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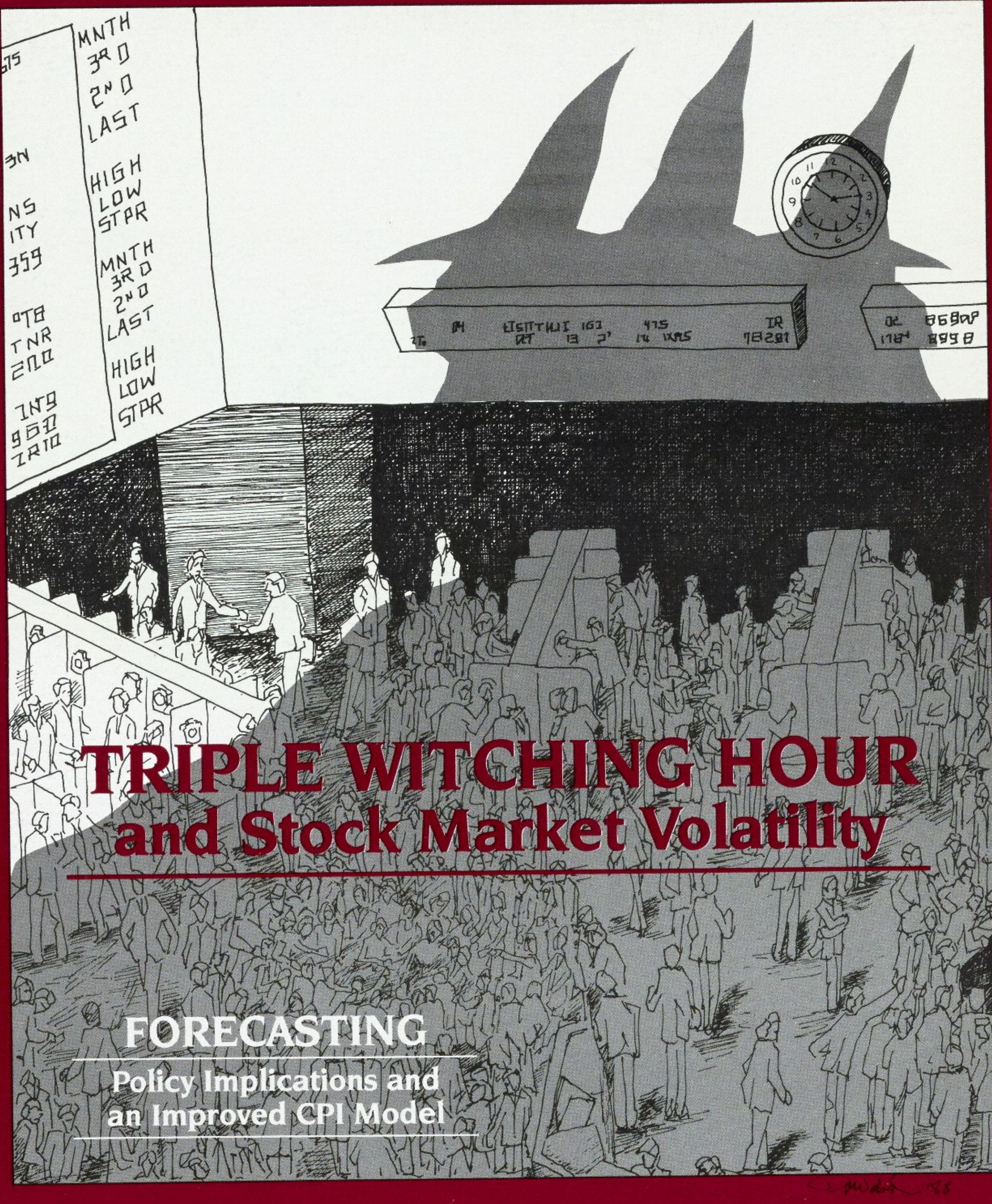

TRIPLE WITCHING HOUR and Stock Market Volatility

FORECASTING
Policy Implications and an Improved CPI Model

Economic Review

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The Effect of the "Triple Witching Hour" on Stock Market Volatility

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This paper investigates the "Triple Witching Hour"—the four times during the year when stock options, stock index options, and stock index futures simultaneously expire—to determine whether these periods are characterized by excessive volatility in the stock market.

The term "triple witching hour" can conjure up images of broomsticks and brew, perhaps the scene from Shakespeare's *Macbeth* in which a trio of witches recite incantations around a boiling cauldron. For stock traders, though, the term represents something far more frightening. To them the "triple witching hour" refers to the four times each year when stock index futures, stock index options, and options on individual stocks expire simultaneously. Typically on triple witching hour days, large blocks of stock change hands as hedgers, arbitrageurs, and speculators seek to maximize returns or minimize losses as they settle the contracts entered into previously.

Analysts have alleged that the triple witching hour is a time of great volatility and wide price swings in the stock market. In mid-1987 the Chicago Mercantile Exchange and the New York Futures Exchange were so moved by the concern over triple witching hour volatility that they changed the rules governing the expiration of index futures and options. Trading in most index futures contracts and some index options now ends one day earlier, with expiration effectively taking place at the open of trading on the expiration day instead of at the close. The impact of triple witching hours and expiration days in general, though, extends far beyond the matter of whether the pattern of stock trading is atypical on certain days of the year. Of interest also is the fact that many of the new features that distinguish modern financial markets from markets of the past are integral to the triple witching hour phenomenon. These new features include futures and options trading, computerized trading, program trading of large blocks of stocks, and index arbitrage. Examination of triple witching hour days offers the opportunity to explore the impact of these innovations.

By looking at triple witching hour days in general, some insight can also be gained into fundamental questions about financial markets. To what extent does the mechanism of exchange—the market itself—affect asset prices? Are stocks rendered riskier merely by the existence of option contracts that are, in effect, "side bets" on stock performance? Why should the popularity of financial instruments that simply reallocate claims on firms' earnings change the inherent risk profile of the market itself?

Information about triple witching hour days can also be used to test widely held views about financial asset prices. For example, the efficient market hypothesis holds that stock prices continuously reflect all available information and that prices change only when new information

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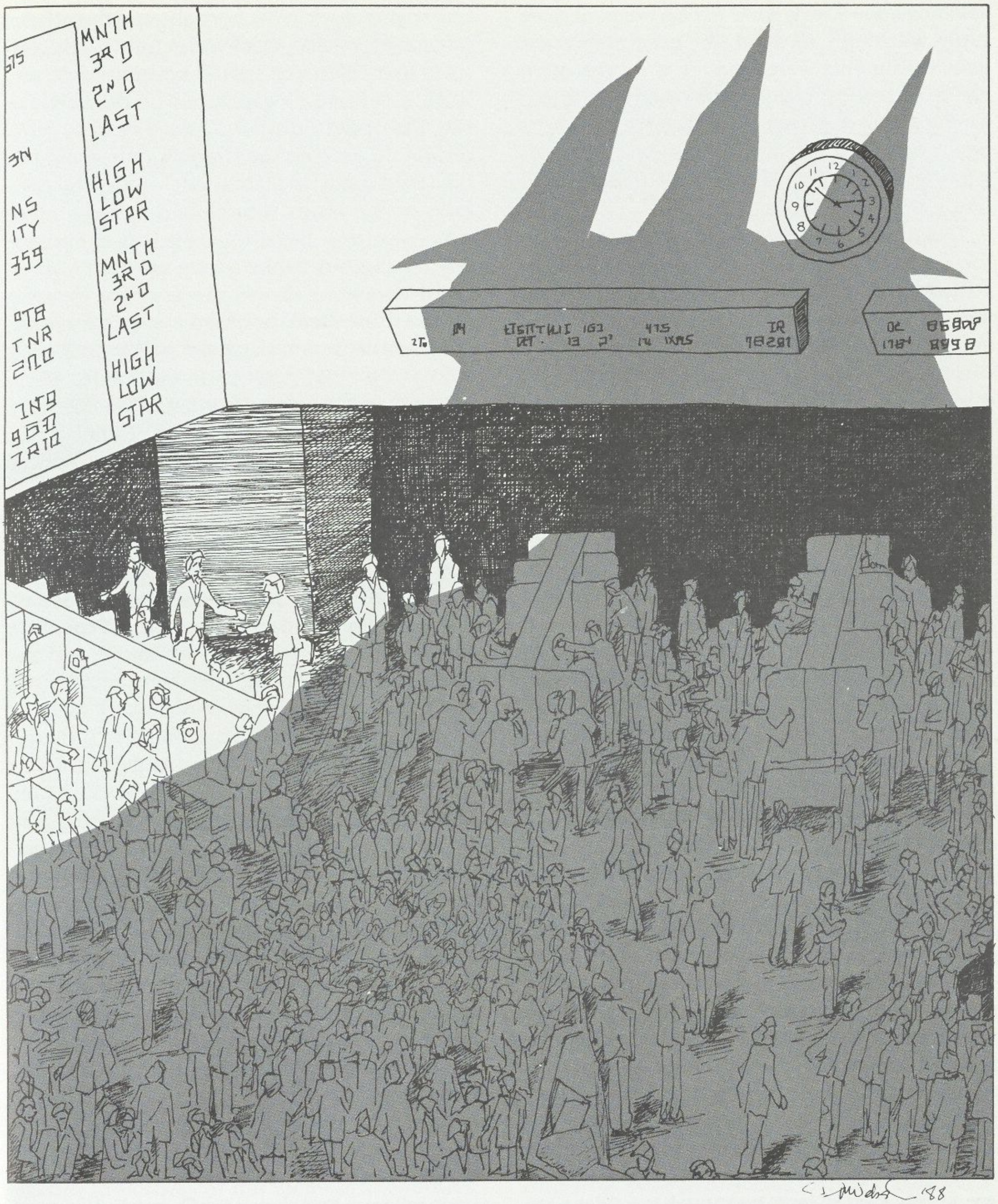


becomes available. Thus, when stock prices swing sharply, analysts must wonder if certain information is driving the movement or whether the mechanism of trade itself is precipitating the price swing.

Yet another branch of theory—option and futures pricing—hinges on the notion that these derivative instruments are "redundant." That is, an investment in options or futures can be perfectly mimicked with investment strategies involving only stocks and bonds. If in fact futures and options are redundant investment vehicles and markets had previously been efficient, the price behavior of stocks should be the same now as before the advent of the new markets. Consequently, price behavior across triple witching hour days should not be unusual since triple witching hours did not exist before the new instruments were created. If, on the other hand, prices do behave differently on triple witching hour days than on other days, either the new assets are not truly redundant, markets previously were not efficient, or markets currently are not efficient.

This article reviews the current research into the triple witching hour phenomenon and investigates whether the market really is more volatile on triple witching hour days. This research also presents preliminary results of the effect of the new settlement procedures on market volatility.

The New Financial Instruments

Stock Index Futures and Index Arbitrage. In order to understand triple witching hour day activity, one should understand the mechanics of stock index futures and options. Stock index futures first traded in 1982. They originated on the same midwestern exchanges that traditionally traded commodity futures and options, and in many ways are similar to their agricultural precursors (see box on page 5).[1] Like a futures contract on coffee or corn, a stock index futures contract will return profits when the price of the underlying asset rises and create losses when the asset price falls.

A stock index futures contract is an instrument that allows an investor to participate in the stock market without ever actually purchasing stocks. Moreover, stock index futures enable investment in large diversified portfolios through a single transaction rather than the numerous transactions that are required to form a diversified stock portfolio. In this way, the investor can save substantially in commission expenses. Although stock index futures are derivative instruments, that is, instruments whose prices are contingent on the values of other assets, the daily transaction volume measured in dollars for stock index futures now exceeds that of actual stocks.[2]

The market for stock index futures created the opportunity for a new type of investment strategy, index arbitrage, which involves exploiting the difference between the value of an underlying stock index portfolio and the price of the corresponding stock index future. Theoretically that difference should never become very large. If, however, a gap opens up between the two, the opportunity for a nearly riskless profit results. To execute the strategy, one would buy the less expensive instrument—either the portfolio or the index future—and sell the more expensive one. If the future is less expensive, one should buy ("take a long position in") the future and sell ("short") the portfolio of actual stocks. If the stock portfolio is less expensive, arbitrage calls for a purchase of the stock portfolio and a short position in the future. (Commissions and the cost of borrowing the necessary funds must also be considered.) Either action ensures a certain profit because the two prices must converge by the time of expiration.

For example, suppose the Standard and Poor's (S&P) 500 index futures price were $300, but the actual Standard and Poor's 500 stock portfolio could be purchased for $250. Seeing this discrepancy, an arbitrageur would calculate whether the gap between the future and the spot prices were enough to cover commissions and the costs of borrowing necessary funds. If indeed the gap were large enough, the arbitrageur could buy the actual stocks and take a short position in the futures. If the price of the actual stocks fell by the expiration date, a loss would be incurred on the actual stock investment, but the profit on the futures investment would more than offset that loss. Suppose, on the other hand, stock prices rose. In that case money would be lost on the short futures position, but even more would be realized from the change in the price of the actual stocks. Again the investor would reap a guaranteed profit. No matter what happens to the price of stocks, the arbitrageur benefits.[3]

Eventually, the arbitrageur must "unwind" his position, that is, sell the stock portfolio and exit the futures contract. In order to retain the arbitrage revenue and clear a profit, unwinding must take place when the two prices are the same or closer together than when the arbitrage strategy was initiated. Convergence may occur before the contract expiration but must certainly occur at expiration—at the witching hour.

Unwinding must be done quickly so that the arbitrageur is not left holding only one risky part of the arbitrage portfolio without the offsetting

A Comparison of Commodity Futures and Stock Index Futures

A commodity future is a contract that obligates an agent either to buy or sell a given quantity of a commodity at a prespecified price on a certain date. For example, taking a "long" position in a coffee futures contract obligates the agent to buy a certain large quantity of coffee (37,500 pounds) when the contract expires. The party taking the "short" position is obligated to sell the commodity. The price is determined via bidding at the time the contract is initiated and is referred to as the *futures price*. Taking a long position in a coffee futures contract is very similar to buying coffee outright, except delivery and payment are postponed until the contract's expiration. Since the contract conveys ownership of coffee, albeit deferred, coffee futures prices should be strongly related to the current price of coffee (also known as the *spot price* or cash price of coffee). Moreover, as the expiration date approaches, owning coffee and "owning" a coffee futures contract become nearly the same thing, and so the spot price of coffee and the coffee futures price converge. At expiration, buying a coffee futures contract is the same as buying actual coffee; the futures price must equal the spot price at that time.

One might think of a stock index futures contract as a contract that obligates an agent either to buy or sell a large portfolio of stocks at a prespecified price upon expiration of the contract. This simplification helps one to understand what determines stock index futures prices and what causes those prices to change. If this simplification were accurate, a stock index future would be just like a coffee futures contract, with the exception that stocks would be bought and sold instead of coffee. In reality, though, stock futures differ from commodity futures in that a stock portfolio is never actually delivered. When the contract expires, the agents exchange money—that is, the contract "cash settles." If the spot price has risen on net during the life of the contract so that the spot price upon expiration is greater than the original futures price, the "short" party pays the "long" party the difference in cash.

For example, suppose you took a long position in a stock index futures contract when the futures price was $100. If, by expiration, the value of the underlying stock portfolio had risen to $120 you would receive cash payments totaling $20—the difference between $100 and $120—over the life of the contract. You would have made money because the stock index value rose above the level the futures price had been when you entered into the futures contract. The cash settlement is not made all at once at expiration, however. Rather, it is made in part at the end of each trading day on the basis of the change that transpired that day in the futures price. On the expiration day you receive or pay only the difference between the futures price from the previous day and the spot price at expiration. Thus, in the example in which the original futures price was $100 and the expiration spot price was $120, the long party would receive payments each day as the futures price rose and perhaps have to make payments to the short party on those days when the futures price fell. Over the life of the contract, though, the net transfer would total $20 paid by the short party to the long party.

half. To accomplish the speedy dispensing of their stock holdings, arbitrageurs often employ the Designated Order Turnaround system of the New York Stock Exchange, a computerized stock order routing system. Alternatively, arbitrageurs may place orders with exchange specialists to execute the orders at the moment the futures contract expires. In either case, index arbitrage requires large volumes of stock to be bought and sold quickly, with many of these transactions occurring on triple witching hour days.

Stock Options. If the unwinding of index arbitrage positions were the only unusual activity taking place on certain days, those days might be called witching hour days, not *triple* witching hour days. Yet stock options and stock index options expire on those days as well, which may generate additional volume. The owner of a stock option has the right, but not the obligation, to buy or sell a certain stock by a specified time and at a particular price. (See box on page 6 for a brief explanation of options.) The following possible scenario illustrates how option expirations can lead to increased stock trading activity.

A call option owner (someone who has bought the right to purchase a certain stock) exercises the option and demands that the option "writer" (the party who sold the option) sell a share of stock. The writer first buys the stock at the stock exchange and then, to fulfill the contractual agreement, sells it to the option owner at the

Options Demystified

An option is a contract that affords the buyer the right, but not the obligation, to buy or sell an asset for a prespecified price on or before some selected date. The prespecified price, which is written into the option contract, is called the *strike price* or *exercise price.* The selected date is the *expiration date,* the last date on which the option owner can choose to buy or sell the underlying asset. The option owner can choose not to exercise the option and thus forfeit the right to buy or sell the underlying asset. In that case the option expires unexercised.

The two types of options are call options and put options. *Call options* confer the right to buy assets; *put options* confer the right to sell. One can think of a call option as a deposit. Suppose a college fraternity is planning a party for the next homecoming. To assure an ample supply of root beer for its party, the fraternity members may wish to place a deposit at the local grocery store reserving the right to buy a crate of root beer for a given price on the day of the party. Here, the fraternity is buying an option, and the grocery store is writing the option. The underlying asset is the crate of root beer, and the cash amount to be paid upon delivery of the root beer is the strike price. The amount of money paid in advance to the grocery store is the option price. Should the fraternity members decide they do not want the root beer, they may wish to surrender the deposit, not buy the root beer, and let the option expire unexercised.

Suppose on the other hand that the price of root beer increases dramatically before the day of the party. Maybe an explosion disables the local bottling plant or a root beer tasters' convention is scheduled for the same day as the party. The agreement with the grocery store would thus become more valuable. The grocery store is bound to sell the root beer to the fraternity for the previously agreed-upon price even though the spot price of root beer has risen in the interim. The fraternity members may exercise the option, buy the root beer at the strike price, and thus enjoy their assets at a bargain price. Alternatively, they may choose to exercise the option, buy the root beer at the strike price, then sell the root beer on the open market for the new higher spot price and retain the profit.

Stock call options are very much like the root beer deposit in this example. The call option buyer has the right but not the obligation to buy a certain stock for the strike price before or on the expiration date. If the market price of the underlying stock rises above the strike price, the option owner can exercise the option, buying the stock for the strike price, and then sell the stock for the higher current market price. The seller of the option must have the necessary shares of stocks to sell to the option buyer. If he does not, he must first buy those shares.

strike price. The option owner then resells the stock to capture profit from the difference between the price stated in the option contract and the current market price. The option's expiration date is the deadline for these maneuvers. Consequently, the existence of stock call options may generate increased trading activity on those days.

A scenario involving stock put options may yield similar activity. The owner of a put option has the right to sell shares of stock at a previously agreed-upon price. If the stock price falls below the strike price, exercise of the option is profitable. If the put owner wishes to exercise the option on an expiration day but does not already own the necessary shares of stock, he must first buy the shares at the market price. He then can sell them for the higher strike price to the party that sold the put and pocket the profit. The put writer might then wish to close out his position and sell the newly acquired stock. Again, one earlier option transaction might, upon expiration, generate three separate stock transactions.

Options on individual stocks have been traded on U.S. exchanges since 1973. Stock options may follow different quarterly schedules, but in general they expire on the third Friday of the month. Four times a year this day coincides with the expiration of index futures and index options.

Stock Index Options. The third aspect of the triple witching hour involves the expiration of stock index options. Since their introduction in 1983, stock index options have made it possible to buy or sell options on entire stock indexes in addition to options on individual stocks. Stock index put options have proved attractive to hedgers who own large portfolios that are likely to rise and fall in value in concert with the market as a whole. By purchasing a stock index put option, investors can protect against losses caused by a market-wide decline.[4] Index options are also popular among speculators who wish to profit from the vicissitudes of the stock market as a whole. By investing in stock index options rather than individual stock options, speculators and hedgers need not be concerned with the idiosyncratic risks associated with individual stocks since the value of a stock index option is based on the value of a large, diversified portfolio.

Unlike options on individual stocks, stock index options settle in cash. No stocks change hands when stock index options are exercised. The exercising party simply receives a cash payment from the option writer equal to the difference between the strike price and the current market value of the underlying index. Although exercisers of index options need not actually sell or buy stocks, such exercise might provoke the option writer, instead, to execute a stock transaction. An option writer is responsible for the difference between the current stock index value and the option strike price. If the stock market has gained or lost much value since the writing of the option, payment by the option writer can be substantial.

Call option writers often hold the underlying stocks in their portfolios so that, should the option be exercised, they can sell the stocks on the exchange in order to raise the funds needed to pay the call option owner.[5] At expiration one can expect any in-the-money options (options for which immediate exercise is profitable) to be exercised, sending some option writers scrambling to cover their positions, thereby promoting heavy stock trading on expiration days.

Stock Volatility Effect

The previous section of this article reviewed how stock index futures, stock options, and stock index options might bring about frenetic equity trading on days when each of these instruments expires. This increased trading activity could in turn exacerbate price volatility. A temporary mismatch between buy and sell orders will either send the price up or down as the price equilibrates supply and demand pressures. Only a small price change is necessary to close a slight gap between buy and sell orders, but a large price change may be necessary when the gap is wide. When trade orders suddenly flood the exchange, large gaps are more likely, and thus large price swings are more likely to occur. On triple witching hour days the full expiration effects of stock options, stock index options, and stock index futures bear on the markets at the same time. This simultaneity provides one reason to expect higher volatility on those days. Of course, even if triple witching hour days are more volatile than other days, other reasons for the phenomenon could exist.

Reviewing the Evidence. Notwithstanding the theoretical reasons for triple witching hour day volatility and the belief by market participants and business journalists that this volatility exists, the phenomenon is ultimately an empirical question and one that warrants close scrutiny of the facts. Several academic studies have addressed the volatility of the triple witching hour days. Some researchers have investigated component parts of the triple witching hour phenomenon, such as the effects of large transactions on prices, while others have probed the impact that the stock index futures market has had on underlying stock price movements.[6]

Among the recent research directly investigating triple witching hour days, the paper by Hans Stoll and Robert E. Whaley (1986a) is the most comprehensive. They looked for evidence of unusual volume and price effects on and around expiration days. Testing the period from May 1982 through December 1985, the researchers failed to find that stock index future expiration days exhibited higher volatility than nonexpiration days.[7] They did conclude, however, that from July 1983 through December 1985, the last hour of trading on triple witching hour days was a frenetic one, exhibiting far greater volume and volatility than the last hour of trading on nonexpiration days.

Stoll and Whaley's results were corroborated in a study by Franklin R. Edwards (1988). Edwards compared hour-by-hour price fluctuations on triple witching hour days with hour-by-hour fluctuations from nonexpiration days during the period from July 1983 through October 1986. Edwards too found that price volatility was significantly greater in the last hour of triple witching days than on ordinary days.

Stoll and Whaley, as well as Edwards, arrived at their conclusions based on the statistical procedure known as an *F-test*, which compares stock prices in one sample with those from another sample. Based on assumptions of certain properties regarding the distribution of stock returns in both samples, the test determines the likelihood that stock prices were equally volatile in the two samples. One troubling feature of the F-test, however, is that it assumes that stock returns are normally distributed; that is, when plotted on a graph, the distribution would resemble a bell curve. However, an abundance of evidence shows that stock returns are not normally distributed but instead are characterized by sporadic extreme observations, either occasional huge losses or huge gains.[8] The recent stock market crash of October 1987 is a graphic reminder that the distribution of stock returns does not conform to a normal distribution. Consequently, the F-test, whose results are easily distorted by extreme occurrences, is not reliable for drawing inferences about underlying stock return distributions and thus for identifying trends that are likely to persist in the future.[9]

Market Volatility and the Triple Witching Hour: A New Perspective

The primary objective of the research presented in this article is to determine if the triple witching hour days in the period before 1987 were, in fact, characterized by unusually high volatility. Unlike past research, this effort uses a statistical procedure that does not require the assumption of normally distributed stock returns. Furthermore, the research presented here benefited from several more triple witching hour days than were available for earlier studies.

This article also includes an examination of the first five triple witching hour days since the 1987 rule change. A study of this data can help determine whether the new expiration procedures succeeded in reducing triple witching hour day volatility.

The tests used are distribution-free statistical tests, that is, they do not rely on the assumption of normally distributed stock returns. The test works as follows: if triple witching hour days are not unusual with regard to volatility, then any given triple witching hour day will just as likely fall in the top half as in the lower half of all days ranked according to volatility. This implication of the hypothesis is tested by ranking all days in the sample by volatility and simply counting how many triple witching hour days ranked in the top 50 percent and how many ranked in the bottom 50 percent. From the results of this tabulation, one can determine whether the hypothesis about equal volatility and the triple witching hour effect is reasonable.

The Data. This research examines the daily returns of the S&P 500 index from January 1983 through June 1988, the period over which stock index futures and index options have been traded. The returns are calculated as daily percent changes in closing prices. The volatility measure used was the absolute value of the daily stock return, which reflects the magnitude of each day's price swing.[10]

"If triple witching hour days are not unusual with regard to volatility, then any given triple witching hour day will just as likely fall in the top half as in the lower half of all days ranked according to volatility."

Prior to June 1984, stock index futures and stock index options expired on the third Thursday of the final month of the quarter. Consequently, the first five expiration days in the sample used here are Thursdays. Since that time all triple witching hour days have been the third Friday of the final month of the quarter.

Before June 1987, the close of trading on the expiration day marked the end of trading in and expiration of stock index futures and stock index options. Since then, with the change in rules, trading in most index futures contracts and some index options ends on the Thursday before the third Friday, but settlement and expiration take place on the next day.[11] The settlement price for the index futures and options is a composite of the opening prices of the individual stocks in the index. In effect, the contracts governed by the new rule now expire at the opening of trading on Friday rather than at the close.

According to the Chicago Mercantile Exchange, the rationale for changing the expiration of stock index futures and options on stock index futures from the close of trading on Friday to the open was as follows: whereas arbitrageurs would previously unwind positions using market-on-close orders—to time their stock transactions exactly with the expiration of the futures or options—now they must place market-on-open orders. Although a specialist cannot delay the close of trading, he may delay the opening of trading in a particular stock if he observes a large imbalance between buy and sell market-on-open orders. With this extra time he can find parties willing to absorb some of the surplus orders. Thus, large price swings might no longer be necessary to equilibrate temporary surges in supply or demand.

"The two tests run on the 1983-87 data set clearly rejected the hypothesis that expiration days were equally likely to have above- as below-median price swings."

Also, because trading in options and futures now stops on the Thursday prior to expiration, some market participants may choose to unwind their positions on a day when they can still buy and sell futures or options. Therefore, the new expiration rules might have the effect of spreading both volume and volatility over two days, whereas they used to be concentrated on one.

Design of the Tests. This study tests first for higher-than-usual volatility of the S&P 500 on the expiration days between January 1983 and May 1987. The test is based on a comparison of the price swings on those days with the median price swing from all other days in the January 1983 to May 1987 sample.[12] Most of the expiration days in this sample, however, occurred on Fridays, and, as documented in Kenneth R. French's (1980) research, the day of the week bears on stock price behavior. Therefore, these expiration days were then compared specifically to the other Fridays in the sample. These two tests yield similar results.

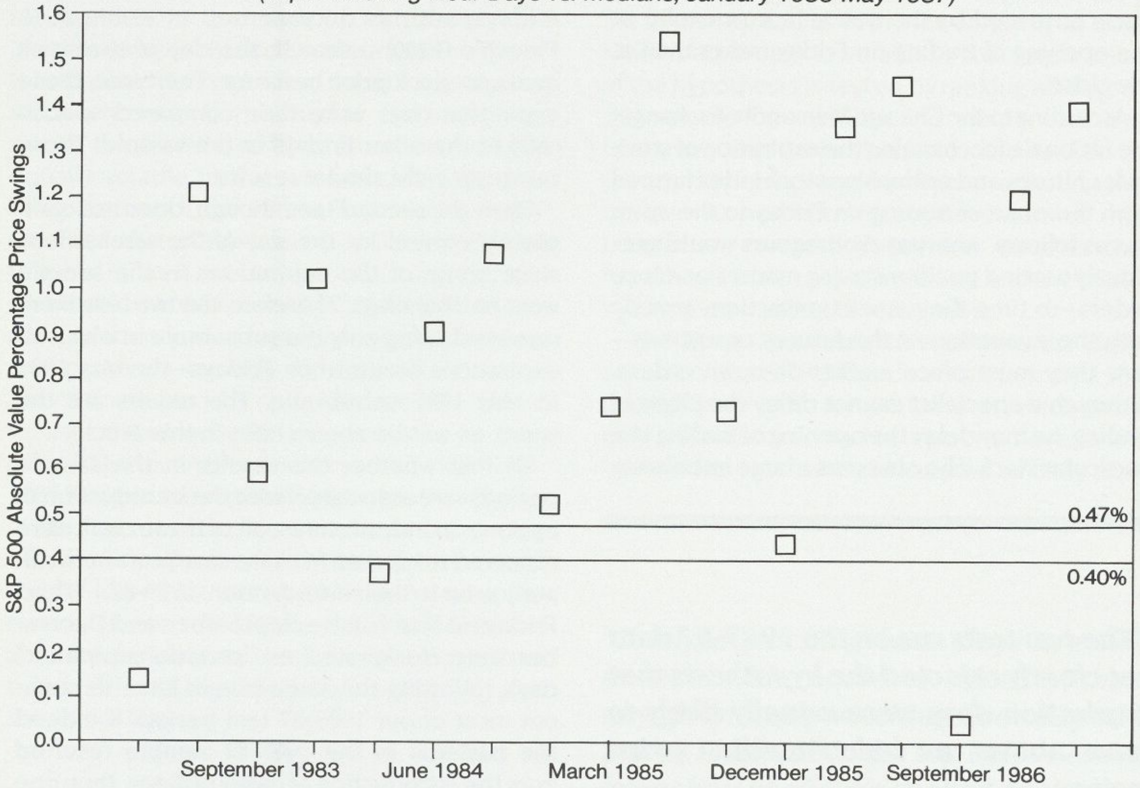
Even the second test, though, does not completely control for the day-of-the-week effect, since some of the expirations in the sample were on Thursdays. Therefore, the two tests were repeated using only the subsample in which all expirations occurred on Fridays—the May 1984 to May 1987 subsample. The results are the same, as will be shown later in this article.

To test whether the results in the sample period were associated with the introduction of options on index futures, all of these tests were repeated using data from the four years immediately prior to their introduction, 1979-82.[13] Third Fridays in March, June, September, and December were designated as "pseudo-expiration" days, following the same rule in force throughout most of our 1983-87 test period. If indeed the patterns in the 1983-87 sample resulted from the introduction of index options, then one would expect to find no similar pattern in the 1979-82 period.

In the period since the 1987 rule change, the triple witching hour is in effect spread out over two days, a Thursday and the following Friday. If a volatility effect is present, it may be on one day or the other, or perhaps spread out over the two days. Consequently, for this recent sample, expiration Fridays were compared to all other Fridays, expiration Thursdays were compared to all other Thursdays, and the two-day price swings that transpired over expiration Thursday-Friday clusters were compared to those price swings that transpired over all other Thursday-Friday clusters.

Results. The two tests run on the 1983-87 data set clearly rejected the hypothesis that expiration days were equally likely to have above- as below-median price swings. These results are presented in Table 1. Chart 1 shows the price swings for each of the 17 expiration days during those years; the median price swing for all other days and the median price swing for all other Fridays are represented by the top and bottom

Chart 1.
S&P 500 Daily Percentage Price Swings
(Triple Witching Hour Days vs. Medians, January 1983-May 1987)



The horizontal lines represent median price swings for the period January 1983-May 1987. The top line shows the median for all days during this period; the bottom line shows the median for Fridays. A box above the median represents a greater-than-usual price swing for that triple witching hour day. A box below the median indicates a lower-than-usual price swing for that day. A box between the medians for the different samples represents a lower-than-usual price swing relative to all days in the sample but a greater-than-usual price swing for Fridays during the sample period. Thus, this chart shows that on triple witching hour days between March 1983 and March 1987, price swings in the S&P 500 index were typically greater than on Fridays and on all days in general.

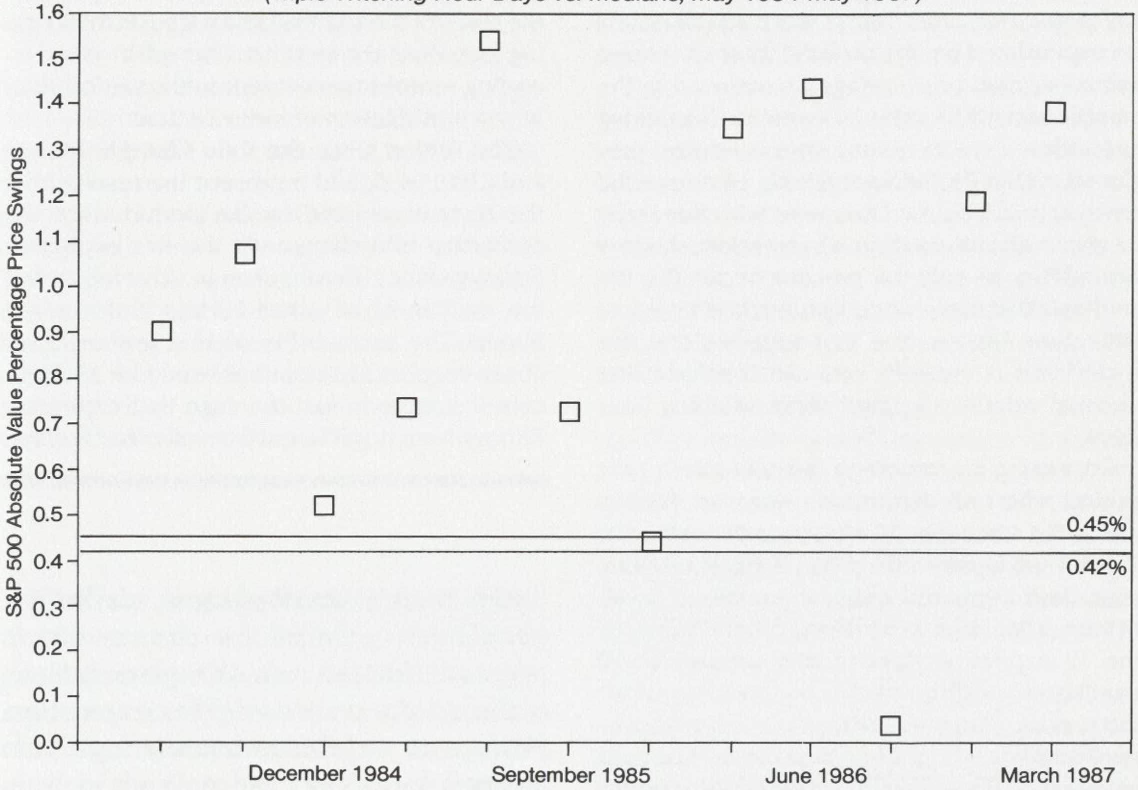
Table 1.
Test of S&P 500 Index Volatility on Triple Witching Hour Days
(January 1983-May 1987)

Test	Sample Size	Below-Median Price Swings	Above-Median Price Swings	Probability* (Percent)
Expiration days vs. all other days	17	4	13	2.5
Expiration days vs. nonexpiration Fridays	17	3	14	0.6

**Probability of the occurrence of at least the indicated number of above-median price swings under the assumption that expiration days are as likely to exhibit above- as below-median price swings.*

Source: Figures in all tables and charts were calculated at the Federal Reserve Bank of Atlanta from data obtained from Data Resources, Inc., Lexington, Mass.

Chart 2.
S&P 500 Daily Percentage Price Swings
(Triple Witching Hour Days vs. Medians, May 1984-May 1987)



The horizontal lines represent median price swings for the period May 1984-May 1987. The top line shows the median for all days during this period; the bottom line shows the median for Fridays. This chart demonstrates that even after controlling for a "day-of- the-week" effect, the daily percentage price swings on triple witching hour days were greater than usual for other days in the period May 1984-May 1987.

Table 2.
Test of S&P 500 Index Volatility on Triple Witching Hour Days
(May 1984-May 1987)

Test	Sample Size	Below-Median Price Swings	Above-Median Price Swings	Probability* (Percent)
Expiration days vs. all other days	12	2	10	1.9
Expiration days vs. nonexpiration Fridays	12	1	11	0.3

**Probability of the occurrence of at least the indicated number of above-median price swings under the assumption that expiration days are as likely to exhibit above- as below-median price swings.*

horizontal lines, respectively. Thirteen of the 17 expiration days had price swings above the median of all other days. If above-median and below-median price swings were equally likely on expiration days, the probability of 13 or more above-median price swings, as occurred in the sample, would be only 2.5 percent. Comparing expiration days to nonexpiration Fridays produced a slightly stronger result, 14 above the median and 3 below. Outcomes with this many or more above-median observations have a probability of only 0.6 percent under the hypothesis that triple witching hour days were just like other Fridays. The test suggests that the hypothesis is unlikely; one can conclude that unusual volatility typified triple witching hour days.

Restricting the sample to the post-March 1984 period when all expirations were on Fridays yields the same results, which are presented in Table 2 and illustrated in Chart 2. Triple witching hour days appeared unusual compared to all other trading days, as well as to other Fridays. Of the 12 expiration days in this subperiod, 10 exhibited volatility above the median of all other days. Outcomes with 10 or more above-median price swings out of a possible 12 would have just a 1.9 percent chance of occurring under the hypothesis of no unusual volatility on triple witching hour days. The second test produced an even stronger result: 11 of the 12 days fell above the median for other Fridays. The probability of this result occurring under the hypothesis of no unusual volatility on triple witching hour days is only 0.3 percent. One can thus conclude that triple witching hour days were more volatile than ordinary Fridays and more volatile compared to all other trading days as well.

These results showed a marked contrast to similar tests run on the 1979-82 data. "Pseudo-triple witching hour" days were created for this presample by examining the third Friday of the final month of the quarter. If something were unusual about these days of the year, apart from being triple witching hour days after 1982, similar patterns of volatility would also be expected in this earlier period. As shown in Table 3 and Chart 3, these expectations were not fulfilled. Exactly half of the pseudo-triple witching hour days, eight of the sixteen, fell above the median of all other days' volatility, and, similarly, eight fell above the median of other Fridays. This result is likely when nothing is unusual about the 16 pseudo-triple witching hour days. Thus, the study of the 1979-82 data suggests that nothing peculiar about third Fridays in quarter-ending months was evident in the period prior to the introduction of index options.

The Period since the Rule Change. Table 4 and Charts 4, 5, and 6 present the results from the tests conducted on the period since the expiration rule change. Of the five expiration Fridays since the rule change, four fell *below* the median of all other Fridays and one fell above. The probability of this few or fewer above-median observations would be 18.8 percent if it were in fact the case that expiration Fridays were no different from all other Fridays.

"With such a small sample, definitive conclusions cannot be drawn, but it appears that the rule change may have reduced the propensity for expiration Fridays to exhibit unusually high volatility."

With such a small sample, definitive conclusions cannot be drawn, but it appears that the rule change may have reduced the propensity for expiration Fridays to exhibit unusually high volatility. Prior to the rule change, ten Fridays fell above the median and only two below, whereas since the rule change only one has fallen above the median and four have fallen below.

The purpose of examining Thursdays and Thursday-Friday clusters is to test the possibility that the rule change simply shifted volatility to the Thursday preceding expiration or perhaps spread the excess volatility across two days. The test of Thursday volatility, however, could not confirm or reject this possibility. Of the five Thursdays preceding expiration Fridays, three fell above the median for all other Thursdays, and two fell below. No conclusions can be drawn from this result, and more observations are needed in order to determine whether these Thursdays are now more or less volatile than ordinary Thursdays.

On the other hand, the test of Thursday-Friday clusters does provide evidence against the notion that the excessive volatility is still generated by the expirations but is now simply spread out over two days. All five of the expiration Thursday-Friday cluster two-day price swings fell below the median of all other Thursday-Friday clusters, which indicates that expiration Thursday-Friday clusters are not likely to display higher-than-usual volatility; if anything, they are likely to display lower-than-usual volatility. Again, though, one must exercise caution when interpreting these results.

"[T]raders may have practiced extra caution and restraint in this early period under the new rule while waiting to see its effects. Also, curbs placed on computerized trading in the aftermath of the October 1987 stock market crash could have contributed to the apparent reduction in volatility. . . ."

The sample size of five observations is small, and a different pattern quite possibly will emerge with time. Moreover, traders may have practiced extra caution and restraint in this early period under the new rule while waiting to see its effects. Also, curbs placed on computerized trading in the aftermath of the October 1987 stock market crash could have contributed to the apparent reduction in volatility on triple witching hour days.

Conclusion

This study of the volatility on triple witching hour days finds that before the rule change, volatility on those days was likely to be greater than the volatility of ordinary trading days. In other words, the change in stock market prices over the course of a triple witching hour day was likely to be greater than the price changes experienced over most ordinary days.

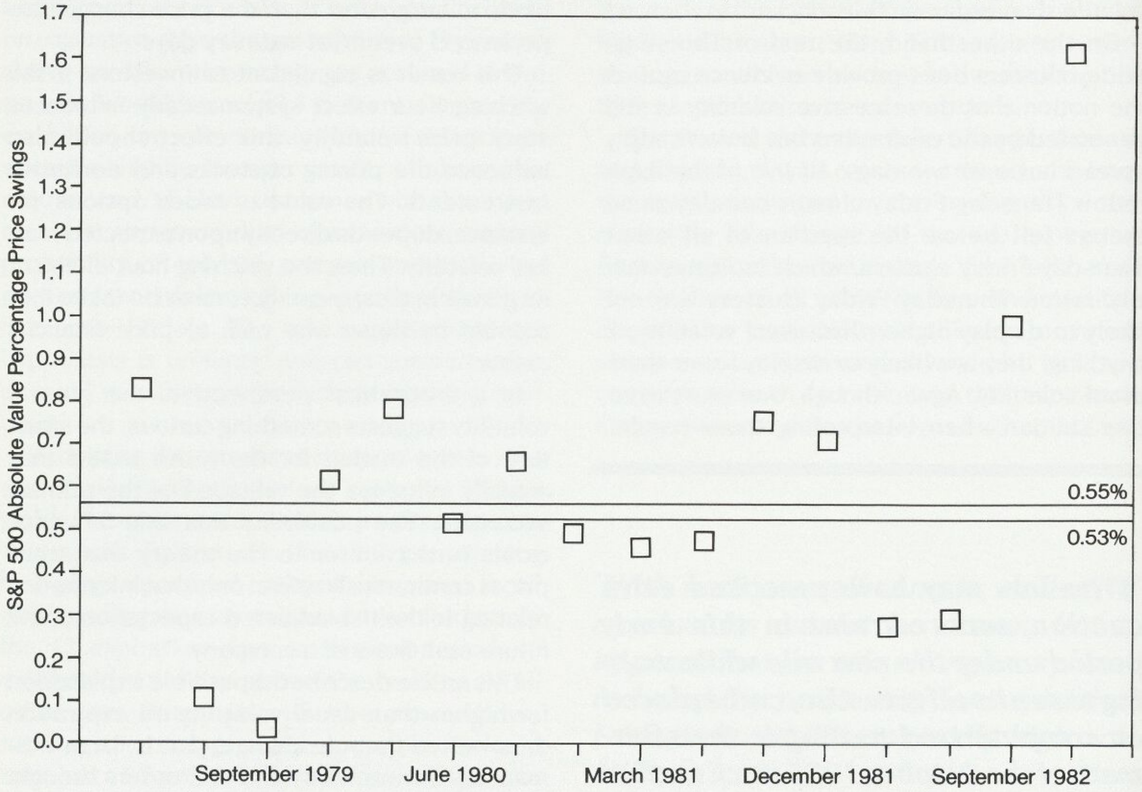
This result is significant to investors. If the witching hour effect systematically influences stock price volatility, this effect should also influence the pricing of stocks and derivative instruments. The value of index options, for instance, depends directly upon expected market volatility. Thus, the witching hour effect, or its possible disappearance, must be taken into account by those who wish to price financial assets.

In a theoretical perspective, the greater volatility suggests something curious: the structure of the market for derivative assets may actually influence the valuation of the primary securities. The possibility that this influence exists runs counter to the theory that stock prices continuously reflect only that information relating to the risk-adjusted expectation of the future cash flows of a company.

This article described a possible explanation for higher-than-usual volatility on expiration days before the rule change, that is, large mismatches between buy and sell orders brought on by the flood of orders submitted by agents covering or settling positions. Another possibility is that with higher volume on expiration days, more new information was brought to the market—information that could have pushed prices one way or the other. Yet, these explanations are only possibilities. Though this research sheds little light on the true cause of the volatility, the study does clarify just what the empirical effect of the triple witching hour was before the rule change.

Finally, the early evidence suggests that since the rule change, expiration Fridays are no longer likely to exhibit higher-than-usual volatility, and expiration Thursday-Friday clusters are likely to exhibit less volatility than other Thursday-Friday clusters. Nonetheless, because of the limited amount of information available since the rule change and other potentially influential events during this period, this result is tentative; the newly emerging evidence could still contradict this result. For now observers must wait to see whether the triple witching effect is still a reality or a thing of the past.

Chart 3.
S&P 500 Daily Percentage Price Swings
(Pseudo-expiration Days vs. Medians, January 1979-December 1982)



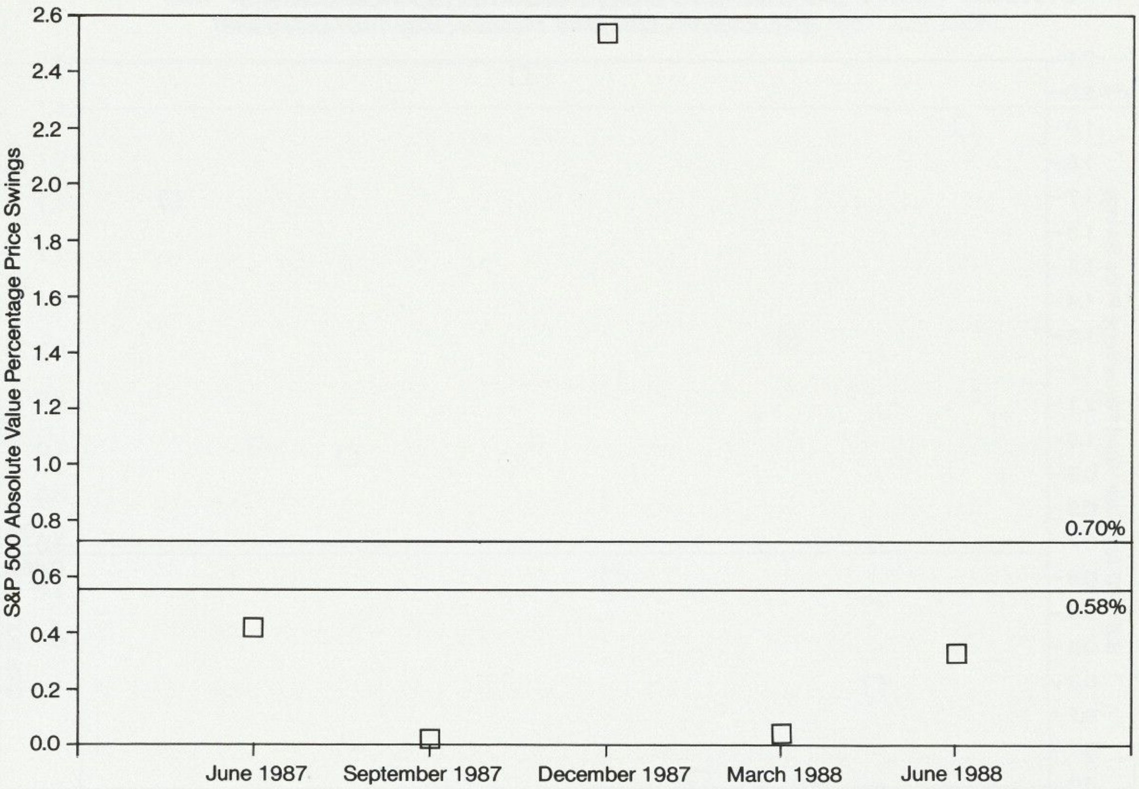
The horizontal lines represent median price swings for the period January 1979-December 1982. The top line shows the median for all days during this period; the bottom line shows the median for all Fridays. Since the boxes representing triple witching hour day price swings are distributed fairly evenly above and below the lines, this chart indicates that before the introduction of options on index futures, pseudo-expiration days were not likely to be more volatile than typical days.

Table 3.
Test of S&P 500 Index Volatility on Pseudo-expiration Days
(January 1979-December 1982)

Test	Sample Size	Below-Median Price Swings	Above-Median Price Swings	Probability* (Percent)
Pseudo-expiration days vs. all other days	16	8	8	59.8
Pseudo-expiration days vs. other Fridays	16	8	8	59.8

**Probability of the occurrence of at least the indicated number of above-median price swings under the assumption that expiration days are equally likely to exhibit above- as below-median price swings.*

Chart 4.
S&P 500 Daily Percentage Price Swings
(Expiration Fridays vs. Medians, May 1987-July 1988)



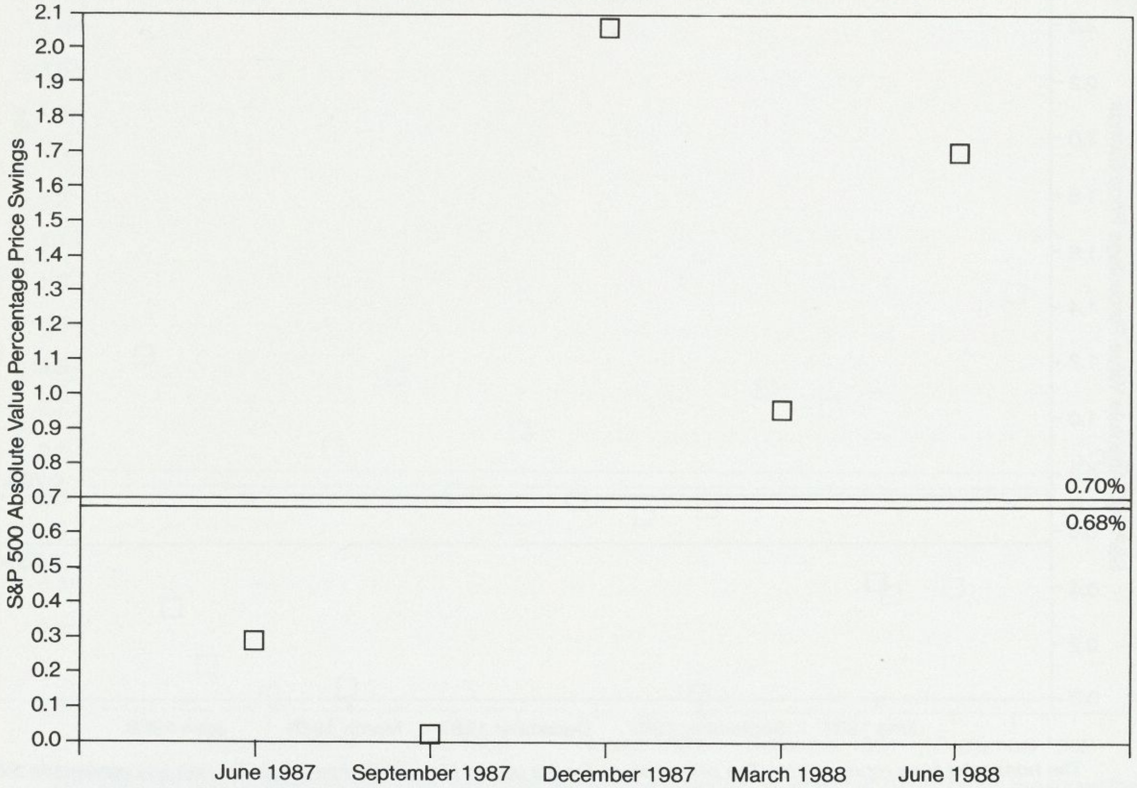
The horizontal lines represent median price swings for the period May 1987-July 1988. The top line represents the median for all days during this period; the bottom line represents the median for Fridays. This chart shows that since the rule change which moved the end of trading on most index futures contracts and some index options to one day earlier, the propensity for expiration Fridays to exhibit greater-than-usual price swings may have been reduced.

Table 4.
Test of S&P 500 Index Volatility on Expiration Days since the 1987 Rule Change

Test	Sample Size	Below-Median Price Swings	Above-Median Price Swings	Probability* (Percent)
Expiration Fridays vs. all other Fridays	5	4	1	18.7
Expiration Thursdays vs. all other Thursdays	5	2	3	50.0
Expiration Thursday-Friday clusters vs. all other Thursday-Friday clusters	5	5	0	3.1

**Probabilities listed for the first and third tests are the probability of the occurrence of at least the indicated number of below-median price swings under the assumption that expiration days are as likely to exhibit above- as below-median price swings. The probability listed for the second test is the probability of the occurrence of at least the indicated number of above-median price swings under the assumption that expiration days are as likely to exhibit above- as below-median price swings.*

Chart 5.
S&P 500 Daily Percentage Price Swings
(Expiration Thursdays vs. Medians, May 1987-July 1988)



The horizontal lines represent median percentage price swings for the period May 1987-July 1988, after the rule change. The top line represents the median for all days during this period; the bottom line represents the median for all Thursdays. Since the boxes in this chart show no distinct pattern, and since the sample on which the chart is based is such a small one, these results are not conclusive regarding price swings on expiration Thursdays since the rule change.

Chart 6.
S&P 500 Percentage Price Swings over Thursday-Friday Clusters
(Expiration Thursday-Friday Clusters vs. Medians, May 1987-July 1988)

The horizontal line represents the median price swing for Thursday-Friday clusters during the May 1987-July 1988 period. Since all the boxes fall below the line indicating typical price swings for Thursday-Friday clusters, the results of this test appear to indicate that expiration Thursday-Friday clusters are not likely to display greater-than-usual price swings. If anything, they are likely to exhibit lower-than-usual price swings. The sample to this date is small, though, and another pattern may emerge over time.

Notes

[1]The U.S. Commodity Futures Trading Commission (CFTC), which oversees agricultural commodity trading, also oversees trading in stock index futures and options on stock index futures.

[2]Galberson (1987).

[3]Stock index arbitrage is not practical for the small or even moderately sized investor. Execution of the strategy with the S&P 500 stocks requires a $25 million position in stocks (Stoll and Whaley, 1986b).

[4]Suppose a pension fund includes a stock portfolio similar in composition to the S&P 500, and the fund manager must ensure that the fund maintains a value above a certain level, $10,000 for example. One way to achieve this security is through the purchase of S&P 500 put options with combined strike prices totaling $10,000. Should the value of the stock portfolio fall below $10,000, the puts can be exercised, earning for the fund a cash payment equal to the shortfall between the current market value of the stocks and the $10,000.

[5]A position in a stock index future can serve the same purpose.

[6]See, for example, Kraus and Stoll (1972); Kawaller, Koch, and Koch (1988); Edwards (1988); Finnerty and Park (1987); or U.S. Congress (1985).

[7]Their sample of nonexpiration days included only Thursdays from the years when stock index futures expired on Thursdays, and Fridays from the years when expirations were on Fridays. In this way, they controlled for possible day-of-the-week effects.

[8]See Fama (1965), Mandelbrot (1963), and Blattberg (1974).

[9]The F-test is still a useful device, however, primarily for summarizing comparisons of stock return volatilities from different samples.

[10]In a nonparametric test like the one employed in this study, using absolute values of returns gives the same result as squared returns. Note also that the expectation of the squared return equals the stock return variance, should that variance exist.

[11]The instruments that are now governed by the new procedures are S&P 500 futures, options on S&P 500 futures, some S&P 500 index options, New York Stock Exchange (NYSE) Composite Index futures, and options on NYSE Composite Index futures. The old rules still govern some S&P 500 index options, S&P 100 index options, Major Market Index futures and options, and Value Line Index futures and options.

[12]May 5, 1987, was chosen as the terminal date for the pre-rule change period since it is halfway between the expiration of the March 1987 contract, the last to expire under the old rules, and the June 1987 contract, the first to expire under the new rules.

[13]A four-year sample is roughly the same size as the previously described test samples.

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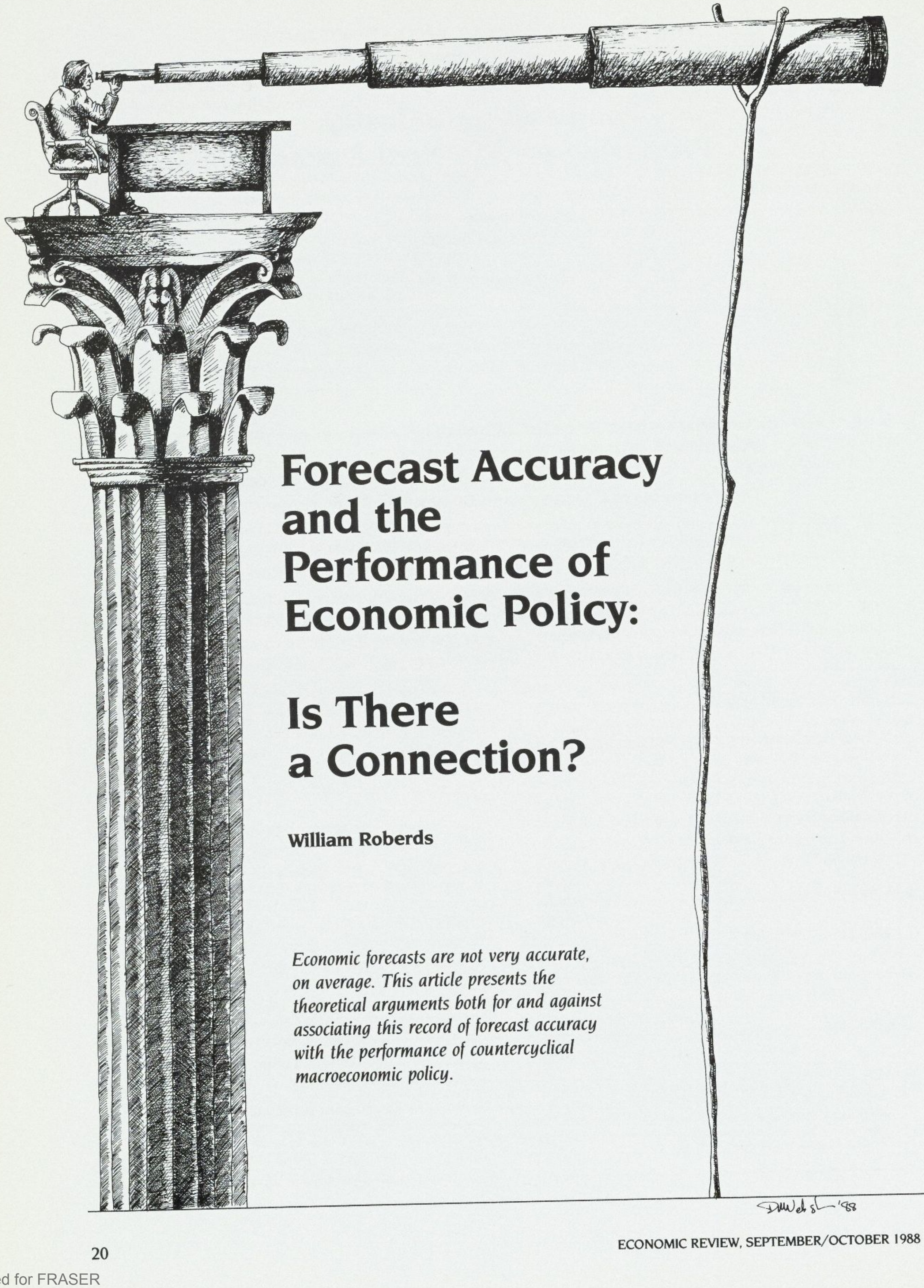

Forecast Accuracy and the Performance of Economic Policy: Is There a Connection?

William Roberds

Economic forecasts are not very accurate, on average. This article presents the theoretical arguments both for and against associating this record of forecast accuracy with the performance of countercyclical macroeconomic policy.

To suggest that economic forecasts are inaccurate is, for many people, to belabor the obvious. Moreover, the reputation of economic forecasters fares no better in the eyes of their peers than in the court of public opinion. For example, in a recent survey article Victor Zarnowitz (1986) finds that the overall accuracy of economic forecasting in the United States has not improved since the 1950s, despite a tremendous increase in the volume of economic research and a steep drop in the cost of electronic computation. On a similar note, Allan H. Meltzer (1987a) concludes that "on average, forecast errors for output growth [that is, growth in the real gross national product of the United States] are so large . . . that it is generally not possible to distinguish consistently between a boom and a recession either in the current quarter or a year in advance."

While the mediocre record of economic forecasts is apparent, effective remedies to improve forecasting remain elusive. (For a related discussion, see the article in this issue by Rogers, "Improving Monthly Models for Economic Indicators," p. 34.) Though calculations by Bryan W. Brown and Shlomo Maital (1981) support the idea that economists' forecasts are unbiased—that is, correct on average—these researchers suggest that forecasts may be inefficient in the strict mathematical sense: they may not make the best use of all available information. Unfortunately, the methods used by Brown and Maital to measure forecast efficiency do not demonstrate how forecasters can better utilize the information available to them.

On a less abstract level, surveys by S.K. McNees (1986), Zarnowitz, and others reveal that forecasters using widely disparate forecasting methodologies enjoy roughly the same level of forecast accuracy. These surveys also present evidence that the forecasting techniques used by professional forecasters are generally more accurate than simple extrapolative methods. Such findings imply that no obvious way is available to improve the accuracy of economic forecasts. In addition, the accuracy of these forecasts is unlikely to improve in the near future.

This conclusion is hardly a comforting one for policymakers who use economic forecasts in their decision making. The uncertainty of economic forecasts raises the possibility that if policy decisions are based on projections of the future state of the economy, inappropriate or counterproductive policy decisions will be undertaken. Monetarists such as Milton Friedman have long argued that precisely this situation has prevailed in the Federal Reserve System's conduct of monetary policy.[1] Recently Meltzer (1987a, b), another monetarist, has taken Friedman's argument one step further by suggesting that a policy of stabilization based on inaccurate forecasts *contributes* to the overall uncertainty in the economy. According to this view, the uncertainty associated with economic forecasts does not result from any lack of skill on the part of economic forecasters. Rather, as will be explored later in this article, the policy process itself causes such uncertainty to be self-perpetuating.

Are the monetarists correct in attributing the poor performance of economic forecasts to policy decisions? Are economic forecasts of any value in formulating economic policy? As will be seen in this article, these questions represent two sides of the same issue—that is, how much weight should policymakers give to current economic conditions in making their decisions? This issue cannot likely be addressed using purely empirical methods, since economists cannot run controlled experiments on the economy to measure the effect of different policies. Another way to analyze the issue is to consider, as this article does, the various theoretical arguments both for and against associating forecast accuracy with the performance of countercyclical policy. This article explores (1) why traditional macroeconomic theories would reject such a linkage; (2) how the rational expectations models of the 1970s would support the existence of precisely such a linkage, even though it might be difficult to detect empirically; and (3) how some of the more recent work with rational expectations models might qualify the conclusions reached by many researchers in the 1970s.

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The Traditional View of the Relationship between Policy Performance and Forecast Accuracy

Mainstream economic theory in the 1950s and 1960s provided a natural role for policy in economic systems. While the Keynesian models of this era were often complex in their details, at their core always lay a particularly simple assumption concerning people's reactions to government policy. In these models, the behavioral rules describing the evolution of the economy could not change in anticipation of possible future policy effects. People would have to wait until policies were enacted before reacting to them.[2]

An example of how this assumption works should be familiar to people who have taken an introductory economics course. Students are generally taught that an autonomous increase in government spending will lead to an even larger increase in private consumption. The ratio of the increase in consumption to the increase in government spending, according to this traditional theory, is presented as one over one minus the marginal propensity to consume out of income, multiplied by the marginal propensity to consume. So if the marginal propensity to consume out of income is 90 percent or .9, then a \$1 increase in government spending leads to a \$10, that is, \$1/(1 - .9), increase in income and a \$9, that is, \$10 x .9, increase in consumption, as shown in Chart 1. In this example, the basic behavioral relationship is summarized by a value of the marginal propensity to consume (the slope of the consumption function), which remains fixed regardless of the direction of policy.

From the tone of this example, one can imagine that such theories often led to a strong role for economic policy. In fact, the strong behavioral assumptions in these models led economists to view the problem of setting economic policy as essentially analogous to manipulating physical systems. According to most models of this era, people reacted to policy changes much as, in the classical models of Newtonian physics, physical systems react to outside forces. The problem of smoothing the economy's fluctuations around a stable growth path was portrayed as being conceptually similar to stabilizing the temperature inside a building.

A graphic example of such an abstract engineering control problem can help explain the role of policy in these models. Chart 2 depicts the time path of an abstract physical system that would tend naturally to oscillate around some average value, which is represented by the black horizontal line in the chart. In an engineering context, the red line in Chart 2 might represent the daily temperature cycle in a building with no climate controls or the annual runoff of an undammed stream. In an economic context, the red line could represent the fluctuations in the growth rate of aggregate real output (real GNP) around some trend value. For a physical system with well-understood characteristics, the mathematical theory of control allows engineers to manipulate the system so that it stays close to its average value, or perhaps some other desirable value. The macroeconomic models of the 1950s and 1960s generally implied that the same approach could be applied to economic systems. By proper application of monetary and fiscal policy, these models held, the economy could be "fine-tuned," or kept very close to some desirable time path.

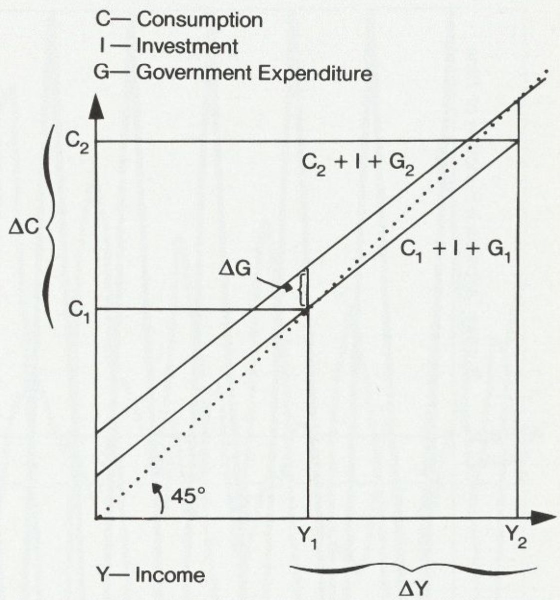
This view of the world has definite implications for the relationship between forecast error and policy performance, as illustrated in Chart 3. This chart depicts the same system as Chart 2, but after the introduction of random influences. (Without randomness, the system could be forecast without error.) The wavy red line shows how such a system might evolve when subject to random shocks. In an economic context this path might represent the growth rate of GNP when the economy is subject to random influences—the weather, movements in world oil prices, and so on—in the absence of any stabilization policy. The wavy black line in Chart 3 represents the evolution of the same system after application of a "control" or policy designed to keep the system on average as near as possible to its desired value, which is again represented by the horizontal black line. Notice that even this "best" policy cannot keep the system exactly at its desired value; thus, errors in forecasting the system will appear even under the theoretically best policy.

In such systems, unpredictable fluctuations will take place. Random, unforecastable fluctuations can occur in a system for two reasons. First, at any given time the system will be subject to further random shocks that cannot be foreseen. Second, it may not be possible to measure accurately the current position of the system given the information available. This second source of uncertainty is clearly important in a macroeconomic setting, in which policymakers usually have only imprecise information available on the current state of the economy.[3]

Thus, Chart 3 illustrates that for systems subject to uncertainty, forecast errors are unavoidable, even after application of policies or controls that stabilize the system. For systems such as the one shown in Chart 3, also, the short-run errors in forecasting the system will be larger after the introduction of the stabilizing policy than before. This difference in the degree of errors occurs because actions designed to stabilize the system must be undertaken on the basis of imperfect information about the state of the system, thus introducing an extra element of short-term randomness. However, this additional element of randomness does not mean that a policy is ineffective in reducing the average size of the system's fluctuations around some desirable path. These last two points are apparent in Chart 3. The path of the unstabilized system (the wavy red line) is much smoother than the path of the stabilized system (the wavy black line) and hence more easily forecast in the short run.[4] However, the stabilized system stays much closer on average to the desirable system value (the horizontal black line) than does the unstabilized system. To make use of a common analogy in this literature, consider the act of driving a car on a winding mountain road. Letting go of the steering wheel leads to easily predictable but undesirable consequences. The consequences of steering are not as predictable but certainly more desirable.

The foregoing example is useful because it illustrates one way that the effectiveness of countercyclical policy is linked to the size of forecast errors. This example also shows why most macroeconomic models of the 1950s and 1960s would not suggest that large errors in forecasting economic aggregates are necessarily caused by poor policy choices. Indeed, these models would suggest almost the opposite conclusion. That is, one would expect larger short-run forecast errors in well managed economies, everything else being equal. The larger forecast errors would result from stabilizing policy actions undertaken by policymakers using imperfect information on the condition of the economy.

Chart 1.
The Keynesian Consumption Function



Along the 45° line, the national identity Y = C + I + G holds (Income = Consumption + Investment + Government Expenditure). If government expenditure increases by amount ΔG, then income increases by amount ΔY from Y_1 to Y_2. If the marginal propensity to consume out of additional income is .9 or 90 percent, then the increase in income leads to an increase in consumption $\Delta C = .9\ \Delta Y$.

Mathematically, the Keynesian consumption function requires that

$$\Delta C = .9\Delta Y, \quad (1)$$

since .9 = the marginal propensity to consume. At the same time, the national income identity requires that

$$\Delta Y = \Delta C + \Delta I + \Delta G. \quad (2)$$

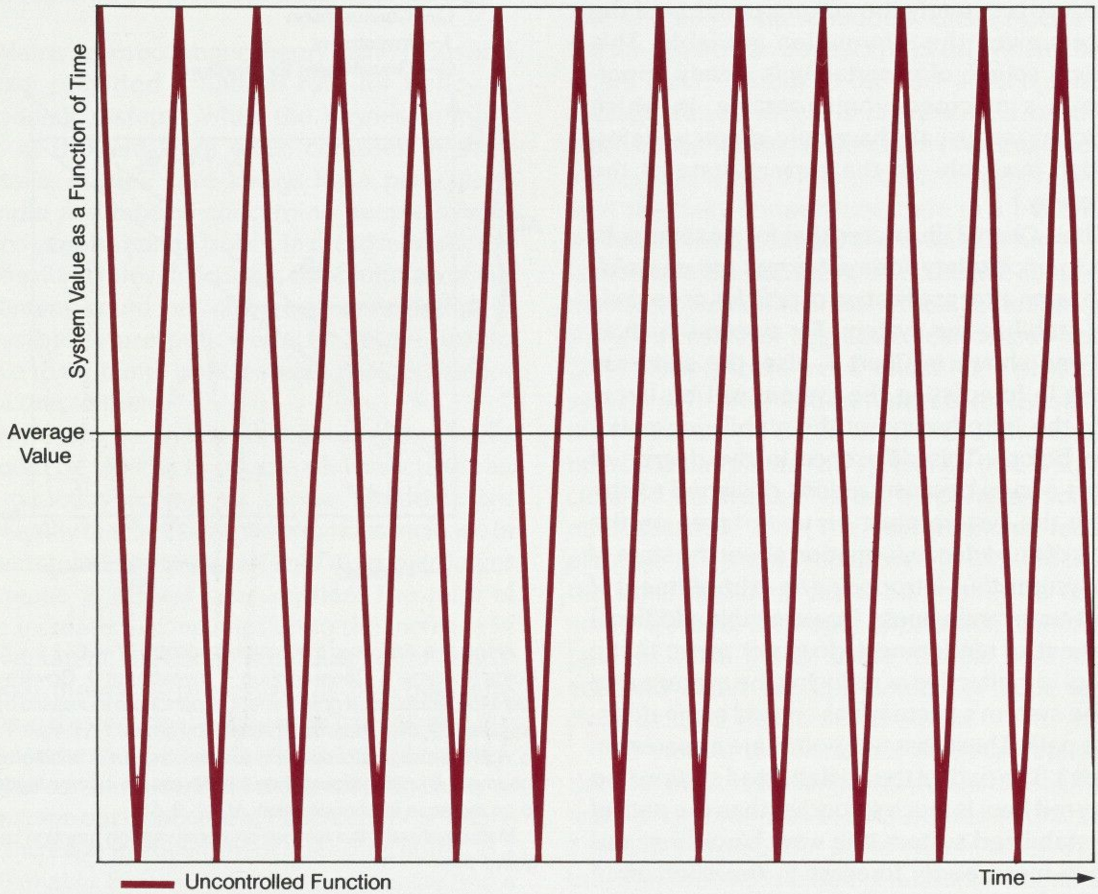
If $\Delta I = 0$ and $\Delta G = \$1$, we can substitute these values into (2) to obtain

$$\Delta Y = \Delta C + 1. \quad (3)$$

Substituting (3) into (1) and solving for ΔY implies that

$$\Delta C = .9\ (\Delta C + 1); \quad (4)$$
$$.1\Delta C = .9;$$
$$\Delta C = .9/.1 = \$9.$$

Chart 2.
Evolution over Time of a System without Random Effects

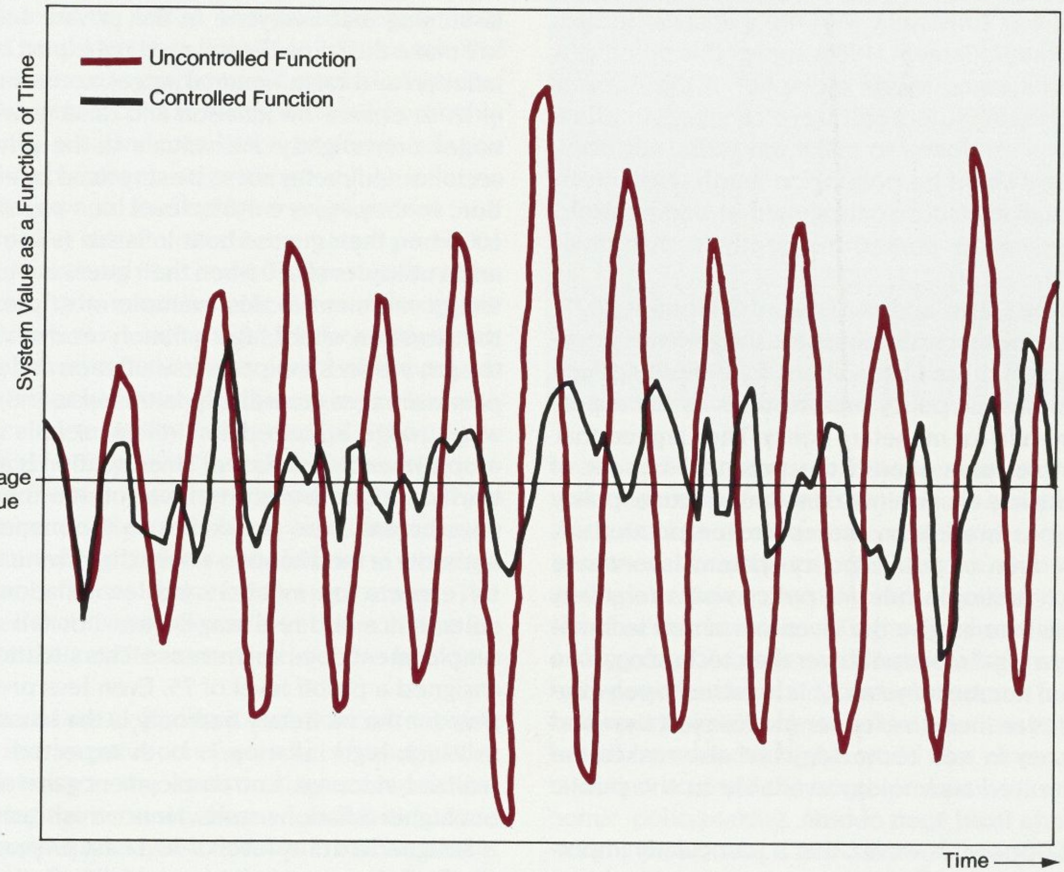


Policy Performance under Rational Expectations

The view of economic policymaking described above was not shared by all macroeconomists during the 1950s and 1960s. In particular, Friedman and other monetarists argued that macroeconomic policy, especially monetary policy, should be set by using very simple guidelines that would not attempt to "lean against the wind" or actively seek to stabilize the course of the economy. The most famous of these monetarist prescriptions for policy is the *k* percent rule suggested by Friedman (1948, 1959). Under this rule, the money supply should grow by a certain prespecified percentage (*k* percent) each year.

One reason that monetarist views found relatively little acceptance during this period was their lack of strong theoretical underpinning. In 1959 Friedman wrote that "there is little to be said in theory for the rule that the money supply should grow at a constant rate. The case for it is entirely that it would work in practice."[5] In the 1970s, however, the monetarist views on setting policy found new theoretical support from macroeconomic models incorporating the hypothesis of rational expectations. Briefly stated, this hypothesis implies that people cannot be fooled as a matter of course. On average, according to rational expectations theory, market participants' expectations about the future must be correct and must utilize all information available at the time of the forecast.[6] In models incorporating rational expectations, people are seen as acting

Chart 3.
Evolution over Time of a System Subject to Random Influences



in anticipation of future policy actions rather than waiting for such actions to occur, as they do in the traditional models described earlier in this article.

The idea of rational expectations, introduced by John F. Muth (1961), at first seemed a minor technical innovation in abstract models of the macroeconomy. In the 1970s, though, rational expectations theory quickly changed the way that many economists viewed the impact of policy. To see the effect of Muth's idea, consider the consumption example in Chart 1. This example assumes that consumers react to any autonomous increase in income by proportionately increasing the amount of their consumption. Thus, elevating consumers' income by increasing the amount of government purchases automatically boosts the amount consumed. But as demonstrated in Robert E. Lucas's research (1976), this conclusion may change according to how consumers view such an increase in government payments. If the increase is viewed as being transitory—for example, lasting less than one year before offsetting tax increases take effect—consumption might change less than proportionately with this increase in income or perhaps not change at all. The point is that under rational expectations, reactions to government policy changes are tempered by expectations of future government policy actions, and these expectations are assumed to be correct on average.

Under the rational expectations hypothesis, the credibility of the analogy between the problems of economic stabilization and physical control is clearly strained. As noted by Lucas and many others, people acting in their own rational self-interest are free to take advantage of any changes in the rules of the marketplace and are not under any obligation to behave in a way consistent with the statistical record. Thomas J. Sargent (1986) argues this point with the following sports metaphor. If the rules of professional football were changed to allow teams six downs to make ten yards, not many teams would be punting on fourth down (even though statistics would show that, under the old rules, teams punted frequently in that situation).

Finn E. Kydland and Edward C. Prescott (1977) were the first to demonstrate the general importance of these observations for evaluating such "simplistic" policy prescriptions as the *k* percent rule for monetary policy. They argued that simple rules offered the potential benefit of reducing uncertainty concerning future policy actions. In addition, the researchers pointed out one area of public policy—patent law—where such a simple rule for policy works relatively well. Patents give the inventors of new technology a legal monopoly over their technology for a fixed number of years. This legal monopoly provides an incentive for people to invest time and money in new technology but also makes the patented technology available to the public after a fixed span of time.

Suppose, however, that a particularly important technology (for example, a cure for heart disease) were to be patented. Then the temptation would exist to revoke the legal monopoly of the patent holder to make this technology widely available at minimal cost. Such a move would have deleterious consequences for future medical research, however, because it would alter the expectations of other medical researchers. These researchers would then rightly have to consider the possibility that the privilege of legal monopoly would not be extended to any new technologies they might develop, and their apprehension would probably result in less inclination to invest in such technology. As a result, a fixed time span for patents may represent the best available choice for policy in this area.

In the context of monetary policy, Kydland and Prescott considered the following theoretical example.[7] In a simplified version of this hypothetical construct, the two choices available for monetary policy are "sound money," which leads to low inflation, and "easy money," which leads to high inflation. The private sector of the economy also has only two choices (assuming that everyone in the private sector will make the same decision): (1) to expect high inflation and raise nominal wages accordingly, or (2) to expect low inflation and raise nominal wages only slightly. Individuals in the private sector would prefer not to be surprised by inflation, so they enjoy a utility level (or a payoff) of 100 when their guess about inflation is correct, and a utility level of 0 when their guess is wrong. The government in this example most prefers the situation where high inflation results when the private sector expects low inflation and sets nominal wages accordingly. In this case, the real wage (wage adjusted for inflation) falls and employment is increased. This situation is arbitrarily assigned a utility level of 100 for the government. Less preferable to the monetary authority is the situation where the private sector expects low inflation and low inflation results, since the real wage does not fall and employment does not increase. This situation is assigned a payoff level of 75. Even less preferable for the monetary authority is the situation in which high inflation is both expected and realized, since again no employment gains occur but higher inflation results. Hence this situation is assigned a utility level of 50. Least preferable of all is the situation where high inflation is expected and low inflation results, causing the real wage to rise and employment levels to fall: a utility level of 25 is assigned.

The possible outcomes in this example and the potential rewards to both the private sector and the government are summarized in Table 1. Each pair of numbers indicates the utility or reward going to the government and private sector, respectively, under one particular outcome or state of the world.

Under the rational expectations hypothesis, the only sustainable situations are those for which the private sector's expectations are on average correct. For example, suppose that the government in this example has historically followed a low inflation policy. Private individuals would then have an incentive to expect low inflation to continue, since their payoff is higher under this belief than under expectations of high inflation (100 vs. 0). Suppose, though, that government policy changed to the high inflation policy. Initially, the result might be a dip in the real wage and a surge in employment, if the private sector did not anticipate the shift to a high inflation policy. The government's utility level would increase from 75 to 100 as a result of the increase in employment. Statistical studies of the data record at this point would probably show a positive correlation between inflation and employment, suggesting that high inflation policies would lead to higher employment. So, if the policy decision had been based purely on the data record (that is, the "best available information"), the most likely choice would be to sustain the policy leading to high inflation. However, rational expectations requires that the private sector not be systematically misled concerning the course of policy. In this example, the private sector's utility level is reduced from 100 to 0 since the wrong course of government policy is anticipated. Hence, a shift to policies leading to sustained high inflation would lead to a change in expectations and a fall in employment. The government's payoff would fall from 100 to 50, while the private sector's would rise from 0 to 100.

According to Kydland and Prescott's example, one negative consequence of basing policy decisions on the statistical record would be moving the economy from a low inflation state (the upper left square in Table 1) to a high inflation state (the lower right square in Table 1) without any offsetting increases in employment or output. Another negative consequence of formulating policy in this fashion would be that high inflation policies would tend to be self-sustaining. Suppose that the government, after maintaining high inflation policies for a number of years, tried to switch to policies compatible with lower inflation. Since the private sector would still be expecting high inflation, the switch would result in higher real wages and a decrease in employment. The data on the economy would again indicate a positive correlation between the inflation rate and employment. Policymakers basing their decision on the statistical record (and presumably, statistical forecasts) would again be led to the inferior choice of policy—that is, a policy consistent with high inflation.

Kydland and Prescott's theoretical analysis is also useful in considering the relationship between forecast errors and the performance of macroeconomic policy. If the notion is accepted that people's decisions are based on correct inferences about future policy actions, then the analogy between physical and economic systems breaks down. According to these researchers' perception, the traditional relationship between effective policy performance and forecast error is invalid because the relationship is based on a model of the world that does not take into account the strategic nature of economic policymaking. Under their view of the world, the automatic need does not exist for a policymaker to react to current information about the economy. Attempts at stabilization could be counterproductive, since they might increase the degree of uncertainty concerning people's expectations for the future course of policy. As a result, additional short-term error need not be introduced into the economy by the actions of policymakers, as it is in the example shown in Chart 3. But if policymakers should react to new information as it becomes available, some additional short-term forecast error might be introduced. The difference is that under Kydland and Prescott's analysis, readjusting policy to new data about the economy may not always be the best thing to do because it might adversely affect people's expectations concerning future policy actions.

The 1970s rational expectations literature made the issue of the link between forecast accuracy and policy performance equivalent to the issue of whether fixed rules or discretionary

Table 1. Government and Private Sector Payoffs under Rational Expectations

	Private sector's expectations	
Government Policy	Low inflation	High inflation
Low inflation	75, 100*	25, 0
High inflation	100, 0	50, 100

**The numbers indicate the payoff to the government and the private sector, respectively, of each combination of government policy and private sector expectations regarding inflation.*

policies would be more desirable for monetary and fiscal policy.[8] If policy is best set by fixed rules, then any additional forecast error introduced into the economy by discretionary policy only increases the aggregate uncertainty in the economy without any offsetting benefits. But if discretionary policy represents the best policy choice, then the traditional logic applies and larger short-term forecast errors might be desirable as a trade-off for longer-term stability.

Forecast Accuracy and Policy Performance: Recent Research

While the theoretical contributions of the 1970s rational expectations literature show how large forecast errors could be associated with ineffective stabilization policies, the literature stops short of demonstrating that this association has actually existed during the postwar period (the only period for which there are reliable statistics on economic forecasts). Beginning with Lucas (1972), a rather large theoretical and empirical literature focused on the role of forecast errors in the money supply (which are presumed to reflect unanticipated, discretionary policy actions on the part of the Federal Reserve System) in generating random fluctuations in aggregate real output. However, statistical attempts to measure the contribution of money forecast errors to errors in forecasting output have at best led to ambiguous results.[9] Dissatisfaction with these findings has led to a wide divergence of professional opinion on the topic of macroeconomic fluctuations more generally and stabilization issues in particular. Some of the more prominent lines of research on business cycles and their implications for stabilization policy are surveyed briefly below.[10]

The first of these is known as the real business cycle approach.[11] This approach incorporates the idea of rational expectations but assigns no causal role to money forecast errors in explaining cyclical fluctuations in real output. Instead, random fluctuations in real output are assumed to result only from uncontrollable random shocks to productive technology. By definition, this theory allows no role for money in determination of real output. Statistical correlations between movements in the money supply and in real output are explained as "reverse causation." The reasoning is that the money supply will naturally expand and contract to accommodate the pace of real economic activity.

The real business cycle approach is a controversial line of research, and recent studies of the postwar U.S. data record have presented much empirical evidence both for and against it. However, the implications of real business cycle theory for monetary policy are unambiguous. Since fluctuations in the money supply have by assumption no effect on real output, this theory sees countercyclical monetary policy as pointless. On the other hand, the theory implies that monetary policy cannot contribute to forecast errors in real economic quantities such as real GNP.

"[T]he theoretical contributions of the 1970s rational expectations literature show how large forecast errors could be associated with ineffective stabilization policies. . . ."

A different way of analyzing macroeconomic fluctuations has been advocated by Christopher A. Sims (1982, 1986). His atheoretical approach advocates a statistical method that does not derive from any explicit economic theory. According to Sims, the major problem of the earlier Keynesian models was not any flaw in their theory but instead the relative unsophistication of their statistical implementation. Hence the traditional analysis presented earlier is applicable to policy problems as long as a statistically valid model of the economic system is used. This approach also differs from the earlier Keynesian models in that it accepts the logical validity of the criticisms of the rational expectations literature. These criticisms are viewed as empirically irrelevant, however, because of the essential nature of policy. Since policy is usually being revised in response to unforeseen circumstances, this approach views it as unrealistic to focus on changing anticipations of policy actions as a singular, once-and-for-all event. The validity of this last argument remains controversial and has been challenged on both theoretical and empirical grounds.[12]

To summarize, this second view would accept the traditional relationship between policy performance and forecast error, with the proviso that stabilization policy be carried out by means of a statistically valid model of the economy. Theoretical objections to this analysis may have logical validity but are seen as having little practical significance.

A third important development in the macroeconomic literature of the 1980s has been the construction of models that explore an interesting implication of the rational expectations hypothesis. That is, nothing about the rational expectations hypothesis precludes people from making decisions on the basis of random, spurious information (sunspots, hemlines, batting averages, and the like). As long as other market participants also believe that such information is important in making economic decisions, then taking this information into account is rational, even if such information has little or nothing to do with the economy in a fundamental sense. For example, if an analyst thinks that the stock market will react positively to an increase in sunspots, the analyst's perceived best interest would lead to buying and selling stocks according to this information. If everyone else in the stock market thinks the same thing, then such beliefs can become self-fulfilling.[13]

"The possibility that much of the randomness in the economy could derive from spurious sources suggests that stabilizing policy measures would be desirable to offset the effects of these fluctuations."

The possibility that much of the randomness in the economy could derive from spurious sources suggests that stabilizing policy measures would be desirable to offset the effects of these fluctuations. Ideally, monetary and fiscal policy could be designed to offset price changes induced by market fixation on spurious events and thereby to reduce the overall randomness in the economy. Yet, the effect of such policies on forecast error would likely be the opposite of the traditional effect described earlier in this article. That is, such policies could reduce the magnitude of forecast errors by eliminating much of the perceived (but actually spurious) uncertainty over prices, especially the prices of commodities and financial claims traded on organized exchanges. In practice, however, the persons implementing such stabilizing policies would be faced with deciding whether price movements were reflections of spurious uncertainty or justified as indicative of changes in the fundamental condition of the economy. Besides, the literature on "sunspots" has not developed to the point where much practical guidance has been offered on this issue. As with the earlier rational expectations literature, the major contribution of the sunspot literature has been to demonstrate the possibility that stabilization policy could be effective in the way outlined above. That stabilization policy would be effective in this fashion remains to be shown.

Another open question is whether existing forecasting technologies would be of much use in filtering out the spurious components of price movements. The drop in stock prices during late October 1987, for example, is often seen in the business press as having little or nothing to do with any fundamental factor affecting the course of the economy, either before or after the fact. Yet most economists' real growth forecasts were revised substantially downward as a result of the crash. The Blue Chip Consensus forecast for real GNP growth in fourth quarter 1987, based on a survey of about 50 commercial forecasts, fell from 2.6 percent at an annual rate in early October 1987 to 1.5 percent. The actual figure for this period was at last revision reported to be 6.1 percent, which does not inspire confidence in economists' ability to extract fundamental information about the economy from price movements in financial markets.

Conclusion

Until the 1970s, most theoretical macroeconomists implicitly viewed the problem of setting fiscal and monetary policy as analogous to that of stabilizing a physical system subject to uncertainty. If such an analogy were valid, large errors in forecasting the course of the economy would of themselves be no cause for concern, especially over the short term. Under this analogy, policies producing large short-term forecast errors could also be those producing the greatest long-term overall stability. Also, even inaccurate forecasts of the future state of the economy would be useful to policymakers as long as these forecasts made the best use of available information.

A major contribution of the theoretical macroeconomics literature of the 1970s was formalizing the monetarists' longstanding objections to the traditional way of thinking about economic policy. Using the concept of rational expectations, researchers were able to construct hypothetical examples in which simple policy rules perform better than policies that attempt to react to all currently available information and to forecasts predicated on this information. In such examples, ignoring the urge to "lean against the wind" typically reduces the overall uncertainty and the size of errors in forecasting the economy. In these examples, also, economic forecasts are seen as having relatively little value for policymakers, since policy itself should not be automatically changed as a result of changes in the economic outlook.

Although the rational expectations literature of the 1970s was successful in challenging the then-prevalent Keynesian paradigm, it has not been successful in producing a new consensus theory of macroeconomic fluctuations. More recent developments in macroeconomic theory have generally attempted to refine and reinterpret the role of rational expectations in explaining fluctuations in the economy. However, various branches of the literature have adopted widely different approaches, each with disparate implications for the conduct of monetary and fiscal policy. Consequently no consensus viewpoint exists on whether better forecasts lead to better policy, or vice versa. On this issue, the best that this professional impasse can offer policymakers is a menu of competing explanations, each with differing recommendations for policy. Nonetheless, this literature is useful in that it highlights the dimensions along which countercyclical policy based on economic forecasts is likely to succeed or fail. These dimensions include the following:

- Policies based on pure statistical extrapolation are likely to be destabilizing if changes in anticipations of those policies cause changes in market conditions. However, the postwar U.S. data record does not unambiguously support the view that changes in policy anticipations can explain a significant proportion of the fluctuations in real output over this period.
- The quantitative effects of changes in policy anticipations may be less important if policy must be continually changed. In this case policy based on statistical extrapolation is more likely to be effective.
- The overall effectiveness of countercyclical monetary policy may be significantly limited by the extent to which movements on the real side of the economy can be attributed to random fluctuations in productivity.
- One potential role for countercyclical policy might be to counteract the effects of price movements resulting from the markets' fixation on spurious information. For policy to be effective in this way, however, policymakers must be better than the markets at distinguishing between spurious price movements and those explained by changes in relevant information about the economy.

Notes

[1] For a succinct and highly readable statement of this view, see Friedman (1988).

[2] The classic works on policy analysis in Keynesian models are those of Tinbergen (1952, 1956). Tinbergen's "theory of economic policy" was formulated without the benefit of the branch of mathematics known as *control theory*, which is used in some of the examples in this article, because it was in its infancy in the 1950s. However, the problems addressed by Tinbergen closely resemble those addressed by control theory. Therefore, discussion of stabilization policy using control theoretic constructs seems justified. For an in-depth explanation of the application of control theory to Keynesian macroeconomic models, see Chow (1981).

[3] In an economic setting, another plausible source of uncertainty is that policy actions themselves may be implemented only with error. Errors in implementing policy could occur in a number of ways. For example, in many democracies, the power to set economic policy is ultimately held by the legislative branch, but the day-to-day implementation of those policies is carried out by the executive branch. Errors in carrying out policy could result from coordination problems between the two branches. Since the effect of such error is similar to that of measurement error, this source of error is not considered in the discussion above.

[4] In the long run, the stabilized system can theoretically be forecast more accurately than the unstabilized system. In practice, however, it is unclear how long the "long run" might be, whereas the short run cannot get any shorter than the next data period, for example, the next quarter for series such as real GNP that are reported on a quarterly basis. For this reason, the discussion of forecast accuracy here is restricted to the short run.

[5] See Friedman (1959): 98.

[6] One common misconception about rational expectations is that it is often equated to the idea that people never make mistakes in forecasting economic aggregates. That is, "rational expectations" is assumed to mean that people have perfect foresight. In lieu of this unrealistic assumption, the rational expectations hypothesis postulates that errors made by people in forecasting the future must be unpredictable in any systematic way.

[7] The version of the example used here was adapted by Backus and Driffill (1985).

[8] This article characterizes any policy that reacts to current information as "discretionary." More subtle definitions of this term are possible but outside the scope of this article.

[9] An interesting study by Sims (1980) and a follow-up study by Runkle (1987) illustrate the ambiguity of the postwar U.S. data record on this issue. Sargent (1976) offers a theoretical explanation of why it would be difficult to determine empirically the contributions of money forecast errors to fluctuations in real output.

[10] For a more complete survey of developments in the macroeconomics literature since 1975, see Fischer (1988).

[11] See Prescott (1986) and the accompanying articles for an introduction to this approach to analyzing macroeconomic fluctuations.

[12] See Sargent (1984) and Miller and Roberds (1987).

[13] The idea that financial markets are driven by spurious information is hardly a new one. One contribution of the recent literature has been to model formally the effects of such spurious information in an abstract setting. Another contribution of this literature has been to show that volatile fluctuations in output and prices can result even when there are no random factors influencing the economy. For a survey and extensive discussion of this literature, see Aiyagari (1988).

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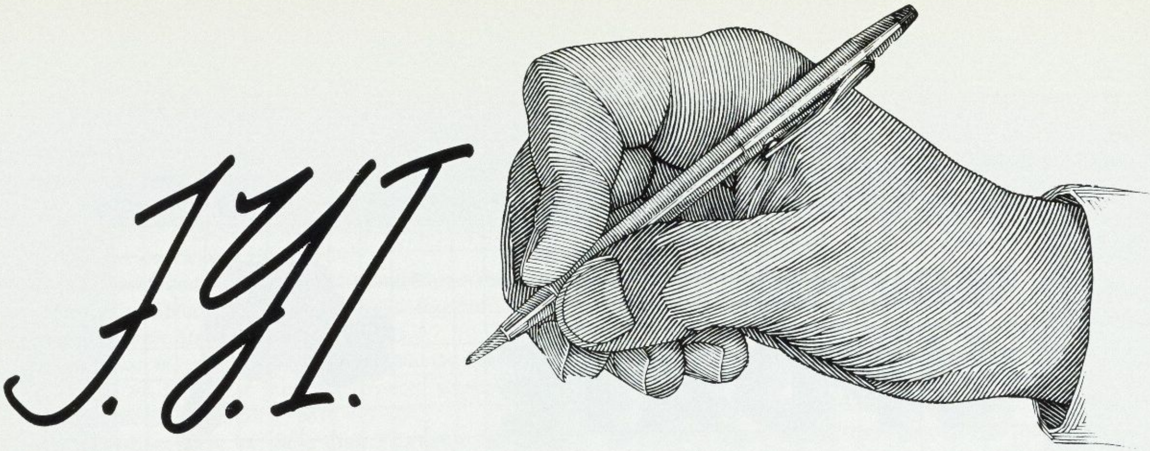

Improving Monthly Models for Economic Indicators: The Example of an Improved CPI Model

R. Mark Rogers

Participants in financial markets watch economic activity and inflation closely. Analysts have incentives to forecast monthly indicators accurately since interest rates and foreign exchange rates as well as equity prices can move significantly should economic reports differ from expectations. Thus, considerable resources are devoted to forecasting economic indicators.

Forecasters' models typically employ the most recent data available. Sometimes models are almost accounting identities, that is, a summation of the indicator's officially defined components, or at least the major components. For example, the U.S. Commerce Department's Bureau of Economic Analysis (BEA) calculates some components of wage and salary information using data from the U.S. Labor Department's Bureau of Labor Statistics (BLS) series for earnings and for hours worked, which are released before the BEA forecast in any given month. Analysts often use percentage changes in the product of earnings and hours worked to forecast percentage changes in wages and salaries and hence personal income.

In addition to such accounting models, some analysts use forecasting models that are more behavioral; they try to project an indicator's future performance based on data believed to influence the indicator, but which are not components of it. For example, mortgage rates influence housing starts but are not components of the latter data.

Some analysts forecast monthly changes in the consumer price index (CPI) based on changes in the producer price index (PPI). Typically, percentage changes in the CPI are forecast from percentage changes in the PPI, since the latter are released each month by the BLS about a week to 10 days before the CPI report. The assumption behind such models is that there is predictable movement in prices from the producer level to those at the consumer level even though the CPI encompasses items like services that are not in the more commodity- or input-oriented PPI. Also, factors influencing profit margins differ in the two indexes.

Whether monthly models are basically of the accounting or behavioral type, they typically have three attributes: (1) the model specification is simple, (2) the model is constructed with

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aggregate data instead of separately estimated components, and (3) the resulting forecasts generally are not very accurate. This article, using five CPI models for examples, shows that significant improvement can be achieved with relatively simple changes in the specifications of the "traditional" monthly CPI model and with only modest disaggregation of the components.[1] These five models are:

- a traditional monthly CPI model;
- a first difference model, which is based on changes in inflation rates combined with a lagged dependent variable;
- two models that incorporate variations on the first difference model; and
- a multiequation model, in which different components of the CPI and PPI are analyzed.

Improvement of monthly CPI forecasting techniques presents a number of challenges for analysts. First, the consumer and producer price indexes are among the most accessible, widely studied, and often cited indicators available to financial analysts. Any greater understanding that economists can gain regarding the performance of these indexes would have implications for popular economic discourse. The forecasting itself is also challenging since parts of the CPI are not included in the PPI, making certain adjustments necessary when performing component analysis of the two indexes.

The research presented in this article moves step by step away from the traditional forecasting model until a number of different models have been developed. The accuracy of each of the resulting forecasting models is analyzed. One factor to remember when reading about these different models is that they are designed to forecast an indicator based on the change in a second indicator that is reported only seven to ten days earlier. These forecasting models are thus designed more to study the impact of short-term fluctuations in the market than to set the stage for long-term policy decisions.

The Traditional Monthly CPI Model

When economists forecast changes in the consumer price index, the most current explanatory data are used. Since the CPI numbers themselves are obtained from the U.S. Census Bureau's Current Population Surveys, no "prior" component data series exist from which the CPI data are derived for the forecast month. Therefore, an accounting-type forecasting model is not appropriate for CPI projections. However, PPI data have been released for the forecast month and, as a result, can be used in the creation of CPI models. These models are generally represented by the equation:

$$\%\Delta CPI_t = a_1\,(\%\Delta PPI_t) + C + e_t\,,$$

where $\%\Delta CPI$ is the monthly percentage change in the consumer price index, $\%\Delta PPI$ is the monthly percentage change in the producer price index (for finished goods), t is the current time period, a_1 is the regression coefficient for $\%\Delta PPI$ (based on a regression using one of two statistical techniques—ordinary least squares or, as explained below, Cochrane-Orcutt), C is a constant, and e_t is the error term. Table 1 shows the regression results for such a model using both techniques over the period 1980-87. A longer observation period could be used, but recent history is more interesting, given the increased volatility of the data.[2] (The price indexes used in this study underwent structural changes around 1980 that seem to have made them more volatile and less predictable. If the true nature of these price series has in fact changed in recent years, it makes sense to weight more recent observations more heavily when specifying a forecasting model.)

From the information provided in Table 1, Model 1a appears to be reasonably acceptable from a statistical perspective. First, as expected, the coefficient of the percentage change in the PPI is positive. Also, the t-statistics for the two independent variables (the percentage change in the PPI and the constant) are statistically significant. However, the forecasting accuracy of the model is not very good. Essentially, for the regression period, the mean absolute percentage change in the CPI is 0.456 while the mean absolute error of this model is 0.213, almost half of the typical percentage change.[3] (Mean absolute error is the average of the model's forecast errors, ignoring plus or minus signs—that is, using absolute values of the misses. Using absolute values avoids the "my feet are in the oven, my head is in the freezer, so on average I feel fine" problem that results when the minus signs are not removed before averaging.) Also, given that the standard deviation of the mean absolute error is 0.188, one can conclude that this model does not produce very accurate forecasts. This certainly is a reasonable conclusion when the average error is about half that of the typical percentage change in the CPI. Of course, the high standard error makes the forecast reliability even lower. The adequacy of the traditional forecasting model should be seriously questioned.

The forecasting accuracy of the traditional model can be improved using the Cochrane-Orcutt estimating procedure, but glaring deficiencies still remain. The Cochrane-Orcutt procedure is a standard statistical method used to remove the serial correlation of errors from a linear regression (prediction) model. Serial correlation of errors refers to the fact that an earlier period's forecast error contains some statistical information about the current period's forecast error. This characteristic, in turn, means that the forecasting (regression) model has not exploited all available information in its predictions, since some predictive power or discernible pattern remains in the errors of the model. The forecast errors of a good forecasting model should be entirely random; the Cochrane-Orcutt procedure is one way of obtaining such randomness. As shown in Model 1b, the R-squared is higher, the Durbin-Watson statistic is near 2 (indicating that the model now has taken into account most serial correlation problems), and the mean absolute error and its standard error are noticeably lower. In effect, this version of the traditional model should forecast more accurately than the version using ordinary least squares. Though forecasting accuracy is improved, use of the Cochrane-Orcutt technique has indicated that deficiencies do exist in the traditional model.

Using the Cochrane-Orcutt estimation technique, the t-statistics for the coefficients of the independent variable (percentage change in the PPI) and the constant fell considerably (shown in Table 1), as is typical when significant serial correlation exists. Furthermore, the key explanatory variable in Model 1b, the percentage change in the PPI, holds little predictive value. Its coefficient is negligible and statistically unreliable. While this version of the traditional model provides better forecasts (based on the mean absolute error and its standard deviation), the Cochrane-Orcutt procedure suggests that the primary forecasting variable is Rho along with the constant. (Rho is a coefficient or "estimated parameter" in the Cochrane-Orcutt procedure that indicates the average effect of one forecast error on the next forecast error.) Thus, as modeled above, the past history of the CPI is a better predictor of this month's CPI than is this month's PPI for finished goods. While past history, or Rho, provides a better forecast for a typical percentage change in the CPI than does the PPI, past history may provide little help in forecasting turning points in inflation. Theoretically, the PPI would provide help here, but Model 1b gives little weight to the PPI relative to Rho; this conclusion suggests that this model specification is not appropriate. The next section of this article, though, shows how CPI forecasting improvements can be made through incremental changes in the projection model.

Model Improvement through Changes in Model Specification

The First Difference Model. While most market economists probably find the traditional model intuitively appealing, they might also describe an entirely different scenario when discussing how changes in the PPI pass through to changes in the CPI. The earlier monthly model is based on the following thinking: "a percentage change in the PPI for a given month leads to a given percentage change in the CPI with the coefficient reflecting differences in price margins between the retail and wholesale levels." Instead, a typical explanation provided by an analyst might read, "the PPI inflation rate rose X percentage points from the month before, and so the CPI inflation rate is expected to jump by Y percentage points from last month; furthermore, the difference in the change in these inflation rates reflects differences in price margins from wholesale to retail levels." In effect, this latter reasoning suggests a model based on changes in inflation rates—or first differences—combined with a lagged dependent variable (that is, values of the CPI percent changes in earlier

Table 1.
Model 1a: The Traditional Monthly CPI Model
(Ordinary Least Squares Estimation Technique)

Dependent Variable: %ΔCPI
Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
%ΔPPI	0.466450	0.612794E-01	7.61186
Constant	0.302377	0.338458E-01	8.93396

Number of Observations: 96
Mean of Dependent Variable: 0.426180
Standard Error of Regression: 0.290821
Mean Absolute Error: 0.213476
Root Mean Squared Error: 0.284028

R^2: 0.3813
R^2-Adjusted: 0.3748
Durbin-Watson: 1.36665
Standard Deviation of Mean Absolute Error: 0.188343

Model 1b: The Traditional Monthly CPI Model
(Cochrane-Orcutt Estimation Technique)

Dependent Variable: %ΔCPI
Regression Period: 2/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
%ΔPPI	0.114030	0.678100E-01	1.68161
Constant	0.368158	0.667769E-01	5.51325
Rho	0.601105	0.819931E-01	7.33116

Number of Observations: 95
Mean of Dependent Variable: 0.414682
Standard Error of Regression: 0.252936
Mean Absolute Error: 0.188996
Root Mean Squared Error: 0.250259

R^2: 0.4891
R^2-Adjusted: 0.4836
Durbin-Watson: 2.15921
Standard Deviation of Mean Absolute Error: 0.164914

months). The use of lagged values of the CPI is necessary for the first difference model suggested by the second line of thinking presented above. Since a jump in the inflation rate of the CPI is being related to a jump in the PPI inflation rate, there should be a first difference term for the dependent variable ($\%\Delta CPI_t - \%\Delta CPI_{t-1}$). However, by adding $\%\Delta CPI_{t-1}$ to the left-hand side of the equation, the dependent variable becomes the more familiar $\%\Delta CPI_t$, which when added to the right-hand (explanatory) side becomes the lagged dependent variable. The suggested model is created to address the question of whether acceleration in the CPI is related to similar movement in the PPI. This model, Model 2, is represented by the equation:

$$\%\Delta CPI_t = a_1\,(\%\Delta CPI_{t-1}) + a_2\,(DPPI_t) + C + e_t,$$

where $\%\Delta CPI_{t-1}$ is a lagged dependent variable and $DPPI_t$ is the change in the PPI inflation rate from period t-1 to period t. In other words, $DPPI_t$ is equal to ($\%\Delta PPI_t - \%\Delta PPI_{t-1}$). If the percentage change in the PPI was 0.6 percent in April, and 0.4 percent in May, the *DPPI* would be

Table 2.
Model 2: First Differences Monthly CPI Model

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: %ΔCPI
Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
Constant	0.100600	0.458729E-01	2.19302

Distributed Lag Interpretation, %ΔCPI

Lag	Coefficient	Standard Error	t-statistic
1 month	0.4864	0.8685E-01	5.601
2 month	0.2250	0.2510E-01	8.963
3 month	0.5674E-01	0.4752E-01	1.194
4 month	-0.1824E-01	0.4421E-01	-0.4127

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: 0.749887 — Standard Error: 0.836693E-01

Distributed Lag Interpretation, DPPI

Lag	Coefficient	Standard Error	t-statistic
Current month	0.1048	0.6486E-01	1.616
1 month lag	0.8084E-01	0.5861E-01	1.379
2 month lag	0.5539E-01	0.6200E-01	0.8933
3 month lag	0.2844E-01	0.4474E-01	0.6358

Mean Lag: 1.02776 — Standard Error: 1.69606
Sum of Lag Coefficients: 0.269466 — Standard Error: 0.195351

Number of Observations: 96	R^2: 0.508627
Mean of Dependent Variable: 0.426180	R^2-Adjusted: 0.487028
Standard Error of Regression: 0.268192	Durbin-Watson: 1.849057
Mean Absolute Error: 0.185914	Durbin-Watson(4): 2.141449
Standard Deviation of Mean Absolute Error: 0.169281	Root Mean Squared Error: 0.250835

Note: Mean lags and their standard error are not meaningful when coefficients for the lags change sign.

-0.2 percent. Table 2 contains the regression results for this model.

In addition to specifying the change in inflation rates, a different estimation technique is incorporated into this model. Distributed lags are used in the model specification along with the Almon distributed lag procedure, a standard technique in estimating regression models that involve distributed lags (collections of the same variable, dated at different times).[4]

Almon lags are estimated for both independent variables: (1) the lagged $\%\Delta CPI$ and (2) the first difference variable for $\%\Delta PPI$. A number of lag structures were examined. After some experimentation with the lags and order of the polynomial, a lag period of four months with lag coefficients following a second degree polynomial was judged to be good for forecast requirements. These constraints imply that the lags follow a curve with only one inflection point, after which the values taper near to zero in the final period.

This first difference model provides interesting behavioral insight into the lag structure of the variables. For the lagged dependent variable, the value for the previous month is the key. The coefficient for the two months previous is just under half that of the one month lag while lags three and four months are of little significance. The lag structure for the first difference variable *DPPI* is perhaps even more interesting. A significant portion of the influence of changes in $\%\Delta CPI$ is in the current period—that for which the CPI is being reported. This period accounts for about 40 percent of the PPI's influence on percentage changes in the CPI, and the one month lag represents about 30 percent of the impact. (The 40 percent figure is this lag period's coefficient divided by the sum of the coefficients for this variable.) Of course, the comparison is meaningful only if the coefficients are of the same sign. Coefficients for three and four month lags are of diminishing importance.

Interestingly, although this first difference model, using Almon lags, has provided insight into the lagged effects of the PPI on the CPI, it has not provided a more accurate forecasting model. The mean absolute error is barely lower than for Model 1b, while the standard deviation for Model 2's mean absolute error is actually slightly higher. However, Model 2 provides the basic structure for an improved, modified single-equation model. Later in this article, Model 2 will also help provide the basis for a multiequation model.

The First Difference Model with a Structural Shift Variable. As mentioned earlier, the first difference model was created to determine whether acceleration in the PPI is related to that for the CPI. The problem with Model 2's specification is that the factors affecting the pass-through of inflation from the wholesale level to the retail level may change over the business cycle or in response to both long-term and sudden structural changes, such as large oil price shocks. While Model 2 attempts to quantify the pass-through of inflation from the wholesale to the retail level, it does not address the impact of structural shifts as indicated by longer-term changes in the CPI/PPI inflation differential. The term $SHIFT_t$ is used in this article to represent the CPI inflation rate minus the PPI inflation rate. Of course, for a given forecast month, this variable is not yet available because of the missing CPI data. Hence, the variable tested is for the prior period, $SHIFT_{t-1}$. As discussed below, distributed lags are used in order to measure the impact of this differential over several months, thereby quantifying the impact of a prevailing trend rather than the noise of one-month percentage changes.

The Almon estimation procedure is employed with a lag structure of four periods, and the distributed lag coefficients are assumed to follow a second degree polynomial. The far end is constrained to zero. All three lagged dependent and independent variables follow this structure. As shown in Table 3a, the regression results of this model structure suggest that the specification is somewhat lacking, although only minor changes may be sufficient to achieve desired model properties.

Several properties of this model are immediately noteworthy. Lagged $\%\Delta CPI$ has coefficients that change sign, but the primary lag is in the first month, as expected, and has a positive sign. The third and fourth month lags have small, negative coefficients and are not significant. The variable *DPPI* (the change in the PPI inflation rates) has a positive coefficient in the current month, but it is more than offset by negative coefficients for the remaining lagged months. This result is not theoretically satisfying, to say the least, and is contrary to the Model 2 distributed lag results for this variable, as well as to theoretical expectations. For the variable *SHIFT*, the coefficient changes sign in the last lagged month, which would be of minor importance if the coefficients of *DPPI* were more certain. The extensive use of Almon lags may have led to multicollinearity problems.[5] While negative coefficients for *SHIFT* may be plausible, they are not expected for the key variable, *DPPI*. At this point, one can assume that for *DPPI*, the primary

Table 3a.
Model 3a: First Differences With Shift Variable Monthly CPI Model

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: %ΔCPI — Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
Constant	0.198789	0.476192E-01	4.17455

Distributed Lag Interpretation, %ΔCPI

Lag	Coefficient	Standard Error	t-statistic
1 month	0.7352	0.1739	4.228
2 month	0.2203	0.2292E-01	9.615
3 month	-0.7379E-01	0.8814E-01	-0.8372
4 month	-0.1472	0.8684E-01	-1.696

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: 0.734466 — Standard Error: 0.763839E-01

Distributed Lag Interpretation, DPPI

Lag	Coefficient	Standard Error	t-statistic
Current month	0.2166	0.6816E-01	3.178
1 month	-0.6361E-01	0.1348	-0.4718
2 month	-0.1931	0.1675	-1.153
3 month	-0.1719	0.1236	-1.391

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: -0.212029 — Standard Error: 0.449407

Distributed Lag Interpretation, SHIFT

Lag	Coefficient	Standard Error	t-statistic
1 month	-0.4086	0.1614	-2.531
2 month	-0.1786	0.4074E-01	-4.383
3 month	-0.3380E-01	0.8132E-01	-0.4156
4 month	0.2573E-01	0.7768E-01	0.3312

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: -0.595244 — Standard Error: 0.135807

Number of Observations: 96
Mean of Dependent Variable: 0.426180
Standard Error of Regression: 0.240054
Mean Absolute Error: 0.166281
Standard Deviation of Mean Absolute Error: 0.159465

R^2: 0.600898
R^2-Adjusted: 0.573992
Durbin-Watson: 2.009688
Durbin-Watson(4): 2.078819
Root Mean Squared Error: 0.229806

Table 3b.
Model 3b: First Differences With Shift Variable Monthly CPI Model

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: %ΔCPI | Regression Period: 2/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
DPPI	0.179168	0.701371E-01	2.55454
Constant	0.188042	0.481077E-01	3.90878

Distributed Lag Interpretation, %ΔCPI

Lag	Coefficient	Standard Error	t-statistic
1 month	0.5696	0.8519E-01	6.686
2 month	0.2111	0.2365E-01	8.929
3 month	-0.3257E-02	0.4449E-01	-0.7321E-01
4 month	-0.7364E-01	0.4186E-01	-1.759

Mean Lag: Not Meaningful | Standard Error: Not Meaningful
Sum of Lag Coefficients: 0.703822 | Standard Error: 0.788271E-01

Distributed Lag Interpretation, SHIFT

Lag	Coefficient	Standard Error	t-statistic
1 month	-0.2384	0.7172E-01	-3.324
2 month	-0.1382	0.4078E-01	-3.390
3 month	-0.6514E-01	0.4261E-01	-1.529
4 month	-0.1906E-01	0.3360E-01	-0.5673

Mean Lag: 0.706835 | Standard Error: 1.03390
Sum of Lag Coefficients: -0.460815 | Standard Error: 0.135934

Number of Observations: 95	R^2: 0.547282
Mean of Dependent Variable: 0.414682	R^2-Adjusted: 0.521849
Standard Error of Regression: 0.243381	Durbin-Watson: 1.926097
Mean Absolute Error: 0.177663	Durbin-Watson(4): 2.229887
Standard Deviation of Mean Absolute Error: 0.155511	Root Mean Squared Error: 0.235570

effect is likely in the current period, and by eliminating the lagged structure for that variable, a "cleaner," more statistically satisfying model may result. Model 3b, the next model discussed in this article, is of the same specification as Model 3a except that *DPPI* does not have a lagged structure.

The Modified First Difference Model with a Structural Shift Variable. As shown in Table 3b, dropping the distributed lag structure from *DPPI* leads to results more consistent with theoretical expectations: *DPPI* has a positive coefficient while the distributed lag coefficients of the other two variables are similar to those estimated in Model 3a. For the lagged dependent variable, the sum of the lag coefficients is positive and relatively high, suggesting that lagged *%ΔCPI* provides most of the explanatory

Table 4a.
Model 4a: The Food Component

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: $\%\Delta CPI_a$
Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
$DPPI_a$	0.168529	0.327195E-01	5.15071
Constant	0.135457	0.516263E-01	2.62381

Distributed Lag Interpretation, $\%\Delta CPI_a$

Lag	Coefficient	Standard Error	t-statistic
1 month	0.2827	0.7744E-01	3.650
2 month	0.2099	0.3406E-01	6.163
3 month	0.1386	0.4565E-01	3.036
4 month	0.6860E-01	0.3938E-01	1.742

Mean Lag: 0.990127 — Standard Error: 0.252148
Sum of Lag Coefficients: 0.699771 — Standard Error: 0.113543

Distributed Lag Interpretation, $SHIFT_a$

Lag	Coefficient	Standard Error	t-statistic
1 month	-0.3024	0.4630E-01	-6.530
2 month	-0.7933E-01	0.2921E-01	-2.716
3 month	0.4541E-01	0.2928E-01	1.551
4 month	0.7185E-01	0.2219E-01	3.238

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: -0.264437 — Standard Error: 0.973780E-01

Number of Observations: 96	R^2: 0.479498
Mean of Dependent Variable: 0.346094	R^2-Adjusted: 0.450581
Standard Error of Regression: 0.257348	Durbin-Watson: 1.650386
Mean Absolute Error: 0.200752	Durbin-Watson(4): 1.805803
Standard Deviation of Mean Absolute Error: 0.149903	Root Mean Squared Error: 0.250072

power of the model. The coefficients of the lagged variable $SHIFT_t$ are all negative.

An important aspect of understanding the economic meaning of this shift variable is that the CPI/PPI inflation differential is usually negative over the period of estimation, and when positive, it is not drastically above zero. Therefore, when the PPI trend inflation rate rises, this differential usually turns negative or becomes more negative. A rise in the PPI trend inflation rate therefore lowers the differential but raises the CPI forecast because of the negative coefficient. In economic theory, this movement is plausible because, when the PPI trend inflation

Table 4b.
Model 4b: The Energy Component

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: $\%\Delta CPI_b$
Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
$DPPI_b$	0.365905	0.387541E-01	9.44169
Constant	0.381572	0.115530	3.30280

Distributed Lag Interpretation, $\%\Delta CPI_b$

Lag	Coefficient	Standard Error	t-statistic
1 month	0.3879	0.6050E-01	6.413
2 month	0.1526E-01	0.3766E-01	0.4053
3 month	-0.1736	0.4443E-01	-3.908
4 month	-0.1787	0.3516E-01	-5.083

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: 0.508764E-01 — Standard Error: 0.125537

Distributed Lag Interpretation, $SHIFT_b$

Lag	Coefficient	Standard Error	t-statistic
1 month	-0.4276	0.5875E-01	-7.279
2 month	-0.2457	0.4103E-01	-5.989
3 month	-0.1138	0.3956E-01	-2.877
4 month	-0.3191E-01	0.2878E-01	-1.109

Mean Lag: 0.694785 — Standard Error: 0.428846
Sum of Lag Coefficients: -0.819095 — Standard Error: 0.136758

Number of Observations: 96	R^2: 0.643226
Mean of Dependent Variable: 0.165543	R^2-Adjusted: 0.623405
Standard Error of Regression: 0.990602	Durbin-Watson: 1.873166
Mean Absolute Error: 0.730886	Durbin-Watson(4): 1.901712
Standard Deviation of Mean Absolute Error: 0.614524	Root Mean Squared Error: 0.952816

rate rises relative to the CPI trend inflation rate, there is cost-push pressure to raise prices at the consumer level. Profit margins are reduced, meaning that, overall, as producer costs accelerate, greater pressure builds to raise consumer prices. In terms of interpreting the model solution, the negative coefficients of the shift variable may be difficult to understand until one realizes that the differential is typically negative or quickly becomes negative as PPI inflation accelerates.

While Model 3b is more appealing theoretically than Model 3a, the summary statistics are not quite as good. Fortunately, these differ-

Table 4c.
Model 4c: The Commodities Less Food and Energy Component

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: $\%\Delta CPI_c$
Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
$DPPI_c$	0.149648	0.607590E-01	2.46297
Constant	0.788119E-01	0.414196E-01	1.90277

Distributed Lag Interpretation, $\%\Delta CPI_c$

Lag	Coefficient	Standard Error	t-statistic
1 month	0.6276	0.1113	5.640
2 month	0.2387	0.2804E-01	8.511
3 month	0.4397E-02	0.5623E-01	-0.7819E-01
4 month	-0.7516E-01	0.5369E-01	-1.400

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: 0.795532 — Standard Error: 0.934713E-01

Distributed Lag Interpretation, $SHIFT_c$

Lag	Coefficient	Standard Error	t-statistic
1 month	-0.2268	0.7638E-01	-2.970
2 month	-0.1598	0.3482E-01	-4.588
3 month	-0.9960E-01	0.4499E-01	-2.214
4 month	-0.4635E-01	0.3845E-01	-1.205

Mean Lag: 0.935148 — Standard Error: 0.755781
Sum of Lag Coefficients: -0.532541 — Standard Error: 0.116078

Number of Observations: 96	R^2: 0.524526
Mean of Dependent Variable: 0.373705	R^2-Adjusted: 0.498111
Standard Error of Regression: 0.207770	Durbin-Watson: 1.945978
Mean Absolute Error: 0.154781	Durbin-Watson(4): 1.819621
Standard Deviation of Mean Absolute Error: 0.130596	Root Mean Squared Error: 0.202072

ences are slight and Model 3b is still an improvement over Model 2. Compared to the traditional model, the forecasts of this specification are more accurate. More importantly, Model 3b provides the structural form for the multiequation model, as explained in the next section of this article.

The Multiequation Model

The rationale for estimating percentage changes in the CPI with an aggregated component model is that individual components of the CPI inherently may have different coefficients

Table 4d.
Model 4d: The Services Less Energy Component

Estimation Technique: Almon, 4 period lags, second order polynomial
Dependent Variable: %ΔCPI_d
Regression Period: 1/80 -12/87

Independent Variables	Coefficient	Standard Error	t-statistic
DPPI	-0.136744	0.103591	-1.32004
Constant	0.234071	0.719659E-01	3.25253

Distributed Lag Interpretation, %ΔCPI_d

Lag	Coefficient	Standard Error	t-statistic
1 month	0.3745	0.1062	3.528
2 month	0.2074	0.3003E-01	6.907
3 month	0.8923E-01	0.5640E-01	1.582
4 month	0.2010E-01	0.5282E-01	0.3806

Mean Lag: 0.645398 — Standard Error: 0.368663
Sum of Lag Coefficients: 0.691248 — Standard Error: 0.100085

Distributed Lag Interpretation, SHIFT

Lag	Coefficient	Standard Error	t-statistic
1 month	0.5962E-01	0.1249	0.4774
2 month	-0.1505	0.6294E-01	-2.391
3 month	-0.2305	0.6644E-01	-3.469
4 month	-0.1803	0.5445E-01	-3.311

Mean Lag: Not Meaningful — Standard Error: Not Meaningful
Sum of Lag Coefficients: -0.501669 — Standard Error: 0.209795

Number of Observations: 96	R^2: 0.429800
Mean of Dependent Variable: 0.563920	R^2-Adjusted: 0.398122
Standard Error of Regression: 0.371341	Durbin-Watson: 2.114584
Mean Absolute Error: 0.239351	Durbin-Watson(4): 2.240218
Standard Deviation of Mean Absolute Error: 0.270907	Root Mean Squared Error: 0.360427

even though the basic structure for each is the same (based on Model 3b). Thus, the aggregated forecast may be more accurate than the single-equation Model 3b.

In order to create a reasonable component model, this article bases each component on a CPI dependent variable with a corresponding PPI independent variable. The four CPI components chosen are (1) food, (2) energy, (3) commodities less food and energy, and (4) services less energy. The relative importance (weights) figures for these components sum to 100 or the CPI total. For the first three CPI components, the PPI components that basically correspond are

Table 5.
Summary Statistics for February 1980-December 1987

Model	R^2	R^2-Adjusted	Mean Absolute Error	Standard Deviation of Mean Absolute Error	Root Mean Squared Error
Model 1a Traditional with OLS	0.3813	0.3748	0.213476	0.188343	0.284028
Model 1b Traditional with Cochrane-Orcutt	0.4891	0.4836	0.188996	0.164914	0.250259
Model 2 Almon with Lagged Dependent Variable and First Differences in PPI Inflation	0.508627	0.487028	0.185914	0.169281	0.250835
Model 3a Almon for Model 2 with the Addition of Structural Shift Variable (%ΔCPI - %ΔPPI)	0.600898	0.573992	0.166281	0.159465	0.229806
Model 3b Model 3a Using Almon Except for the First Difference Variable	0.547282	0.521849	0.177663	0.155511	0.235570
Model 4 Four Equation Composite Based on Model 3b Specification	0.613312*	N.A.	0.166072	0.142370	0.218256

**Correlation coefficient squared between actual and forecast data.*

(1) finished consumer foods, (2) finished energy goods, and (3) finished consumer goods excluding energy. No PPI series corresponds to the services-less-energy CPI component since the producer price index has no services components. Since this last CPI component has had a large weight in the CPI (growing from about one-third in 1970 to just over one-half in 1987), the use of a multiequation model is even more compelling if only to ferret out the services component.

The first three CPI component series—food, energy, and commodities-less-energy—are modeled exactly after the structure of Model 3b. Each component model's explanatory variables are the appropriate lagged dependent variable and respective PPI components for $DPPI_i$ and $SHIFT_i$, where i is the appropriate component (food, energy, or commodities less food and energy). For the services-less-energy component, the same structure is used except that the $DPPI_i$ and $SHIFT_i$ variables are based on the overall CPI and PPI series. Of course, the lagged dependent variable is the lagged services-less-energy series. For all four equations the previously discussed Almon procedure is used on the lagged dependent variable and on $SHIFT_i$. As in Model 3b, $DPPI_i$ does not have Almon lags. The regression results for these four equations are found in Tables 4a-4d.

For the first three components, the coefficients (including the signs) and t-statistics are similar to those for Model 3b. As expected, the magnitude of various coefficients varies, as does the relative importance of the right-hand variables. For example, the coefficients for $DPPI_i$ for the food and the commodities less food and energy components are relatively low compared to that for the energy component. Hence for these two components, the lagged dependent variables (as indicated by the sum of the lag coefficients) represent the primary explanatory variable, whereas for the energy component the $DPPI_i$ variable is relatively more important. Overall, the summary statistics indicate that these three component models are satisfactory.

For the services-less-energy component, the coefficient sign for *DPPI* is negative instead of positive as the general model relating the PPI to the CPI leads one to expect. However, the lagged dependent variable provides considerable explanatory power in conjunction with the structural shift variable. The lower R^2 and R^2-adjusted for this component model probably result largely from the fact that overall PPI numbers had to be used for $DPPI_i$ and $SHIFT_i$ since no services components exist in the PPI. While the R^2 and R^2-adjusted are still reasonably good, improvements can be made and a different model structure may be more appropriate.[6] However, to maintain consistency, the model structure in Table 4d is retained and is used in the overall aggregate forecast for the CPI.

At this point, the four component forecasts must be aggregated in order to compare forecast accuracy with the single-equation models. Aggregation is based on the standard Bureau of Labor Statistics method as explained by Chester V. McKenzie (1961).

The summary statistics for Model 4 are shown in Table 5 along with the statistics for the other models. As indicated by the absolute and root mean squared errors, the multiequation model forecasts more accurately than the models discussed previously. One might argue that the composite model is only slightly better than Model 3b. Yet, with component forecasts, judgment can be better used to determine if the overall forecast should be lowered or raised. Generally, outside information can more easily be brought to bear on the components of the price indexes than on the entire index. Forecasters might have access to information on the persistence of a disturbance to one of the underlying components of a series. For example, a bad agricultural harvest might have severe effects on the food component of a price index for several quarters but might not be expected to have any permanent effect. This knowledge should therefore lead to an adjustment to that component forecast, rather than to a judgmental adjustment of the entire index.

Although forecasters can use judgment with single-equation models, such tinkering is somewhat cruder. With the single-equation models, one cannot determine which underlying independent component variable may be causing an unusual forecast.

Summary Comparison: In-Sample and Out-of-Sample

Significant improvement in the forecast accuracy of monthly CPI models can be made through improved model specification and disaggregation. Changes in specification lowered the root mean squared error over the period February 1980 through December 1987 from 0.284 for the traditional model to 0.236 for the improved first difference Model 3b. Using a four-equation model with the same specification as Model 3b further lowered the root mean squared error to 0.218. Thus, relatively simple changes in model specification and use of components led to significantly improved forecasts for percentage changes in the monthly consumer price index. However, these numbers reflect an in-sample comparison. A more rigorous comparison would use out-of-sample forecasts. An out-of-sample comparison is simply a comparison of forecast values to actual values for a time period following the period of estimation. An in-sample comparison is a comparison of forecast errors in the same period as the estimation period.

To compare out-of-sample accuracy, identically specified models were re-estimated for the period July 1974 through December 1979. Some producer price series did not start until 1974, and lagged variable needs required that the estimation period begin later in the year. Forecasts were then estimated for the out-of-sample, or *ex-post,* period January 1980 through December 1987. These forecast comparisons are shown in Table 6. Overall errors are higher simply because the forecasts are out-of-sample—

Table 6.
Out-of-Sample Forecast Comparison for the Regression Period July 1974-December 1979
Summary Statistics for the Forecast Period January 1980-December 1987

Model	Correlation Coefficient Squared*	Mean Absolute Error	Standard Deviation of Mean Absolute Error	Root Mean Squared Error
Model 1a Traditional with OLS	0.387242	0.276911	0.183773	0.331814
Model 1b Traditional with Cochrane-Orcutt	0.466024	0.223763	0.175890	0.284050
Model 2 Almon with Lagged Dependent Variable and First Differences in PPI Inflation	0.438596	0.215923	0.185510	0.284039
Model 3a Almon for Model 2 with the Addition of Structural Shift Variable (%ΔCPI - %ΔPPI)	0.483423	0.197599	0.177658	0.265102
Model 3b Model 3a Using Almon Except for the First Difference Variable	0.510342	0.189737	0.174690	0.257292
Model 4 Four Equation Composite Based on Model 3b Specification	0.530937	0.197948	0.162639	0.255655

**Correlation coefficient squared between actual and forecast data. R^2 and R^2-adjusted are not available over the out-of-sample period.*

forecast data are almost always lower when fitted to the same period for which the model is estimated. Yet, with in-sample forecasts, accuracy typically improves as more explanatory variables are added. This effect must be discounted, and an out-of-sample comparison is probably the best method of doing so.

As shown in Table 6, the progression of improvement is nearly identical with the in-sample results except that Model 3b is slightly more accurate than Model 3a, the reverse of results shown in Table 5. The multiequation forecast accuracy is still essentially identical to the best single-equation model. Overall, the improvement in forecast accuracy is quite dramatic. For example, regarding the mean absolute error, the accuracy of Model 4 is about 30 percent greater than that of Model 1a.[7]

Methodology Suggestions

This attempt to improve the monthly CPI model reflects certain methodological considerations regarding the development of monthly economic models in general. First, the decision must be made whether to use an accounting or behavioral forecasting model or perhaps a combination of the two. The primary factor determining the choice is whether component data are available prior to an indicator's release. If they are available, use of an accounting model is more appropriate.

Future CPI models could benefit from revised model specification and estimation technique. Use of simple percentage change or "log-log" models does not automatically ensure a better model specification.[1] Specification should follow actual accounting processes in the definition of an indicator; alternatively, in behavioral models, closer attention ought to be paid to duplicating the way independent and dependent variables are related in actual practice. When considering the estimation technique, at the minimum the serial correlation problem should be addressed since models with significant serial correlation can result in missed turning points, a critical shortcoming, despite such models' accuracy on average over long time periods. Of course, estimation techniques other than ordinary least squares or Cochrane-Orcutt should be considered.

The decision to use a multiequation model involves several considerations, some complex, others straightforward. One issue concerns whether the dependent variable can be separated into major components according to differing behavioral factors. A second consideration is whether independent variables are available for corresponding dependent variable components, or at least a significant portion of them. Relative accuracy is a third consideration. Finally, even if pure econometric multiequation forecasts have no greater accuracy, component analysis may provide insight into forecasting error for judgmental adjustment.

Note

[1] A "log-log" model is one in which the dependent and independent variables are logarithmic transformations of specific data series. Such a model structure is often assumed for generating various types of elasticities.

Notes

[1]The "traditional" model is generally used by money market analysts for relatively quick forecasts. This model specification was also used by Bechter and Pickett (1973).

[2]The inclusion of earlier observations generally increased forecasting accuracy without affecting the relative accuracy of competing models discussed in this paper.

[3]Mean absolute percentage change is used instead of mean percentage change since the former does not take into account declines which offset some increases in the CPI before the average is calculated.

[4]This technique is used to help solve the problem of "overparameterization" that is always present in forecasting economic time series. "Overparameterization" simply means that reality is complicated, and so the ideal forecasting model would allow for many different effects of various variables (observed at different time intervals) on the variable to be forecast. Since relatively few data are available, however, not all these effects can be estimated with any degree of accuracy. One way of overcoming this problem is to place constraints on the way that the variables being used to forecast a series are brought into the model. The Almon lag scheme is one such set of constraints.

[5]Multicollinearity occurs when two or more variables (such as the lagged variables) are highly—but not perfectly—correlated with each other, making it difficult to distinguish their individual influences on changes in the dependent variable.

[6]An alternative approach might be an ARIMA model, but that is outside the scope of this paper.

[7]This figure is the percentage improvement if the Model 4 number is the numerator. If, instead, Model 1a's number is divided by Model 4's, the improvement is roughly 40 percent.

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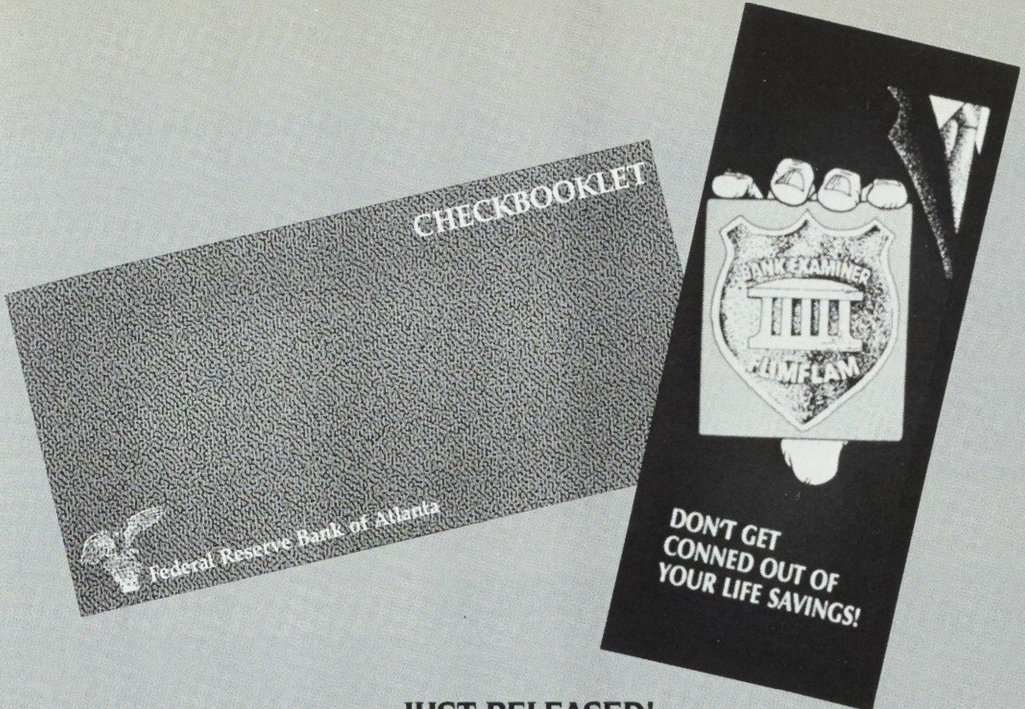

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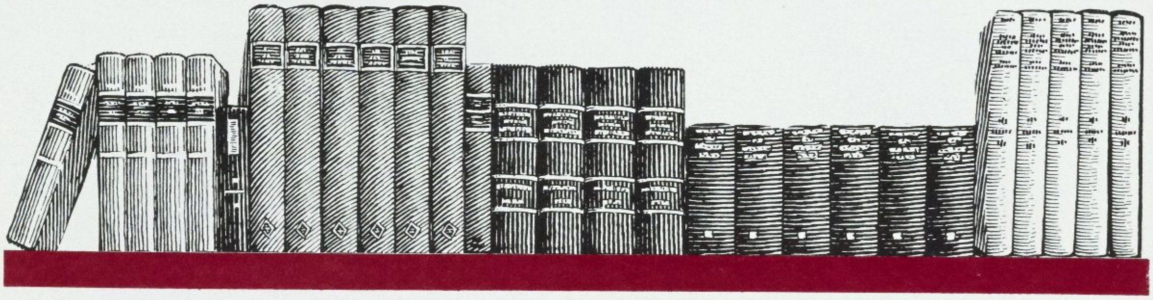
Book Review

Buying into America

by Martin and Susan Tolchin
New York: Times Books, 1988.
400 pages. $19.95.



Foreign investment in the United States is becoming more widespread and significant in value each day. Not only financial assets like U.S. government securities and corporate stocks and bonds but also real assets such as office buildings, manufacturing plants, forestland, and beachfront properties are coming under increased foreign control. In their latest book, *Buying into America,* Martin and Susan Tolchin document and describe the growing scope of these activities, note how defenders of the trend justify this surge of foreign investment, and review the long-term costs that such investments may entail for the nation.

This book has received much publicity, largely because of its wealth of information on a popular topic. Americans are uncertain about the long-run consequences of foreign investment and appear to be growing more apprehensive as the pace of such activity accelerates. One of the authors' stated purposes in writing the book was to heighten awareness and concern over the potentially costly impacts of foreign investment they see for Americans.

Martin and Susan Tolchin form a politically savvy and veteran writing team. He is a correspondent in the Washington bureau of *The New York Times,* and she is a professor of public administration in the School of Government and Business Administration at George Washington University. They seem to have a faculty for writing about topics that touch a public nerve and are in vogue in the politically charged public policy arena. Titles of their previous books—*Dismantling America: The Rush to Deregulate; Clout: Womanpower and Politics;* and *To the Victor: Political Patronage from the Clubhouse to the White House*—demonstrate this bent.

In *Buying into America: How Foreign Money Is Changing the Face of Our Nation,* the husband-wife team concludes that foreign investment in the United States definitely is not without its costs. Tolchin and Tolchin argue that the influx of foreign money into the U.S. economy poses a severe threat to the ability of the United States to control its fate and defend its position as a premier industrial power. Opening paragraphs in the book refer to "mayors, governors and cabinet officers . . . circling the globe in quest of foreign funds, with the intensity of third-world ministers trying to stave off the financial collapse of their shaky governments." Moreover, the authors assert, "under pressure to bring home the bacon, politicians have paid scant attention to the long-run economic, political, and social effects of their country's deepening dependence on foreign money." The Tolchins are, of course, partly right. By adopting a xenophobic tone, however, they divert too much attention away from important macroeconomic issues with greater influences on American society—for example, the low U.S. saving rate and large government budget deficits.

The story told by the Tolchins can be summarized as follows: The United States—government and citizens alike—is spending too much, and foreign lenders are financing the consumption spree. In the process, foreigners are acquiring U.S. financial and real assets so quickly and in such large amounts that they have accumulated significant economic and political clout here. Unless something is done soon to slow or reverse our dependence on foreign money, which has made the United States the world's biggest debtor, Americans are in extreme danger of mortgaging their future and reverting to colonial status. In a nutshell, they argue, America is spending its way into the poorhouse by borrowing for consumption rather than using the funds to expand or develop industrial capacity.

Worse yet, in Tolchin and Tolchin's view, the United States seems to be giving away the proverbial farm with open-door, laissez-faire national trade and investment policies, and state governments are needlessly providing extravagant subsidies to lure foreigners here. Meanwhile, the authors portray foreign businesses and governments—both separately and together—as accelerating this nation's economic and political demise by means of sinister and subversive plots. The writers note, for example, that foreign corporations may try to buy into critical defense-related manufacturing activities to acquire technology; sometimes, foreign governments encourage such activities and may even subsidize unfair competitive practices. National security can, of course, be compromised because of such actions. The authors also point to a moral issue: the openness of the U.S. financial system has encouraged, albeit incidentally, capital flight to the United States from dictators and criminals seeking a safe repository for their ill-gotten gains.

The Tolchins argue persuasively that the significant and fast-growing net-debtor status of the United States should generate concern among its citizens. Reliance on foreign money to finance a consumption binge certainly entails long-run costs in the form of an interest and debt repayment burden that threatens to grow even heavier over the next few years. The authors also assert—with some validity—that competition among states for foreign direct investment has led to excessive subsidies in the form of cheap land, tax holidays, job training, grants, and other breaks. Such competition among state and local governments can be wasteful and cause a cleavage between national and local interests. In instances when the investment would have been made without the inducement, the long-run profitability or benefit to the United States is suboptimal.

While some foreign investment incentives seem questionable, the Tolchins fail to recognize that the jobs, tax revenues, and other benefits that result generally warrant such lures. Moreover, foreign investment may promote economic growth and enhance the ability of domestic industries to compete, thus adding jobs to the host economy. Such investment often brings innovative management techniques and better technology along with new plants or equipment. Local government leaders are keenly aware of these and other benefits; investment may boost employment, improve the community's economic diversity, and support its property and payroll tax base even when investment incentives are provided.

Among the Tolchins' other concerns, national security issues are legitimate. Fortunately, safeguards have already been developed; for example, defense contracts cannot be awarded to firms that are more than 25 percent foreign-owned, and investments in a few sensitive industries are prohibited. As a practical matter, though, determining which industries qualify for safeguard treatment is difficult, suggesting that industrial restrictions should be used sparingly lest certain industries' competitive edge be dulled by insulation and protection.

The Tolchins' other objections to foreign investment stem from their belief that foreigners' interest in the United States derives from a desire to avoid protective tariffs, to acquire new technology, to gain a foothold in the large and affluent U.S. market, or simply to make money. Yet these motivations are not as sinister as the light in which this book casts them; indeed, a prevailing view among economists holds that world resource allocation is improved to the extent that foreign investment is market-driven and lured by the profitability criterion. Once here, foreign investors should want the U.S. economy to operate as profitably and efficiently as possible. What's more, foreigners' efforts to avoid protective tariffs, acquire new technology, and increase market shares are common to virtually all businesses, regardless of their geographical bases, political motivations, or the areas into which expansion is projected.

In *Buying into America*, the Tolchins achieve success in publicizing what they regard as the potential dangers of foreign investment in the United States, thus meeting one of their major goals. Unfortunately, they are not as successful in reaching another major purpose—accurately describing how foreign money is changing the face of our nation. This objective is not met because the Tolchins overstate the dangers of foreign investment and give short shrift to its benefits. This shortcoming of *Buying into America* is particularly reflected in the shotgun approach taken regarding interactions between the United States and the rest of the world. The authors bring up such diverse incidents as clandestine Moscow-directed economic warfare and third-world-initiated money laundering along with open and aboveboard international economic transactions such as foreign corporations' establishment of manufacturing plants in the United States and foreigners' portfolio purchases of U.S. stocks and bonds. Moreover, Tolchin and Tolchin essentially lump these disparate interactions together as *all* being costly to the United States.

The unbalanced treatment of the issues in *Buying into America* is, perhaps, motivated by the authors' strong desire to call attention to the dangers of foreign investment, but they still go too far. Imbalance is also created by confusing consequences with causation: investment often is a response to a problem rather than the root of a problem. For example, if the United States is indeed on a consumption spree, as the Tolchins assert, the condemnation of foreigners who are willing to finance this consumption is neither a practical nor a charitable stance.

In assessing the merits of foreign investment, two fundamental issues need to be addressed. First, an analyst should determine whether foreign investment in the United States is creating wealth or simply redistributing existing wealth. The Tolchins vaguely address this question with loose assertions that long-run "costs" such as profits, interest, dividend, and principal repatriation may outweigh short-term employment gains created by foreign investment. However, *Buying into America* definitely does not attempt to analyze the costs and benefits of foreign investment in a methodologically sound and empirical framework.

A typical example of the type of no-win situation that the Tolchins depict concerns foreign investment in the real estate market. They write that "foreign investors often contribute to soaring real estate prices," but in the same paragraph they state that "foreign investors conduct distress sales that take the bottom out of U.S. real estate markets." The authors also downplay the impact of jobs created by foreign investments while suggesting, incorrectly, that foreigners dominate entire industries; as measured by employment, U.S. affiliates of foreign manufacturers constituted under 8 percent of the work force in 1986 and exceeded 10 percent in only a few industries.

The second important issue to be considered in evaluating foreign investment is whether our relatively receptive and open economic environment is preferred to one with more government intervention in markets involving international activities. The Tolchins' philosophical answer, like protectionists' on the narrower trade issue, is clear: they recommend much greater government intervention via information gathering and control of activities. The Tolchins seem either not to recognize or to ignore the fact that increased government involvement could also generate substantial costs for our economic system in the form of inefficiencies.

Beyond the direct costs associated with increased U.S. government surveillance and intervention, potentially large costs to the private sector might also ensue from the adoption of measures that restrict capital flows. Official U.S. balance of payments statistics for 1987 show that the flow of foreign direct investment (for property, plant, and equipment) to the United States was $41.5 billion during 1987, but U.S. companies did even more direct investment abroad ($49.3 billion). Moreover, the stock of U.S. direct investment abroad is much larger than what foreigners own here as a result of large U.S. outflows during the past several decades.

Foreign Investment: The Tolchins' Myths, Costs, and Recommendations

Recitation of the Tolchins' nine "myths" of foreign investment is daunting, and their list of major potential economic and political costs of foreign investment is frightening. So, too, for that matter, are many of their recommendations.

For the Tolchins, the perpetuation of the following myths is the real problem because they engender a paralyzing resistance to changes in public policy:

- foreign capital will help America rebuild its industrial capacity;
- foreign investment is separate from trade policy;
- investment policy exists apart from foreign policy;
- foreign investments are a sign of America's economic health;
- money is neutral, not political, and investors are interested in profit, not power;
- U.S. policymakers and the American people have enough information on which to base intelligent decisions;
- no changes are needed in the current U.S. laissez-faire policy toward foreign investment;
- foreign investment and free trade are the same thing; and
- foreign investment helps American business.

The writers suggest that each of the following cost items entails a significant offset to the limited job-creating benefits of foreign investment:

- U.S. political and economic independence is lost;
- foreign corporations eliminate U.S. industrial competition with peremptory strikes;
- states give foreign investors extravagant concessions;
- foreign corporations are antagonistic to U.S. workers' unionization rights; and
- foreign investment will eventually worsen U.S. budget and trade deficits.

The Tolchin solution to the challenge of foreign investment is a much-expanded role for the U.S. government in monitoring and controlling international economic transactions. Government must:

- shield citizens from the negative impact of foreign investment and assert some control over its future direction;
- require a policy of full disclosure of foreigners' investments in this nation;
- identify the benefits of foreign investment and reinforce state efforts to maximize those benefits;
- study the points at which foreign investment weakens U.S. national security and take measures to limit those investments;
- take a hard look at foreign investors as employers and identify their shortcomings along with their strengths;
- control foreign investment when it is inimical to American business or American interests;
- recognize the U.S. bargaining position and negotiate from strength; and
- demand a level playing field and reciprocity abroad.

The most severe shortcoming of this book, though, is that it is anecdotal (and repetitive at that) rather than analytical. How foreign money is changing the face of our nation is an important topic for research. Careful analysis, however, is required to determine the ways in which this change is taking place. Moreover, important distinctions should be made when discussing the topic of foreign investment. Taking these distinctions into account and employing an analytical framework would produce a much more useful, and less polemical, product.

Specifically, it is crucial from an economic perspective to distinguish foreign portfolio investment, which may be an accommodating consequence of U.S. budget and trade deficits, from foreign direct investment in real assets. An appropriate discussion would reflect on the causes and consequences of direct versus portfolio investment and include some quantitative estimation of the macroeconomic impacts of the different types of capital flows. Clearly, the employment effect of a foreign auto manufacturer locating an assembly plant in this country is much different from that of a foreign pension fund's purchase of the federal government's latest bond issue. Furthermore, neither of these activities bears much resemblance to nefarious international transactions in terms of political or social effects.

The intrusion of foreign money into an economy is not a new issue. In light of this fact, an appropriate stance on the part of the United States and other countries receiving foreign investment would be to realize that the world is increasingly interdependent and that, while interdependency has its costs, its benefits are often much better.

William J. Kahley

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FINANCE

$ millions	JUL 1988	JUN 1988	MAY 1988	JUL 1987	JUN 1987	MAY 1987	ANN % CHG (*)
UNITED STATES							
Commercial Bank Deposits	1,818,838	1,809,405	1,779,243	1,694,997	1,678,133	1,660,331	+ 7
Demand	380,672	372,675	358,816	369,381	359,026	351,237	+ 3
NOW	172,739	173,784	170,359	155,256	155,818	152,850	+11
Savings	524,239	522,873	513,614	510,573	511,724	509,119	+ 3
Time	794,253	787,501	780,451	691,733	687,310	678,900	+15
SOUTHEAST							
Commercial Bank Deposits	219,005	218,949	215,993	201,150	201,102	199,066	+ 9
Demand	41,635	42,668	41,032	40,767	40,994	40,350	+ 2
NOW	24,005	24,251	23,722	21,785	22,025	21,759	+10
Savings	58,503	58,560	57,959	57,326	57,745	57,643	+ 2
Time	99,751	98,453	97,547	84,934	84,135	83,016	+17
ALABAMA							
Commercial Bank Deposits	22,486	22,372	21,914	20,405	20,352	19,954	+10
Demand	4,099	4,245	3,999	4,041	4,102	4,025	+ 1
NOW	2,609	2,587	2,523	2,146	2,148	2,102	+22
Savings	4,840	4,895	4,813	4,606	4,623	4,579	+ 5
Time	11,474	11,228	11,057	9,978	9,885	9,700	+15
FLORIDA							
Commercial Bank Deposits	86,558	86,648	85,312	78,403	78,387	77,652	+10
Demand	16,163	16,506	16,081	15,824	16,009	15,825	+ 2
NOW	10,734	10,946	10,728	9,860	10,015	9,917	+ 9
Savings	27,266	27,413	21,137	26,933	27,061	26,908	+ 1
Time	34,264	33,581	33,055	27,327	26,900	26,523	+25
GEORGIA							
Commercial Bank Deposits	35,986	35,884	32,254	32,403	32,265	31,827	+11
Demand	9,013	9,194	8,655	8,568	8,545	8,303	+ 5
NOW	3,419	3,407	3,310	3,088	3,097	3,077	+11
Savings	9,370	9,328	9,189	8,873	8,972	8,963	+ 6
Time	15,993	15,689	15,584	13,246	13,040	12,730	+21
LOUISIANA							
Commercial Bank Deposits	28,089	28,145	28,089	27,187	27,309	27,404	+ 3
Demand	5,008	5,123	5,002	4,961	4,963	4,931	+ 1
NOW	2,389	2,403	2,392	2,218	2,250	2,221	+ 8
Savings	8,090	8,033	8,032	7,898	7,955	7,980	+ 2
Time	13,070	13,069	13,069	12,475	12,488	12,626	+ 5
MISSISSIPPI							
Commercial Bank Deposits	15,175	15,200	15,054	13,973	14,145	14,034	+ 9
Demand	2,429	2,433	2,350	2,338	2,357	2,338	+ 4
NOW	1,568	1,546	1,536	1,400	1,398	1,400	+11
Savings	2,990	2,991	2,972	3,028	3,066	3,102	- 1
Time	8,520	8,571	8,472	7,426	7,507	7,416	+15
TENNESSEE							
Commercial Bank Deposits	30,711	30,700	30,370	28,779	28,644	28,189	+ 7
Demand	5,032	5,167	4,945	5,035	5,018	4,928	- 0
NOW	3,294	3,362	3,233	3,073	3,117	3,042	+ 7
Savings	5,947	5,900	5,816	5,988	6,068	6,039	- 1
Time	16,430	16,315	16,310	14,482	14,315	14,021	+13

NOTES: All deposit data are extracted from the Federal Reserve Report of Transaction Accounts, other Deposits and Vault Cash (FR2900), and are reported for the average of the week ending the first Monday of the month. Most recent data, reported institutions with over $30 million in deposits and $3.2 million of reserve requirements as of December 1987, represents 95 percent of deposits in the six-state area. The major differences between this report and the "call report" are size, the treatment of interbank deposits, and the treatment of float. The total deposit data generated from the Report of Transaction Accounts eliminates interbank deposits by reporting the net of deposits "due to" and "due from" other depository institutions. The Report of Transaction Accounts subtracts cash in process of collection from demand deposits, while the call report does not. The Southeast data represent the total of the six states. Subcategories were chosen on a selective basis and do not add to total. P = preliminary. * = Most recent month vs. year-ago month.

FINANCE

$ millions	AUG 1988	JUL 1988	JUN 1988	AUG 1987	JUL 1987	JUN 1987	ANN % CHG (*)
UNITED STATES							
Commercial Bank Deposits	1,817,963	1,818,838	1,809,405	1,677,766	1,694,997	1,678,133	+ 8
Demand	360,672	380,672	372,675	354,979	369,381	359,026	+ 2
NOW	171,527	172,739	173,784	153,372	155,256	155,818	+12
Savings	522,596	524,239	522,873	508,633	510,573	511,724	+ 3
Time	806,054	794,253	787,501	697,147	691,733	687,310	+16
SOUTHEAST							
Commercial Bank Deposits	219,940	219,005	218,949	200,839	201,150	201,102	+10
Demand	40,694	41,635	42,668	39,435	40,767	40,994	+ 3
NOW	23,837	24,005	24,251	21,384	21,785	22,025	+11
Savings	58,405	58,503	58,560	57,385	57,326	57,745	+ 2
Time	101,189	99,751	98,453	86,512	84,934	84,135	+17
ALABAMA							
Commercial Bank Deposits	22,606	22,486	22,372	20,200	20,405	20,352	+12
Demand	4,003	4,099	4,245	3,923	4,041	4,102	+ 2
NOW	2,619	2,609	2,587	2,131	2,146	2,148	+23
Savings	4,828	4,840	4,895	4,582	4,606	4,623	+ 5
Time	11,628	11,474	11,228	9,926	9,978	9,885	+17
FLORIDA							
Commercial Bank Deposits	86,737	86,558	86,648	78,889	78,403	78,387	+10
Demand	15,562	16,163	16,506	15,134	15,824	16,009	+ 3
NOW	10,596	10,734	10,946	9,681	9,860	10,015	+ 9
Savings	27,175	27,266	27,413	27,232	26,933	27,061	- 0
Time	34,787	34,264	33,581	28,373	27,327	26,900	+23
GEORGIA							
Commercial Bank Deposits	36,614	35,986	35,884	32,157	32,403	32,265	+14
Demand	8,879	9,013	9,194	8,481	8,568	8,545	+ 5
NOW	3,407	3,419	3,407	3,021	3,088	3,097	+13
Savings	9,344	9,370	9,328	8,790	8,873	8,972	+ 6
Time	16,563	15,993	15,689	13,328	13,246	13,040	+24
LOUISIANA							
Commercial Bank Deposits	28,087	28,089	28,145	26,986	27,187	27,309	+ 4
Demand	4,953	5,008	5,123	4,738	4,961	4,963	+ 5
NOW	2,391	2,389	2,403	2,176	2,218	2,250	+10
Savings	8,087	8,090	8,033	7,887	7,898	7,955	+ 3
Time	13,125	13,070	13,069	12,556	12,475	12,488	+ 5
MISSISSIPPI							
Commercial Bank Deposits	15,168	15,175	15,200	14,014	13,973	14,145	+ 8
Demand	2,320	2,429	2,433	2,279	2,338	2,357	+ 2
NOW	1,560	1,568	1,546	1,400	1,400	1,398	+11
Savings	2,972	2,990	2,991	3,013	3,028	3,066	- 1
Time	8,578	8,520	8,571	7,553	7,426	7,507	+14
TENNESSEE							
Commercial Bank Deposits	30,728	30,711	30,700	28,593	28,779	28,644	+ 7
Demand	4,868	5,032	5,167	4,880	5,035	5,018	- 0
NOW	3,256	3,294	3,362	2,975	3,073	3,117	+ 9
Savings	5,994	5,947	5,900	5,881	5,988	6,068	+ 2
Time	16,508	16,430	16,315	14,776	14,482	14,315	+12

NOTES: All deposit data are extracted from the Federal Reserve Report of Transaction Accounts, other Deposits and Vault Cash (FR2900), and are reported for the average of the week ending the first Monday of the month. Most recent data, reported institutions with over $30 million in deposits and $3.2 million of reserve requirements as of December 1987, represents 95 percent of deposits in the six-state area. The major differences between this report and the "call report" are size, the treatment of interbank deposits, and the treatment of float. The total deposit data generated from the Report of Transaction Accounts eliminates interbank deposits by reporting the net of deposits "due to" and "due from" other depository institutions. The Report of Transaction Accounts subtracts cash in process of collection from demand deposits, while the call report does not. The Southeast data represent the total of the six states. Subcategories were chosen on a selective basis and do not add to total. P = preliminary.
* = Most recent month vs. year-ago month.

EMPLOYMENT

	MAY 1988	APR 1988	MAY 1987	ANN % CHG		MAY 1988	APR 1988	MAY 1987	ANN % CHG
UNITED STATES									
Civilian Labor Force - thous.	120,775	120,264	119,695	+ 1	Nonfarm Employment - thous.	105,969	105,744	102,268	+ 4
Total Employed - thous.	114,222	113,905	112,377	+ 2	Manufacturing	19,445	19,370	18,926	+ 3
Total Unemployed - thous.	6,553	6,359	7,318	-10	Construction	5,290	5,083	5,012	+ 5
					Trade	25,235	24,383	24,248	+ 4
Unemployment Rate - % SA	5.6	5.3	6.1		Government	17,696	17,658	17,303	+ 2
					Services	25,358	25,231	24,170	+ 5
Mfg. Avg. Wkly. Hours	40.9	41.0	40.9	0	Fin., Ins. & Real Est.	6,651	6,627	6,539	+ 2
Mfg. Avg. Wkly. Earn. - $	415	415	404	+ 3	Trans., Com. & Pub. Util.	5,561	5,510	5,358	+ 1
SOUTHEAST									
Civilian Labor Force - thous.	16,542	16,307	16,327	+ 1	Nonfarm Employment - thous.	13,864	13,842	13,467	+ 3
Total Employed - thous.	15,536	15,363	15,227	+ 2	Manufacturing	2,385	2,382	2,349	+ 2
Total Unemployed - thous.	1,006	1,025	1,131	-11	Construction	789	784	777	+ 2
					Trade	3,457	3,447	3,355	+ 3
Unemployment Rate - % SA	6.4	6.4	6.6		Government	2,428	2,426	2,361	+ 3
					Services	3,122	3,122	2,979	+ 4
Mfg. Avg. Wkly. Hours	41.1	41.2	41.1	0	Fin., Ins. & Real Est.	822	822	803	+ 2
Mfg. Avg. Wkly. Earn. - $	369	367	361	+ 2	Trans., Com. & Pub. Util.	764	763	746	+ 2
ALABAMA									
Civilian Labor Force - thous.	1,862	1,846	1,894	- 2	Nonfarm Employment - thous.	1,527	1,520	1,505	+ 1
Total Employed - thous.	1,720	1,720	1,752	- 2	Manufacturing	374	372	367	+ 2
Total Unemployed - thous.	126	126	142	-11	Construction	75	73	74	+ 1
					Trade	337	334	332	+ 2
Unemployment Rate - % SA	7.4	7.4	8.1		Government	305	304	302	+ 1
					Services	282	282	274	+ 3
Mfg. Avg. Wkly. Hours	41.0	41.0	41.2	- 0	Fin., Ins. & Real Est.	70	70	71	- 1
Mfg. Avg. Wkly. Earn. - $	368	288	359	+ 3	Trans., Com. & Pub. Util.	73	72	73	0
FLORIDA									
Civilian Labor Force - thous.	6,104	6,035	5,879	+ 4	Nonfarm Employment - thous.	5,094	5,096	4,835	+ 5
Total Employed - thous.	5,816	5,731	5,581	+ 4	Manufacturing	541	541	528	+ 2
Total Unemployed - thous.	288	304	313	- 8	Construction	349	346	338	+ 2
					Trade	1,389	1,391	1,309	+ 3
Unemployment Rate - % SA	5.0	5.3	5.0		Government	782	778	738	+ 6
					Services	1,393	1,398	1,300	+ 7
Mfg. Avg. Wkly. Hours	40.9	40.7	40.8	+ 0	Fin., Ins. & Real Est.	369	370	359	+ 3
Mfg. Avg. Wkly. Earn. - $	339	335	331	+ 2	Trans., Com. & Pub. Util.	262	262	255	+ 3
GEORGIA									
Civilian Labor Force - thous.	3,144	3,089	3,089	+ 2	Nonfarm Employment - thous.	2,793	2,788	2,764	+ 1
Total Employed - thous.	2,953	2,907	2,937	+ 1	Manufacturing	570	570	571	- 0
Total Unemployed - thous.	191	182	151	+26	Construction	149	149	150	- 1
					Trade	693	690	691	+ 0
Unemployment Rate - % SA	6.2	6.2	5.7		Government	490	489	481	+ 2
					Services	550	549	535	+ 3
Mfg. Avg. Wkly. Hours	41.1	41.3	41.7	- 1	Fin., Ins. & Real Est.	156	156	155	+ 1
Mfg. Avg. Wkly. Earn. - $	356	357	352	+ 1	Trans., Com. & Pub. Util.	177	176	174	+ 1
LOUISIANA									
Civilian Labor Force - thous.	1,908	1,889	1,982	- 4	Nonfarm Employment - thous.	1,498	1,496	1,487	+ 1
Total Employed - thous.	1,687	1,687	1,734	- 3	Manufacturing	168	168	163	+ 3
Total Unemployed - thous.	202	203	248	-19	Construction	82	82	82	0
					Trade	363	361	361	+ 1
Unemployment Rate - % SA	10.8	10.7	12.7		Government	313	314	317	- 1
					Services	329	328	320	+ 3
Mfg. Avg. Wkly. Hours	42.0	42.6	41.7	+ 1	Fin., Ins. & Real Est.	85	85	85	0
Mfg. Avg. Wkly. Earn. - $	467	467	458	+ 2	Trans., Com. & Pub. Util.	104	104	103	+ 1
MISSISSIPPI									
Civilian Labor Force - thous.	1,156	1,153	1,156	0	Nonfarm Employment - thous.	888	886	865	+ 3
Total Employed - thous.	1,075	1,069	1,041	+ 3	Manufacturing	233	233	227	+ 3
Total Unemployed - thous.	81	84	115	-30	Construction	34	33	34	0
					Trade	190	187	186	+ 2
Unemployment Rate - % SA	7.2	7.6	10.1		Government	199	200	193	+ 3
					Services	143	143	139	+ 3
Mfg. Avg. Wkly. Hours	40.0	39.9	39.9	+ 0	Fin., Ins. & Real Est.	39	39	38	+ 3
Mfg. Avg. Wkly. Earn. - $	313	312	301	+ 4	Trans., Com. & Pub. Util.	43	43	42	+ 2
TENNESSEE									
Civilian Labor Force - thous.	2,378	2,374	2,328	+ 2	Nonfarm Employment - thous.	2,064	2,057	2,011	+ 3
Total Employed - thous.	2,259	2,249	2,181	+ 4	Manufacturing	499	498	496	+ 1
Total Unemployed - thous.	120	125	147	-18	Construction	100	100	98	+ 2
					Trade	485	481	475	+ 2
Unemployment Rate - % SA	5.4	5.8	6.5		Government	340	341	330	+ 3
					Services	425	422	411	+ 3
Mfg. Avg. Wkly. Hours	41.6	41.8	41.3	+ 1	Fin., Ins. & Real Est.	102	102	96	+ 6
Mfg. Avg. Wkly. Earn. - $	369	370	364	+ 1	Trans., Com. & Pub. Util.	106	106	99	+ 7

NOTES: All labor force data are from Bureau of Labor Statistics reports supplied by state agencies. Only the unemployment rate data are seasonally adjusted. The Southeast data represent the total of the six states.

EMPLOYMENT

	JUN 1988	MAY 1988	JUN 1987	ANN % CHG		JUN 1988	MAY 1988	JUN 1987	ANN % CHG
UNITED STATES									
Civilian Labor Force - thous.	123,028	120,775	119,517	+ 3	Nonfarm Employment - thous.	106,709	105,969	102,910	+ 4
Total Employed - thous.	116,209	114,222	113,498	+ 2	Manufacturing	19,642	19,445	19,091	+ 3
Total Unemployed - thous.	6,819	6,553	7,655	-11	Construction	5,495	5,290	5,176	+ 6
					Trade	25,529	25,235	24,518	+ 4
Unemployment Rate - % SA	5.3	5.6	6.1		Government	17,363	17,696	17,051	+ 2
					Services	25,593	25,358	24,341	+ 5
Mfg. Avg. Wkly. Hours	41.1	40.9	41.1	0	Fin., Ins. & Real Est.	6,729	6,651	6,616	+ 2
Mfg. Avg. Wkly. Earn. - $	418	415	406	+ 3	Trans., Com. & Pub. Util.	5,615	5,561	5,398	+ 4
SOUTHEAST									
Civilian Labor Force - thous.	16,592	16,542	16,408	+ 1	Nonfarm Employment - thous.	13,878	13,864	13,482	+ 3
Total Employed - thous.	15,544	15,536	15,248	+ 2	Manufacturing	2,393	2,385	2,363	+ 1
Total Unemployed - thous.	1,047	1,006	1,190	-18	Construction	796	789	785	+ 1
					Trade	3,457	3,457	3,368	+ 3
Unemployment Rate - % SA	6.1	6.4	6.6		Government	2,401	2,428	2,311	+ 4
					Services	3,135	3,122	2,995	+ 5
Mfg. Avg. Wkly. Hours	41.6	41.1	41.4	+ 0	Fin., Ins. & Real Est.	827	822	812	+ 2
Mfg. Avg. Wkly. Earn. - $	373	369	362	+ 3	Trans., Com. & Pub. Util.	768	764	751	+ 2
ALABAMA									
Civilian Labor Force - thous.	1,875	1,862	1,913	- 2	Nonfarm Employment - thous.	1,542	1,527	1,507	+ 2
Total Employed - thous.	1,736	1,720	1,770	- 2	Manufacturing	378	374	370	+ 2
Total Unemployed - thous.	128	126	143	-10	Construction	77	75	76	+ 1
					Trade	339	337	334	+ 2
Unemployment Rate - % SA	7.0	7.4	7.8		Government	310	305	295	+ 5
					Services	283	282	277	+ 2
Mfg. Avg. Wkly. Hours	41.4	41.0	41.6	- 0	Fin., Ins. & Real Est.	71	70	71	0
Mfg. Avg. Wkly. Earn. - $	370	368	363	+ 2	Trans., Com. & Pub. Util.	73	73	73	0
FLORIDA									
Civilian Labor Force - thous.	6,142	6,104	5,883	+ 4	Nonfarm Employment - thous.	5,083	5,094	4,841	+ 5
Total Employed - thous.	5,847	5,816	5,570	+ 5	Manufacturing	540	541	530	+ 2
Total Unemployed - thous.	295	288	313	- 6	Construction	351	349	342	+ 3
					Trade	1,384	1,389	1,309	+ 6
Unemployment Rate - % SA	4.6	5.0	5.0		Government	771	782	726	+ 6
					Services	1,395	1,393	1,307	+ 7
Mfg. Avg. Wkly. Hours	41.0	40.9	41.1	- 0	Fin., Ins. & Real Est.	371	369	363	+ 2
Mfg. Avg. Wkly. Earn. - $	343	339	333	+ 3	Trans., Com. & Pub. Util.	262	262	256	+ 2
GEORGIA									
Civilian Labor Force - thous.	3,147	3,144	3,101	+ 1	Nonfarm Employment - thous.	2,801	2,793	2,780	+ 1
Total Employed - thous.	2,948	2,953	2,924	+ 1	Manufacturing	570	570	572	- 0
Total Unemployed - thous.	199	191	177	+12	Construction	151	149	152	- 0
					Trade	695	693	696	- 0
Unemployment Rate - % SA	6.1	6.2	5.0		Government	487	490	478	+ 2
					Services	556	550	541	+ 3
Mfg. Avg. Wkly. Hours	41.4	41.1	42.3	- 2	Fin., Ins. & Real Est.	157	156	157	0
Mfg. Avg. Wkly. Earn. - $	357	356	358	- 0	Trans., Com. & Pub. Util.	177	177	175	+ 1
LOUISIANA									
Civilian Labor Force - thous.	1,925	1,908	1,990	- 3	Nonfarm Employment - thous.	1,498	1,498	1,483	+ 1
Total Employed - thous.	1,699	1,687	1,739	- 2	Manufacturing	169	168	164	+ 3
Total Unemployed - thous.	202	202	281	-28	Construction	82	82	81	+ 1
					Trade	364	363	364	+ 0
Unemployment Rate - % SA	10.2	10.8	10.9		Government	311	313	309	- 1
					Services	329	329	320	+ 3
Mfg. Avg. Wkly. Hours	42.9	42.0	41.5	+ 3	Fin., Ins. & Real Est.	85	85	86	- 1
Mfg. Avg. Wkly. Earn. - $	474	467	450	+ 5	Trans., Com. & Pub. Util.	105	104	104	+ 1
MISSISSIPPI									
Civilian Labor Force - thous.	1,149	1,156	1,168	- 2	Nonfarm Employment - thous.	884	888	861	+ 3
Total Employed - thous.	1,059	1,075	1,044	+ 1	Manufacturing	235	233	229	+ 3
Total Unemployed - thous.	90	81	123	-27	Construction	35	34	35	0
					Trade	191	190	187	+ 2
Unemployment Rate - % SA	7.4	7.2	10.0		Government	189	199	184	+ 3
					Services	145	143	139	+ 4
Mfg. Avg. Wkly. Hours	40.7	40.0	40.2	+ 1	Fin., Ins. & Real Est.	39	39	39	0
Mfg. Avg. Wkly. Earn. - $	319	313	304	+ 5	Trans., Com. & Pub. Util.	43	43	42	+ 2
TENNESSEE									
Civilian Labor Force - thous.	2,365	2,378	2,354	+ 1	Nonfarm Employment - thous.	2,068	2,064	2,011	+ 3
Total Employed - thous.	2,237	2,259	2,201	+ 5	Manufacturing	502	499	498	+ 1
Total Unemployed - thous.	127	120	153	-17	Construction	102	100	99	+ 2
					Trade	481	485	480	+ 2
Unemployment Rate - % SA	5.4	5.4	6.7		Government	333	340	319	+ 3
					Services	428	425	412	+ 3
Mfg. Avg. Wkly. Hours	41.9	41.6	41.7	+ 1	Fin., Ins. & Real Est.	104	102	97	+ 6
Mfg. Avg. Wkly. Earn. - $	374	369	367	+ 2	Trans., Com. & Pub. Util.	107	106	99	+ 7

NOTES: All labor force data are from Bureau of Labor Statistics reports supplied by state agencies. Only the unemployment rate data are seasonally adjusted. The Southeast data represent the total of the six states.

CONSTRUCTION

12-month cumulative rate

UNITED STATES

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	50,437	50,200	47,289	+ 7
Industrial Bldgs.	7,143	7,232	8,250	-13
Offices	13,045	12,985	13,840	- 6
Stores	13,400	13,363	12,095	+11
Hospitals	2,335	2,229	2,449	- 5
Schools	1,081	1,092	1,192	- 9

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	93,892	93,196	96,230	- 2
Residential Permits - Thous.				
Single-family units	995.6	1007.2	1069.4	- 7
Multifamily units	460.6	462.0	589.2	-22
Total Building Permits Value - $ Mil.	141,036	140,102	143,530	- 2

SOUTHEAST

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	7,751	7,780	7,787	- 0
Industrial Bldgs.	809	814	1,058	- 24
Offices	1,869	1,911	1,868	+ 0
Stores	2,426	2,417	2,412	+ 1
Hospitals	507	495	416	+ 22
Schools	261	264	146	+ 79

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	15,651	15,557	15,765	- 1
Residential Permits - Thous.				
Single-family units	201.9	202.4	205.4	- 2
Multifamily units	102.8	100.9	120.6	-15
Total Building Permits Value - $ Mil.	23,374	23,336	23,513	- 1

ALABAMA

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	493	511	570	- 14
Industrial Bldgs.	23	22	67	- 66
Offices	158	161	169	- 7
Stores	175	189	185	- 5
Hospitals	16	16	13	+ 23
Schools	24	22	21	+ 14

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	606	601	667	- 9
Residential Permits - Thous.				
Single-family units	9.9	10.0	11.0	-10
Multifamily units	3.4	3.3	6.1	-44
Total Building Permits Value - $ Mil.	1,099	1,112	1,237	-11

FLORIDA

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	3,723	3,702	3,752	- 1
Industrial Bldgs.	361	369	399	- 10
Offices	815	821	841	- 3
Stores	1,062	1,057	1,154	- 8
Hospitals	193	182	288	- 33
Schools	95	96	34	+179

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	8,968	8,944	8,772	+ 2
Residential Permits - Thous.				
Single-family units	113.8	115.4	108.3	+ 5
Multifamily units	71.4	70.9	78.3	- 9
Total Building Permits Value - $ Mil.	12,691	12,647	12,523	+ 1

GEORGIA

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	1,905	1,950	1,787	+ 7
Industrial Bldgs.	244	245	310	- 21
Offices	545	580	446	+ 22
Stores	588	578	548	+ 7
Hospitals	123	123	20	+515
Schools	101	103	42	+140

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	3,665	3,610	3,613	+ 1
Residential Permits - Thous.				
Single-family units	45.5	46.8	49.5	- 8
Multifamily units	18.8	18.3	19.8	- 5
Total Building Permits Value - $ Mil.	5,570	5,560	5,400	+ 3

LOUISIANA

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	358	368	445	- 20
Industrial Bldgs.	15	16	37	- 58
Offices	61	62	91	- 33
Stores	157	161	135	+ 16
Hospitals	106	106	34	+212
Schools	9	12	36	- 75

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	389	396	361	+ 8
Residential Permits - Thous.				
Single-family units	6.1	6.4	7.3	-16
Multifamily units	0.5	0.5	1.7	-71
Total Building Permits Value - $ Mil.	747	764	884	-15

MISSISSIPPI

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	219	224	233	- 6
Industrial Bldgs.	29	28	22	+ 32
Offices	52	56	55	- 5
Stores	61	63	81	- 25
Hospitals	17	16	24	- 29
Schools	13	12	8	+ 63

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	285	286	320	-11
Residential Permits - Thous.				
Single-family units	4.7	4.8	5.3	-11
Multifamily units	1.4	1.1	1.7	-18
Total Building Permits Value - $ Mil.	504	510	553	- 9

TENNESSEE

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Nonresidential Building Permits - $ Mil.				
Total Nonresidential	1,054	1,024	1,001	+ 5
Industrial Bldgs.	136	133	223	- 39
Offices	239	231	267	- 10
Stores	384	368	308	+ 25
Hospitals	53	52	37	+ 43
Schools	19	19	6	+217

	MAY 1988	APR 1988	MAY 1987	ANN % CHG
Residential Building Permits Value - $ Mil.	1,738	1,719	1,915	- 9
Residential Permits - Thous.				
Single-family units	21.9	22.0	23.6	- 7
Multifamily units	7.2	6.8	13.0	-45
Total Building Permits Value - $ Mil.	2,763	2,743	2,916	- 5

NOTES: Data supplied by the U.S. Bureau of the Census, Housing Units Authorized By Building Permits and Public Contracts, C-40. Nonresidential data exclude the cost of construction for publicly owned buildings. The Southeast data represent the total of the six states.

CONSTRUCTION

12-month cumulative rate	JUN 1988	MAY 1988	JUN 1987	ANN % CHG		JUN 1988	MAY 1988	JUN 1987	ANN % CHG
UNITED STATES									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	50,612	50,437	47,747	+ 6	Value - $ Mil.	94,377	93,892	96,733	- 2
Industrial Bldgs.	7,323	7,143	8,127	- 10	Residential Permits - Thous.				
Offices	12,773	13,045	14,071	- 9	Single-family units	992.1	995.6	1068.8	- 7
Stores	13,679	13,400	12,230	+ 12	Multifamily units	462.5	460.6	572.1	-19
Hospitals	2,315	2,335	2,531	- 8	Total Building Permits				
Schools	1,079	1,081	1,204	- 10	Value - $ Mil.	141,697	141,036	144,481	- 2
SOUTHEAST									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	7,743	7,751	7,836	- 1	Value - $ Mil.	15,692	15,651	15,882	- 1
Industrial Bldgs.	777	809	1,050	- 26	Residential Permits - Thous.				
Offices	1,891	1,869	1,833	+ 3	Single-family units	200.5	201.9	207.1	- 3
Stores	2,469	2,426	2,428	+ 2	Multifamily units	106.0	102.8	115.0	- 8
Hospitals	484	507	436	+ 11	Total Building Permits				
Schools	237	261	174	+ 36	Value - $ Mil.	23,406	23,374	23,567	- 1
ALABAMA									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	508	493	566	- 10	Value - $ Mil.	588	606	685	-14
Industrial Bldgs.	22	23	59	- 63	Residential Permits - Thous.				
Offices	175	158	166	+ 5	Single-family units	9.9	9.9	10.9	- 9
Stores	177	175	185	- 4	Multifamily units	2.8	3.4	6.5	-57
Hospitals	14	16	14	0	Total Building Permits				
Schools	18	24	26	- 31	Value - $ Mil.	1,097	1,099	1,252	-12
FLORIDA									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	3,689	3,723	3,776	- 2	Value - $ Mil.	9,008	8,968	8,934	+ 1
Industrial Bldgs.	333	361	426	- 22	Residential Permits - Thous.				
Offices	816	815	814	+ 0	Single-family units	112.7	113.8	111.1	+ 1
Stores	1,062	1,062	1,167	- 9	Multifamily units	74.9	71.4	73.4	+ 2
Hospitals	173	193	302	- 43	Total Building Permits				
Schools	97	95	36	+169	Value - $ Mil.	12,698	12,691	12,710	- 0
GEORGIA									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	1,916	1,905	1,792	+ 7	Value - $ Mil.	3,682	3,665	3,555	+ 4
Industrial Bldgs.	252	244	276	- 9	Residential Permits - Thous.				
Offices	551	545	440	+ 25	Single-family units	45.3	45.5	48.9	- 7
Stores	613	588	548	+ 12	Multifamily units	18.6	18.8	19.8	- 6
Hospitals	124	123	20	+520	Total Building Permits				
Schools	83	101	60	+ 38	Value - $ Mil.	5,599	5,570	5,346	+ 5
LOUISIANA									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	354	358	453	- 22	Value - $ Mil.	385	389	480	-20
Industrial Bldgs.	22	15	37	- 40	Residential Permits - Thous.				
Offices	60	61	92	- 35	Single-family units	5.9	6.1	7.4	-20
Stores	146	157	143	+ 2	Multifamily units	0.9	0.5	1.7	-47
Hospitals	105	106	34	+209	Total Building Permits				
Schools	9	9	35	- 74	Value - $ Mil.	739	747	894	-17
MISSISSIPPI									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	219	219	237	- 8	Value - $ Mil.	293	285	320	- 8
Industrial Bldgs.	23	29	31	- 26	Residential Permits - Thous.				
Offices	54	52	55	- 2	Single-family units	4.7	4.7	5.3	-11
Stores	64	61	75	- 15	Multifamily units	1.8	1.4	1.5	+20
Hospitals	19	17	24	- 21	Total Building Permits				
Schools	13	13	9	+ 44	Value - $ Mil.	512	504	558	- 8
TENNESSEE									
Nonresidential Building Permits - $ Mil.					Residential Building Permits				
Total Nonresidential	1,057	1,054	1,012	+ 4	Value - $ Mil.	1,735	1,738	1,907	- 9
Industrial Bldgs.	124	136	221	- 44	Residential Permits - Thous.				
Offices	235	239	267	- 12	Single-family units	22.1	21.9	23.4	- 6
Stores	407	384	311	+ 31	Multifamily units	7.1	7.2	12.1	-41
Hospitals	50	53	42	+ 19	Total Building Permits				
Schools	17	19	8	+113	Value - $ Mil.	2,762	2,763	2,807	- 2

NOTES: Data supplied by the U.S. Bureau of the Census, Housing Units Authorized By Building Permits and Public Contracts, C-40. Nonresidential data exclude the cost of construction for publicly owned buildings. The Southeast data represent the total of the six states.

GENERAL

	LATEST DATA	CURR PERIOD	PREV PERIOD	YEAR AGO	ANN % CHG
UNITED STATES					
Personal Income ($ bil. - SAAR)	Q1	3,884.3	3,855.2	3,652.5	+ 6
Plane Pass. Arr. (thous.)		N.A.	N.A.	N.A.	
Petroleum Prod. (thous.)	MAY	8,444.0	8,181.0	8,237.0	+ 3
Consumer Price Index 1967=100	JUNE	353.5	352.0	340.1	+ 4
Kilowatt Hours - mils.	MAY	190.8	192.0	188.9	+ 1
SOUTHEAST					
Personal Income ($ bil. - SAAR)	Q1	480.0	475.1	447.2	+ 7
Plane Pass. Arr. (thous.)	MAY	5,920.4	6,083.3	6,059.1	- 2
Petroleum Prod. (thous.)	MAY	1,310.0	1,319.0	1,426.0	- 8
Consumer Price Index 1967=100		N.A.	N.A.	N.A.	
Kilowatt Hours - mils.	MAY	31.3	30.7	31.4	- 0
ALABAMA					
Personal Income ($ bil. - SAAR)	Q1	50.2	49.8	47.1	+ 7
Plane Pass. Arr. (thous.)	MAY	175.0	158.9	182.0	- 4
Petroleum Prod. (thous.)	MAY	57.0	56.0	56.0	+ 2
Consumer Price Index 1967=100		N.A.	N.A.	N.A.	
Kilowatt Hours - mils.	MAY	4.4	4.2	4.5	- 2
FLORIDA					
Personal Income ($ bil. - SAAR)	Q1	193.0	190.9	177.4	+ 9
Plane Pass. Arr. (thous.)	MAY	2,858.9	3,113.7	2,787.6	+ 3
Petroleum Prod. (thous.)	MAY	21.0	22.0	23.0	- 9
Consumer Price Index		JULY	MAY	JULY	
1977=100 MIAMI		188.3	187.2	180.5	+ 4
Kilowatt Hours - mils.	MAY	9.6	9.6	9.3	+ 3
GEORGIA					
Personal Income ($ bil. - SAAR)	Q1	91.6	91.1	85.3	+ 7
Plane Pass. Arr. (thous.)	MAY	2,137.8	2,095.9	2,301.8	- 7
Petroleum Prod. (thous.)		N.A.	N.A.	N.A.	
Consumer Price Index 1967=100		N.A.	N.A.	N.A.	
Kilowatt Hours - mils.	MAY	5.4	5.0	5.6	- 4
LOUISIANA					
Personal Income ($ bil. - SAAR)	Q1	52.5	51.9	50.4	+ 4
Plane Pass. Arr. (thous.)	MAY	343.6	340.9	346.7	- 1
Petroleum Prod. (thous.)	MAY	1,157.0	1,166.0	1,268.0	- 9
Consumer Price Index 1967=100		N.A.	N.A.	N.A.	
Kilowatt Hours - mils.	MAY	4.5	4.4	4.7	- 4
MISSISSIPPI					
Personal Income ($ bil. - SAAR)	Q1	27.8	27.3	26.6	+ 5
Plane Pass. Arr. (thous.)	MAY	42.0	39.1	48.1	+13
Petroleum Prod. (thous.)	MAY	75.0	75.0	79.0	- 5
Consumer Price Index 1967=100		N.A.	N.A.	N.A.	
Kilowatt Hours - mils.	MAY	2.1	2.0	2.1	0
TENNESSEE					
Personal Income ($ bil. - SAAR)	Q1	64.9	64.1	60.4	+ 7
Plane Pass. Arr. (thous.)	MAY	363.1	334.8	392.9	- 8
Petroleum Prod. (thous.)		N.A.	N.A.	N.A.	
Consumer Price Index 1967=100		N.A.	N.A.	N.A.	
Kilowatt Hours - mils.	MAY	5.3	5.5	5.2	+ 2

	JULY 1988	JUNE 1988	JULY 1987	ANN % CHG
UNITED STATES				
Agriculture				
Prices Rec'd by Farmers Index (1977=100)	142	137	129	+10
Broiler Placements (thous.)	92,563	94,804	90,647	+ 2
Calf Prices ($ per cwt.)	85.00	86.70	80.70	+ 5
Broiler Prices (¢ per lb.)	42.10	36.70	8.10	+50
Soybean Prices ($ per bu.)	8.87	8.56	5.20	+71
Broiler Feed Cost ($ per ton)	(Q3)248	(Q2)181	(Q3)193	+28
SOUTHEAST				
Agriculture				
Prices Rec'd by Farmers Index (1977=100)	136	126	94	+45
Broiler Placements (thous.)	39,638	40,539	37,388	+ 6
Calf Prices ($ per cwt.)	85.28	82.89	80.63	+ 6
Broiler Prices (¢ per lb.)	42.15	34.86	26.21	+61
Soybean Prices ($ per bu.)	9.06	8.62	5.34	+70
Broiler Feed Cost ($ per ton)	(Q3)226	(Q2)163	(Q3)181	+25
ALABAMA				
Agriculture				
Farm Cash Receipts - $ mil. Dates: JAN., MAY	946		724	+31
Broiler Placements (thous.)	14,177	14,681	13,024	+ 9
Calf Prices ($ per cwt.)	82.70	74.40	79.00	+ 5
Broiler Prices (¢ per lb.)	40.00	35.00	25.00	+60
Soybean Prices ($ per bu.)	9.45	8.85	5.29	+79
Broiler Feed Cost ($ per ton)	216	158	185	+17
FLORIDA				
Agriculture				
Farm Cash Receipts - $ mil. Dates: JAN., MAY	3,113		2,830	+10
Broiler Placements (thous.)	2,409	2,426	2,430	- 1
Calf Prices ($ per cwt.)	95.80	96.70	84.20	+14
Broiler Prices (¢ per lb.)	42.40	35.10	26.60	+60
Soybean Prices ($ per bu.)	9.45	8.85	5.29	+79
Broiler Feed Cost ($ per ton)	216	158	185	+17
GEORGIA				
Agriculture				
Farm Cash Receipts - $ mil. Dates: JAN., MAY	1,034		986	+ 5
Broiler Placements (thous.)	15,780	15,939	14,951	+ 6
Calf Prices ($ per cwt.)	76.90	75.90	76.70	+ 0
Broiler Prices (¢ per lb.)	42.50	34.00	25.50	+67
Soybean Prices ($ per bu.)	9.02	7.64	5.15	+75
Broiler Feed Cost ($ per ton)	216	158	185	+17
LOUISIANA				
Agriculture				
Farm Cash Receipts - $ mil. Dates: JAN., MAY	470		362	+30
Broiler Placements (thous.)	N.A.	N.A.	N.A.	
Calf Prices ($ per cwt.)	91.00	86.00	86.00	+ 6
Broiler Prices (¢ per lb.)	N.A.	N.A.	N.A.	
Soybean Prices ($ per bu.)	8.90	8.59	5.46	+63
Broiler Feed Cost ($ per ton)	266	185	165	+61
MISSISSIPPI				
Agriculture				
Farm Cash Receipts - $ mil. Dates: JAN., MAY	692		490	+41
Broiler Placements (thous.)	7,272	7,493	6,982	+ 4
Calf Prices ($ per cwt.)	82.90	84.50	80.20	+ 3
Broiler Prices (¢ per lb.)	44.70	36.20	29.30	+53
Soybean Prices ($ per bu.)	8.84	8.87	5.37	+65
Broiler Feed Cost ($ per ton)	266	185	165	+61
TENNESSEE				
Agriculture				
Farm Cash Receipts - $ mil. Dates: JAN., MAY	741		665	+11
Broiler Placements (thous.)	N.A.	N.A.	N.A.	
Calf Prices ($ per cwt.)	82.50	80.50	79.30	+ 4
Broiler Prices (¢ per lb.)	N.A.	N.A.	N.A.	
Soybean Prices ($ per bu.)	8.96	9.27	5.38	+67
Broiler Feed Cost ($ per ton)	261	197	208	+25

NOTES: Personal Income data supplied by U.S. Department of Commerce. Taxable Sales are reported as a 12-month cumulative total. Plane Passenger Arrivals are collected from 26 airports. Petroleum Production data supplied by U.S. Bureau of Mines. Consumer Price Index data supplied by Bureau of Labor Statistics. Agriculture data supplied by U.S. Department of Agriculture. Farm Cash Receipts data are reported as cumulative for the calendar year through the month shown. Broiler placements are an average weekly rate. The Southeast data represent the total of the six states. N.A. = not available. The annual percent change calculation is based on most recent data over prior year. R = revised.

Economic Review

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