 1. There are several explanations for the positive slope of the aggregate supply curve. We concentrate on a particular, widely used explanation: that the nominal wages of workers are set by agreement for a fixed period of time and the amount of employment is determined by the employer. This agreement can either be a formal contract or an informal handshake (also called an implicit contract) between labor and management; in either case, nominal wages adjust slowly to *unexpected* changes in the economic environment. As a result, profits rise as prices rise and fall as prices fall. Firms respond to these changes in profits by appropriate changes in output and employment.[3]

This response does not describe the situation relevant for *expected* changes in the economic environment, however, because expected changes are taken into account when nominal wage agreements are made. Thus, figure 1 also includes a vertical line labeled Q^{FI}, which indicates the supply curve relevant when expected changes occur. The superscript FI stands for "full information," to indicate that this is the supply curve applicable when the only changes in the economic environment are those expected to occur when wage agreements were signed. Notice that this curve does not show a direct relationship between price and quantity. In fact, it shows that, for expected changes, the relevant supply curve is vertical at the output level labeled Q^{FI}.

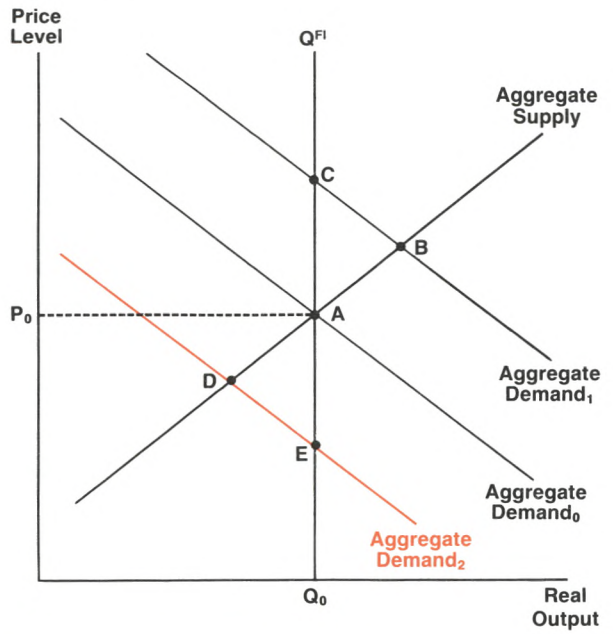
The output level Q^{FI} does not change when prices change because workers and firms, when negotiating wage agreements, will adjust the nominal wage to compensate for changes in the price level. Thus, an expected increase in the price level will be compensated by an increase in the contracted nominal wage.

This vertical aggregate supply curve is a reflection of the "natural rate hypothesis." The

[2]With the inflation rate held constant, the increase in the nominal interest rate implies an equivalent increase in the real interest rate.

[3]Early versions of this theoretical approach were developed by Fischer (1977) and Gray (1976). See Barro (1977) for a criticism of this approach. Optimal fixed wage contracts can be found from microeconomic contracting models such as Azariadis (1975); these are models of fixed real wage contracts that shift risk from workers to firms. McCallum (1987) gives a pragmatic argument for the prevalence of nominal wage contracts as opposed to real wage contracts.

Figure 2



natural rate hypothesis states that the full employment level of output is independent of the price level. In this model, the vertical line Q^{FI} represents the natural rate hypothesis.

Monetary policy works by inducing movements in the aggregate demand curve. As the nominal money stock rises, wealth rises and the interest rate falls *at any given price level*; as a result, the demand for goods rises. Graphically, the aggregate demand curve shifts to the right. Thus, expansionary policy (increases in the money stock) shifts the aggregate demand curve to the right, and contractionary policy (decreases in the money stock) shifts it to the left.

To illustrate what this model implies, consider the results of an unexpected increase in aggregate demand, illustrated in figure 2. Since the short-run aggregate supply curve has a positive slope, the aggregate demand increase will produce increases in both price and output until such time as wages are renegotiated. In figure 2, the short-run equilibrium occurs at point B, the intersection of the short-run aggregate supply curve with the new, unexpectedly higher aggregate demand curve.

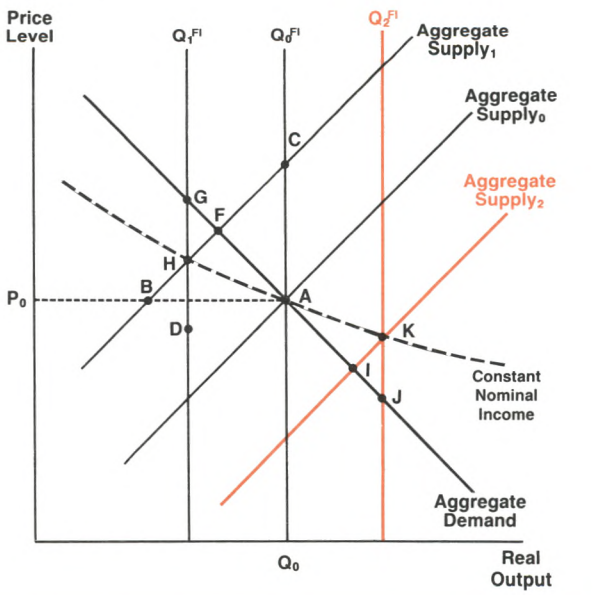
Of course, when workers revise the terms of their labor contracts in response to an unexpected rise in prices, nominal wages will rise and the short-run aggregate supply curve will shift to the left, until it intersects the new aggregate demand curve at point C, where the demand curve crosses the full information aggregate supply curve. When workers become fully informed and have changed their nominal wage accordingly, changes in aggregate demand result only in price level changes.

One implication of this analysis is that an expected increase in demand only produces higher prices. In figure 2, this is illustrated by the movement of the economy from the intersection of the original aggregate demand curve and Q_0^{FI} at point A to the intersection of the new aggregate demand curve and Q_0^{FI} at point C, without the intervening short-run equilibrium at point B.

The analysis of a decline in aggregate demand is symmetric to the above analysis. An unexpected decline in aggregate demand leads initially to lower prices and output on the short-run aggregate supply curve at point D. After firms adjust workers' nominal wages downward in response to lower prices, the full information level of output, point E, is achieved once more.

Unexpected changes in supply, termed supply shocks, are different from demand shocks because they shift both the short-run and the full information aggregate supply curves. For example, suppose that the negative supply shock illustrated in figure 3 occurs, shifting both the long-run and short-run aggregate supply curves to the left.

Figure 3



The short-run equilibrium occurs at point F, the intersection of aggregate demand with the new short-run aggregate supply curve. The full information output also declines from Q_0^{FI} to Q_1^{FI} because the supply shock has reduced the quantity of output firms want to produce even if wages and prices fully adjust to the shock. The adjustment from short-run equilibrium at point F to full information equilibrium at point G occurs when workers renegotiate their nominal wages upward, shifting the short-run supply curve leftward again until it intersects the new full information output level Q_1^{FI} at point G.

Why does the full information output level shift in response to supply shocks? By definition, the full information output level is the one that will be produced when the economy completely adjusts to any disturbance. Thus, a negative supply shock reduces the full information level of output because it reduces the productive capacity of the economy.

Notice that a reduction in the full information level of output need not be permanent. That depends on the nature of the supply shock. If it is only temporary, the full information output level will return to Q_0^{FI} after the shock dissipates. Nonetheless, the decline in Q^{FI} from Q_0^{FI} to Q_1^{FI} represents the reduction in potential output, however temporary, that occurs in conjunction with a negative supply shock.

Finally, the analysis of a positive supply shock is symmetric to the analysis of a negative supply shock. Consider a positive shock to supply. The full information level of output shifts from Q_0^{FI} to Q_2^{FI} as the short-run aggregate supply curve also shifts to the right. If the shock is unexpected, initial equilibrium is at point I, and after all wage adjustments have been made, the economy will produce at the full information level of output at point J.

Monetary Policy in the Aggregate Demand-Supply Model

The aggregate supply-demand framework we employ assumes that random shocks occur to both demand and supply curves. Demand shocks include unexpected changes in business or consumer confidence, income taxes, exchange rates, monetary policy or government spending. These lead to unexpected changes in one or more of the components of aggregate demand: consumption, investment, government spending and net exports. Supply shocks include unexpected changes in the production process, such as oil price surprises, droughts or technological change, that enhance or diminish the aggregate quantity of goods supplied.

Before examining how monetary policy might respond to these shocks, the goals of policy must be discussed. We assume that the monetary authority wants to stabilize the price level and/or the level of output. In the model presented, the only level of real output that can be achieved after wages have fully adjusted to shocks is the full information level of output. Furthermore, in the short run, before contracts are renegotiated, output deviates from full information output only when shocks occur. Thus, output stabilization implies that the monetary policymaker seeks to stabilize output at its full information level. In achieving this goal, the policymaker attempts to keep output where the private sector would produce if it recognized and fully adjusted to the shocks disturbing the economy.[4]

We consider three types of policy targets. Price level targeting involves setting the money stock so that the aggregate demand curve strikes the aggregate supply curve at a point like point A in figure 2. Thus, the price level target might be P_0. When demand or supply shocks occur, the monetary authority will attempt to maintain the short-run equilibrium price level at P_0. In contrast, real output targeting involves changing the money stock so that the aggregate demand curve intersects the aggregate supply curve at Q_0, the target level for real output. Because the full information output level, Q^{FI}, is the level that would be achieved after all adjustments have taken place, the monetary authority would set the real output target at this value. Finally, nominal GNP targeting involves setting the money stock so that the product of the equilibrium price (P) and equilibrium output (Q) equals the target for nominal GNP, $(PQ)^*$. Under this procedure, the monetary authority does not attempt to determine the specific price and real output components of nominal GNP; instead, the policymaker is concerned with their product.

[4]The stochastic disturbances that affect the economy need not all originate from factors exogenous to the policymakers. Stochastic shocks that originate with unexpected policy actions can also adversely impact the economy.

What actions can be taken in the face of demand and supply shocks? If aggregate demand shifts unexpectedly to the right, as was illustrated in figure 2, stabilizing the price level requires the policymaker to contract the money stock; this would shift the aggregate demand curve back to its original position and restore the original price level, P_0, at point A. This same monetary policy response is also necessary to stabilize either real output or nominal GNP.[5] Thus, for demand shocks, the policy response is identical regardless of the specific goal of the policymaker. Because demand shocks move prices and output in the same direction, a policy that offsets price changes will also offset output and nominal GNP movements simultaneously. This result is not true, however, for supply shocks.

The graphical representation of a negative supply shock is presented in figure 3. As the supply shock shifts the aggregate supply curve to the left (from AS_0 to AS_1), the resulting incipient shortage of goods at the initial price level puts upward pressure on the price level. The rise in prices, which reduces the aggregate quantity of goods demanded, continues until the reduced quantity demanded is equal to the lower quantity supplied (point F).

An important feature of this model is the relation between the intersection of the full information output level and the short-run aggregate supply curve for various values of the supply shock. In figure 3, a negative supply shock shifts both Q^{FI} (from Q_0^{FI} to Q_1^{FI}) and the short-run aggregate supply curve to the left. The initial intersection of short-run aggregate supply and full information output occurred at point A; after the shock, these curves intersect at point H. Similarly, a positive supply shock would shift both Q^{FI} (from Q_0^{FI} to Q_2^{FI}) and the short-run aggregate supply to the right. In this case, short-run aggregate supply and full information output would intersect at point K after the shock.

It can be demonstrated that these intersections of short-run aggregate supply and full information output occur at the same level of nominal spending. In other words, the value of P_0Q_0 at point A, P_1Q_1 at point H and P_2Q_2 at point K are identical.[6] The dashed line connecting these points contains all possible intersections of short-run aggregate supply and full information output after a supply shock, but with the nominal wage held constant. Since these intersection points are points of identical nominal spending, the dashed line connecting them is called a rectangular hyperbola. This result is generated by the contract market structure of the labor market; it is *not* a feature of all aggregate demand-aggregate supply models. This model is used because it provides a strong theoretical rationale for the use of nominal GNP targeting.

In the absence of any policy response, the negative supply shock shown in figure 3 would move the economy from equilibrium at point A to point F in the short run and then to point G in the long run. Monetary policy actions designed to maintain the price level at its original value would decrease the money stock to reduce the demand curve. In figure 3, point B is the new short-run equilibrium following the supply shock and the reduction in aggregate demand required to keep the price level at P_0. In this case, however, price stabilization produced a larger decline in real output than did the initial negative supply shock.

On the other hand, maintaining real output at Q_0 would require sufficient growth in the money stock to shift the aggregate demand curve to the right to point C. In this case, the original output level, Q_0, is maintained, but the price level has jumped sharply. Moreover, the inflationary impact of output stability does not stop at point C. Because the rise in output prices is a surprise to workers and other input suppliers, input prices will rise and the short-run aggregate supply curve will shift to the left again. Thus, even without further policy-induced demand changes, the price level will be driven up further; if monetary policy responds again to maintain real output, the price spiral will continue onward and upward.[7]

---

[5]It may seem perverse for monetary policy to attempt to *reduce* real output! Recall, however, that we are abstracting from the growth in output. As a result, this seemingly perverse policy is just the graphical analog of trying to smooth out cyclical variations in real output that occur along the economy's long-run growth path.

[6]See Bean (1983) or Bradley and Jansen (1989) for a formal demonstration of this claim.

[7]Point B is also a temporary position. When output is below its natural or full employment rate, unemployment is also high. This unemployment will eventually push down wages and costs, moving the short-run aggregate supply curve to the right and intersecting the long-run aggregate supply curve at a point like D. Thus, price stabilization policy in the natural rate model may perversely lead to deflation.

Finally, consider what happens with nominal income targeting. In this case, the monetary authority adjusts the money stock to keep nominal GNP at its target level. In this model, the intersection of the short-run aggregate supply and full information output *after a supply shock* occurs at the same level of nominal spending as their intersection before a supply shock. For example, in figure 3, points A and H are intersections of full-information output and short-run aggregate supply before and after a supply shock. Nominal GNP targeting requires reducing the money supply enough to move the economy from point F after the supply shock occurs to point H; nominal spending at point H is equal to nominal spending at the initial equilibrium point A. Because a supply shock causes short-run aggregate supply and full information output to intersect at points of constant nominal spending, nominal GNP targeting keeps the economy at its full information output level. That is, under nominal GNP targeting, the aggregate demand will always intersect the short-run aggregate supply curve at the full information output level *for any value of the supply shock*.

Nominal income targeting yields two potential improvements over policies designed to stabilize the price level as the level of real output. First, nominal income targeting permits both price and output to adjust simultaneously; thus, it avoids more extreme movements in either price or output alone that occur when policy is directed toward stabilizing one of these variables.

Second, in the model we discuss, nominal income targeting also enables the economy to avoid the changes in nominal wages that produce a second set of adjustments. Nominal wages will *not* change because nominal GNP targeting always stabilizes output at the full information output level, the level firms would choose to produce if they could recognize and fully adjust to the shocks confronting them.

Thus, nominal GNP targeting responds as well as price or output level targeting to demand shocks and is superior to either in responding to supply shocks, especially if policy is directed toward keeping output at the full information level.

TARGETING NOMINAL GNP: COULD IT WORK IN PRACTICE?

Despite concern expressed by some commentators about the division of nominal GNP into its real GNP and price level components, nominal GNP targeting is "perfectly" stabilizing at the only sustainable output level, the "natural" or full information rate of output.[8] Monetary policymakers need not be concerned with anything except the nominal GNP target itself because the real GNP level achieved will automatically be the full information rate of output![9]

Thus, one key result of nominal GNP targeting is that policymakers don't have to estimate the natural rate of output as they would under a real GNP targeting procedure. Under nominal GNP targeting, hitting the preannounced target is sufficient to generate an equality between the actual and full information rate of real GNP, *even if the policymaker knows nothing about the full information rate of output at any point in time.*

The obvious question is, To what extent do these results apply to the real economy?

Can the Monetary Authority Control Nominal GNP?

Targeting nominal GNP requires that the monetary authority control nominal GNP. That is, a change in the money stock must lead to a predictable consequent change in nominal GNP. Few economists doubt that, in broad terms, nominal GNP can be influenced by the monetary authority. For example, the St. Louis equation, which has been used to aid policymaking at the Federal Reserve Bank of St. Louis and elsewhere, demonstrates the relationship between changes in the money stock and subse-

[8]Note that this case does not rule out fluctuations in real GNP, as shocks to the aggregate supply function will alter real GNP and price while keeping nominal GNP constant. These shocks to aggregate supply can be anything that affects the ability of the economy to produce output, such as changes in production technology, exogenous OPEC oil price shocks and droughts. All of these factors may alter the natural rate of output; under nominal GNP targeting, actual real output will also change to remain equal to the natural rate of output.

[9]Stabilizing nominal GNP is not a desirable goal in and of itself; instead, it is desirable because of its implications for stabilizing output at the full information level. In this sense, nominal GNP targeting actually represents an "intermediate target" of policy. An intermediate target is one that is adopted because, by achieving it, one also achieves the ultimate policy goals.

quent changes in nominal GNP over a period of several quarters.[10]

Of course, questions about the controllability of nominal GNP are really questions about the impact of money on the components of spending. They apply equally well to the price or output level. To see this, assume that policymakers adopt a real GNP target. Policymakers might proceed with the two-step procedure described recently by Benjamin Friedman (1988), in which policymakers first choose a target value for real GNP, then estimate the value of the money stock consistent with their real GNP goal. The estimated money stock is an intermediate target of policy in lieu of attempting to hit the real GNP target over periods shorter than a quarter. This procedure works only if achieving the money target is related to achieving the real GNP target. But such a relationship between money and nominal GNP is exactly what is required for nominal GNP targeting to be practical.[11]

Moreover, as discussed earlier, hitting a nominal GNP target will automatically guarantee hitting a real GNP level equal to the full information rate of output. Since this is not measured directly, but is, instead, estimated from various sources, it is useful to know that hitting a targeted nominal GNP level, that can be measured directly, will keep real GNP at its full information rate.[12]

Do Policymakers Know Enough About the Economy?

A common criticism of policymaking is that economists and policymakers do not know enough about how the economy functions to have a model that describes accurately the behavior of macroeconomic variables like real GNP and the price level. In this case, it has been argued that policy action based on a flawed or incomplete model might cause more harm than good. To avoid this problem, Milton Friedman and others have advocated policy rules that do not depend on the state of the economy; these rules are called "non-contingent" monetary policy rules.

Milton Friedman and others have emphasized that "long and variable lags" exist between changes in money aggregates and the full response of GNP. Because the variability in these lags is neither predictable nor well understood, Friedman argues that ignorance of the causes and patterns of variability in the lag structure justifies the use of a constant money rule, such as having a money aggregate grow at exactly 3 percent per year forever. This type of money rule is non-contingent; that is, it does not vary even though nominal GNP, the price level and/or real output varies.

In contrast, nominal GNP targeting can be achieved only with a state-contingent money rule. For example, a rule specifying 3 percent annual nominal GNP growth requires faster money growth when nominal GNP growth is less than 3 percent and slower money growth when nominal GNP growth is above 3 percent. In practice, nominal GNP targeting is a "feedback" money rule, with the feedback running from observed GNP changes to money growth.

One approach to evaluating the potential usefulness of state-contingent money rules is to see whether there is a rule whose favorable properties are robust across alternative theoretical models. This is analogous to Bennett McCallum's search for a money rule with desirable properties across alternative empirical models. The shaded insert describes a nominal GNP rule proposed by McCallum that satisfies the criterion of

[10]The historical reference is Andersen and Jordan (1968) and Andersen and Carlson (1970). A recent update is reported in Carlson (1986).

[11]For a critical analysis of intermediate targeting, see B. Friedman (1975, 1988).

[12]One issue in the controllability of nominal GNP arises because nominal GNP is only observed every quarter, and even then is available only with a lag of several weeks. The question arises whether quarterly observations on GNP are sufficiently timely to allow the monetary authority to target nominal GNP. This issue is specious. First, no technical issue prevents more frequent (e.g., monthly) observation of nominal GNP. Second, numerous economic variables are observed more frequently than nominal GNP and are related to nominal GNP both theoretically and statistically. These can be used to forecast movements of nominal GNP between observations. Over a decade ago, LeRoy and Waud (1975, 1977) demonstrated that such forecasts could be made with data observed at different frequencies using a statistical approach known as the Kalman filter. Thus, monthly or even weekly estimates of nominal GNP are available as guides to policymakers.

Finally, it is important to note that alternative policies such as price level targeting or real GNP targeting also face the observability question. The price level and real output are also observed quarterly, although various components of the price level such as the Consumer Price Index and the Wholesale Price Index are observed monthly. Thus, targeting other variables does not avoid any problems associated with infrequent measurements of the targeted variable.

McCallum's Nominal GNP Rule

Recently, Bennett McCallum has recommended a particular rule for targeting nominal GNP that uses the monetary base. This rule specifies how the policymaker can adjust the monetary base to counteract a portion of the current change in nominal GNP. The reason that only a portion of the total change in nominal GNP is offset is to avoid an instrument instability problem with use of the monetary base. The proposed policy is nondiscretionary: it embodies a targeted path for nominal income growth of 3 percent per year. The particular rule he recommends is:

$$\Delta b_t = 0.00739 - (1/16)(v_{t-1} - v_{t-17}) + \lambda(x^*_{t-1} - x_{t-1}),$$

where Δb_t is the change in the (natural logarithm of the) monetary base, v_t is (the natural logarithm of) base velocity, x_t is (the natural logarithm of) nominal GNP and x^*_t is the target path for (the natural logarithm of) nominal GNP. Since this rule applies quarterly, the constant of .00739 yields a 3 percent annual growth in the monetary base, *ceteris paribus*. This rule specifies that the monetary base grows at 3 percent per year, with deviations from the 3 percent rule for changes in a 16-quarter difference in velocity, and for deviations of nominal GNP from target. The base target is deterministic, simply growing at 3 percent per year.

McCallum's rule has the monetary base responding to a 16-quarter difference in velocity in an attempt to detect and respond to permanent changes in velocity. A one-time permanent increase in velocity will lead to a reduction in the monetary base growth rate spread over a 16-quarter interval, after which it returns to its 3 percent per annum rate. If the velocity change lasts only one quarter, then the response of base growth is positive for one quarter, negative for the following quarter, and afterwards returns to its steady 3 percent per annum rate (absent further changes in velocity).

The term $\lambda(x^*_{t-1} - x_{t-1})$ in the base rule indicates the response of base growth to last quarter's deviation of nominal GNP from target. The parameter λ indicates the speed with which deviations of nominal GNP from target are corrected. The larger is λ, the quicker is the deviation of nominal GNP from target corrected by base growth. Too large a value for λ can cause dynamic instability, however, so this parameter must be chosen with care. McCallum recommends a value of .25, which would generate an increase in base growth of 1 percent per year for each 1 percent deviation of nominal GNP from its targeted path.

To investigate the properties of this proposed rule, McCallum conducts simulation experiments from which he concludes that the adoption of his rule over the 1954-85 period would have produced a root mean square error (RMSE) of nominal income of 2 percent vs. an actual RMSE over this period of nearly 6 percent.

An issue that McCallum does not address is deviations of real GNP from the natural rate of output under his rule relative to the actual experience. Indeed, this is difficult to assess for several reasons. First, measures of the natural rate of output such as potential GNP are, at best, rough constructs. Second, alternative macroeconomic models reach very different conclusions about the decomposition of nominal GNP into its real GNP and price level components. Therefore, McCallum's rule, even if it smooths nominal GNP relative to the historical experience, may not be optimal because part of the historical experience may reflect changes in the natural rate of output, to which real GNP and, under some monetary procedures, nominal GNP should respond.

generating desirable results in simulations across a variety of empirical models.

Of course, it is difficult to evaluate the robustness of a policy rule across alternative theoretical constructs; moreover, even doing so is no guarantee that the theoretical constructs considered actually contain one that conforms "closely" (somehow defined) to the underlying "real-world" economy. Still, the exercise is worth conducting, if only to pinpoint the limitations of our knowledge of the economy. Indeed, such ignorance of how the economy works was precisely the reason Friedman used to advocate his constant money growth rule.

While such an exercise is complicated by the plethora of theoretical macroeconomic constructs available today, many that incorporate a natural rate structure on the supply side seem to show that a nominal GNP target, *if achievable on a timely basis*, will better stabilize the economy than a non-contingent policy rule, such as a fixed money growth rule. The specific state-contingent money rule found to be best, however, differs significantly across these models. Moreover, these models essentially ignore the effect of the lags that would be present in empirically implementing the state-contingent money rule.

After incorporating both the effect of these lags and the inconsistencies across models in ranking alternative state-contingent monetary policy rules, the presumed advantages of nominal GNP targeting become more tenuous.[13] For instance, the advantage of using nominal GNP targeting in the model described in this paper depends on the ability of the policymaker to recognize and respond to changes in nominal GNP more quickly than the private sector can recognize and respond to shocks to the economy. While this may seem reasonable for the model we use, other theoretical models yield other conclusions.

For example, one aggregate demand-supply model generates a positively sloped aggregate supply curve by assuming that workers have incomplete information about the current economic environment; specifically, they lack information on the current prices of goods that they purchase infrequently. Workers accept nominal wage offers based on their *forecasts* of the price level rather than the price level itself. Nominal wages are assumed to be set by an auction market for labor services, in which the wage adjusts instantaneously to current economic conditions.[14] In this case, a larger-than-expected rise in the price of all goods means that workers' forecast of the price level are below the actual price level, thereby inducing workers to accept lower nominal wage offers than usual. Until workers discover what has happened to the price level (which includes observing prices for goods purchased relatively infrequently), they will continue to offer their labor services at a lower real wage than the one they would demand if they were fully informed. This lower real wage induces firms to expand employment and output. In this alternative framework, nominal GNP targeting may be preferable to a fixed money rule; but price level targeting always works to keep real GNP at the natural rate.[15]

Thus, even within an aggregate demand-supply framework, different underlying assumptions about how the labor market operates will produce different evaluations of the relative usefulness of alternative policy rules. Until economists can agree on a model that reasonably explains changes in the state of the economy, it is difficult to take the policy recommendations from any particular model very seriously. In particular, advocates of nominal GNP targeting cannot point to overwhelming theoretical justification for their policy recommendation.[16] Consequently, while the theoretical

[13]Bean (1983), however, demonstrates that nominal GNP targeting in a multiple-period, wage-contracting setting is still preferable to money targeting. In this case, the nominal GNP target is a prospective target, in which rational forecasts of next period's nominal GNP are held constant while the actual value of next period's nominal GNP may vary with unanticipated shocks. In this case, however, nominal GNP targeting is itself dominated by a more general state-contingent rule. Bradley and Jansen (1989) extend Bean's results to a model with elastic labor supply and wage indexing to price.

[14]See Rasche (1973) for an early example.

[15]See Bradley and Jansen (1988) for an analysis of price level targeting in a more recent version of this model.

[16]An additional point in the issue of ignorance of the true model is the well-known result of William Brainard (1967). If the parameter values of the economic model are not perfectly known, policymakers should respond cautiously when employing any state-contingent policy rule, including nominal GNP targeting. Investigating the properties of nominal GNP targeting in a variety of theoretical or empirical models is one way to assess the importance of this ignorance of the true model for policy prescriptions. Since the true model is almost certainly unknown to anyone not practicing mysticism in academic or policymaking garb, however, the theoretical case for any state-contingent policy rule is again weakened.

model outlined earlier in this paper strongly supports the usefulness of nominal GNP targeting, a similar model that differs only in the underlying assumptions about the labor market suggests that price level targeting is superior to nominal GNP targeting.

CONCLUSION

The potential usefulness of nominal GNP targeting for monetary policy purposes has gained widespread attention in recent years. Nominal GNP targeting has several useful features in the context of a simple theoretical model; chief among them is the stabilization of real GNP at its natural rate of output. Moreover, this stabilization occurs automatically, without monetary policymakers having to know what the natural rate of output actually is. Finally, in the case of demand (but not supply) shocks, nominal GNP targeting will also provide price level stabilization.

While nominal GNP targeting may be superior theoretically to alternative policy targets, several problems arise when considering real-world applications of nominal GNP targeting. Ignorance of the correct equations, parameter values and lag structure that characterize the U.S. economy reduces the appeal of nominal GNP targeting.

REFERENCES

Andersen, Leonall C., and Keith M. Carlson. "A Monetarist Model for Economic Stabilization," this *Review* (April 1970), pp. 7-25.

Andersen, Leonall C., and Jerry L. Jordan. "Monetary and Fiscal Actions: A Test of their Relative Importance in Economic Stabilization," this *Review* (November 1968), pp. 11-24.

Azariadis, C. "Implicit Contracts and Underemployment Equilibria," *Journal of Political Economy* (1975), pp. 1183-202.

Barro, Robert J. "Long-Term Contracting, Sticky Prices, and Monetary Policy," *Journal of Monetary Economics* (1977), pp. 305-16.

Bean, Charles R. "Targeting Nominal Income: An Appraisal," *The Economic Journal* (December 1983), pp. 806-19.

Bradley, Michael D., and Dennis W. Jansen. "The Optimality of Nominal Income Targeting when Wages are Indexed to Price," *Southern Economic Journal* (July 1989), pp. 13-23.

_____. "Informational Implications of Money, Interest Rate, and Price Rules," *Economic Inquiry* (July 1988), pp. 437-48.

Brainard, William. "Uncertainty and the Effectiveness of Policy," *American Economic Review* (May 1967), pp. 411-25.

Carlson, John B. "Rules versus Discretion: Making a Monetary Rule Operational," Federal Reserve Bank of Cleveland *Economic Review* (Quarter III, 1988), pp. 2-13.

Carlson, Keith M. "A Monetarist Model for Economic Stabilization: Review and Update," this *Review* (October 1986), pp. 18-28.

Fischer, Stanley. "Long Term Contracts, Rational Expectations, and the Optimal Money Supply Rule," *Journal of Political Economy* (1977), pp. 191-205.

Frankel, Jeffrey. "A Modest Proposal for International Nominal Targeting (INT)," National Bureau of Economic Research Working Paper No. 2849 (February 1989).

Friedman, Benjamin M. "Targets and Instruments of Monetary Policy," National Bureau of Economic Research Working Paper No. 2668 (July 1988).

_____. "Targets, Instruments, and Indicators of Monetary Policy," *Journal of Monetary Economics* (October 1975), pp. 443-73.

Friedman, Milton. *A Program for Monetary Stability* (Fordham University Press, 1959).

Gray, Jo Anna. "Wage Indexation: A Macroeconomic Approach," *Journal of Monetary Economics* (1976), pp. 221-35.

Jansen, Dennis W. "Real Balances in an Ad Hoc Keynesian Model and Policy Ineffectiveness," *Journal of Money, Credit, and Banking* (August 1985), pp. 378-86.

Kahn, George A. "Nominal GNP: An Anchor for Monetary Policy?" Federal Reserve Bank of Kansas City *Economic Review* (November 1988), pp. 18-35.

LeRoy, Stephen F., and Roger N. Waud. "Applications of the Kalman Filter in Short-Run Monetary Control," International Economic Review (February 1977), pp. 195-207.

_____. "Observability, Measurement Error, and the Optimal Use of Information for Monetary Policy," Special Studies Paper No. 72 (Board of Governors of the Federal Reserve System, 1975).

McCallum, Bennett T. "The Case for Rules in the Conduct of Monetary Policy: A Concrete Example," Federal Reserve Bank of Richmond *Economic Review* (September/October 1987), pp. 10-18.

McNees, Stephen K. "Prospective Nominal GNP Targeting: An Alternative Framework for Monetary Policy," *New England Economic Review* (September/October 1987), pp. 3-9.

Rasche, Robert H. "A Comparative Static Analysis of Some Monetarist Propositions," this *Review* (December 1973), pp. 15-23.

Taylor, John B. "What Would Nominal GNP Targeting Do to the Business Cycle?" *Carnegie-Rochester Conference Series on Public Policy* (Spring 1985), pp. 61-84.

Thornton, Daniel L. "Why Does Velocity Matter?" this *Review* (December 1983), pp. 5-13.

FEDERAL RESERVE BANK OF ST. LOUIS
REVIEW INDEX 1989

JANUARY/FEBRUARY

R. Alton Gilbert, "Payments System Risk: What Is It and What Will Happen If We Try To Reduce It?"

Keith M. Carlson, "Federal Budget Trends and the 1981 Reagan Economic Plan"

Cletus C. Coughlin and Geoffrey E. Wood, "An Introduction to Non-Tariff Barriers to Trade"

Michael T. Belongia and Werner Hermann, "Can a Central Bank Influence Its Currency's Real Value? The Swiss Case"

MARCH/APRIL

John A. Tatom, "U.S. Investment in the 1980s: The Real Story"

Michelle R. Garfinkel, "The FOMC in 1988: Uncertainty's Effects on Monetary Policy"

Gerald P. Dwyer, Jr. and R. W. Hafer, "Interest Rates and Economic Announcements"

Mack Ott, "Is America Being Sold Out?"

H. Robert Heller, "Money and the International Monetary System"

MAY/JUNE

Jeffrey D. Karrenbrock, "The 1988 Drought: Its Impact on District Agriculture"

Lynn M. Barry, "Eighth District Banks: Back in the Black"

Thomas B. Mandelbaum, "The Eighth District Business Economy in 1988: Still Expanding, But More Slowly"

R. W. Hafer and Scott E. Hein, "Comparing Futures and Survey Forecasts of Near-Term Treasury Bill Rates"

Gerald P. Dwyer, Jr. and R. Alton Gilbert, "Bank Runs and Private Remedies"

JULY/AUGUST

Michelle R. Garfinkel, "What Is An 'Acceptable' Rate of Inflation? A Review of the Issues"

R. W. Hafer, "Does Dollar Depreciation Cause Inflation?"

Cletus C. Coughlin and Thomas B. Mandelbaum, "Have Federal Spending and Taxation Contributed to the Divergence of State Per Capita Incomes in the 1980s?"

Dennis W. Jansen, "Does Inflation Uncertainty Affect Output Growth? Further Evidence"

Daniel L. Thornton, "Tests of Covered Interest Rate Parity"

SEPTEMBER/OCTOBER

Karl Brunner, "The Role of Money and Monetary Policy"

Michelle R. Garfinkel, "The Causes and Consequences of Leveraged Buyouts"

Michelle R. Garfinkel and Daniel L. Thornton, "The Link Between M1 and the Monetary Base in the 1980s"

Jürgen von Hagen, "Monetary Targeting with Exchange Rate Constraints: The Bundesbank in the 1980s"

NOVEMBER/DECEMBER

Werner Hermann and G. J. Santoni, "The Cost Of Restricting Corporate Takeovers: A Lesson From Switzerland"

Keith M. Carlson, "Do Price Indexes Tell Us About Inflation? A Review of the Issues"

Michael D. Bradley and Dennis W. Jansen, "Understanding Nominal GNP Targeting"

Federal Reserve Bank of St. Louis
Post Office Box 442
St. Louis, Missouri 63166

The* Review *is published six times per year by the Research and Public Information Department of the Federal Reserve Bank of St. Louis. Single-copy subscriptions are available to the public free of charge. Mail requests for subscriptions, back issues, or address changes to: Research and Public Information Department, Federal Reserve Bank of St. Louis, P.O. Box 442, St. Louis, Missouri 63166.