I

President's Report and Papers Presented to the Board of Directors at the Spring Meeting, 1973

THE NEW REALITIES OF THE BUSINESS CYCLE

JOHN R. MEYER

Introduction and Brief Historical Background

The classification of economic fluctuations has long been a subject of interest to economists. A very considerable literature exists, dating well back into the nineteenth century, concerning the various kinds and types of business cycle phenomena.[1] That literature, moreover, is associated with some of the most widely known names in all of economics—Mitchell, Burns, Kitchin, Juglar, Kondratief, Kuznets, Schumpeter, Hansen, Haberler. Some of these names, in fact, have come to be associated with certain specific types of cyclical phenomena: Kitchin with the short or inventory cycle; Juglar with the "regular" (e.g., approximately 7-year) trade cycle; Kondratief, Kuznets, and Schumpeter with long cycles (of 20 or 40 years or more).

Business cycle taxonomy was, of course, basic to much early National Bureau research and therefore to much of empirical research in economics generally. Specifically, business cycles, economic growth, and income distribution were essentially the three fundamental, and about equally emphasized, elements in the early National Bureau research program.

In its business cycle studies, the National Bureau emphasis has been to a considerable extent on defining turning points; that is, so-called "peaks" and "troughs" of the basic (Juglar) trade cycle and the shorter inventory (Kitchin) cycle. As one might expect, popular concern or discussion has focused on the problems created by the so-called recession or depression periods between peak and trough. These were, and of course remain, the "infamous" shaded areas in National Bureau time-series plots, or for that matter, in plottings of economic time-series commonly done by others, both in the private and public domains.

Historical discussion of cyclical phenomena has been very extensively concerned with the manner in which an accumulation of individual choices made by decentralized private decision-makers in a market economy can give rise to surges or contractions in total economic activity. The key words were "accumulation" and "private." In these early discussions, public policy, if it entered at all, tended to be concentrated on *monetary* considerations and, of course, monetary policy has not always been primarily public in character. Indeed, only in the twentieth century did most market economy or Western societies evolve the political accommodations necessary to divide responsibility for monetary policy between the private and public sectors. In a sense, the advent of the "Keynesian policy revolution" completed this evolution by empha-

[1] A good concise bibliography of the more important historical references can be found appended to Arthur Burns, "The Nature and Causes of Business Cycles," originally published in the *International Encyclopedia of the Social Sciences,* New York, Crowell-Collier and Macmillan, Inc., 1968, Volume 2, pp. 226-245, and reprinted in the *Business Cycle in the Changing World,* New York, National Bureau of Economic Research, 1969, pp. 3-53. A very extensive bibliography can be found in Alvin H. Hansen, *Business Cycles and National Income,* New York, Norton, 1964, pp. 699-710.

sizing the role of fiscal policy, which by definition is public in character. The very necessity of its being public may, in fact, account for much of the acrimony surrounding early discussion and adoption of these policies.

The Keynesian revolution, and its consequences, has also led to a good deal of dissatisfaction with traditional ways of viewing and classifying cyclical phenomena. Two important changes in the empirical facts of cyclical behavior would seem to account for this change in attitude, and both of these changes can be deemed developments or even consequences of Keynesian policies. The first of these is the emergence of a systematic bias in public policy toward achieving lower unemployment at the expense of somewhat greater, and more persistent, price inflation; that is, economic policy in Western democracies seems to have been increasingly dominated during the postwar period by a willingness to sacrifice something in the way of price stability to achieve lower unemployment.[2] The second new systematic empirical regularity to emerge in the "Keynesian policy era" is that declines in absolute measures of output have become increasingly rare in the market economies of Europe, Japan and, to a lesser degree, North America. It seems fair to say that by the usual semantics no actual depression has occurred in these economies in the entire post-World War II period and that while there have been recessions, even these have been few, short, and usually far between.

These empirical changes have not gone unnoticed, of course, in the literature on business cycle chronology. Perhaps the most "formal" recognition of this awareness is the emergence of so-called "growth" cycles in which a declining *rate* of growth, rather than an *absolute* decline,[3] defines a recession. Similarly, too, in recognition of the systematic bias toward price inflation, an increasing emphasis is to be found in the taxonomic exercises on real rather than monetary measures.[4] Still another recognition of these same facts has been the increasing emphasis on the GNP gap—that is, the difference between potential and actual GNP—as an important measure for setting government budgeting and stabilization policies. Likewise, we are becoming more sophisticated about our definitions and analyses of unemployment, recognizing that the simple aggregate on national unemployment may convey only a small portion of the total information needed for policy purposes; increasingly we wish detail on the cyclical, frictional, and structural components of unemployment, hopefully classified by demographic and area characteristics as well.[5]

Of course, national income models, as these emerged from the conjuncture of Keynes' theory and the development of the essential accounting by Kuznets, Jaszi, and others, have also had a profound impact on how we study cyclical phenomena. We have seen a shift from more exploratory and taxonomic investigations to the testing of explicit hypotheses, as suggested by theory. Large-scale econometric models of international economies represent the fullest and most recent expressions of this line of development. Without wishing to resurrect the debates of some two and one-half decades ago between Burns, Mitchell, Vining, Koopmans, and others, I would simply point out that these two channels of development—one emphasizing the development of behavioral hypotheses from empirical observation and the other rigorous testing of suggested hypotheses—tend to be complementary and necessary.[6] But, whatever one's tastes

[2] The existence of this bias was perhaps first noted and commented upon systematically by Arthur Smithies, "Reflections on the Work and Influence of John Maynard Keynes," *Quarterly Journal of Economics* (November 1951), pp. 578-601. The durability of this issue is perhaps best attested by an elegant theoretical analysis of some possible sources of the bias as developed by William Nordhaus in a paper presented at the meeting of the Econometrics Society in Toronto, Canada, December 1972.

[3] Ilse Mintz, "Dating American Growth Cycles," *The Business Cycle Today,* National Bureau of Economic Research, New York, 1972, pp. 39-88. (Also see her forthcoming *Dating U.S. Growth Cycles.*)

[4] Cf. Solomon Fabricant, "The Recession of 1969–1970," *The Business Cycle Today, op. cit.,* pp. 89-136.

[5] In this connection, David C. Hoaglin and Edwin Kuh, of the National Bureau's Computer Research Center for Economics and Management Science, have been exploring the use of modern data analysis techniques to distinguish among the three conventional components of unemployment—frictional, cyclical, and structural. A report on their progress will be found in Part II, Section 6. Similarly, Geoffrey Moore, in the following piece, suggests a program of research on these and related matters.

[6] Some empirical support for this observation might, in fact, be derived from the work of Treyz, Su, and Haitovsky on the testing of econometric forecasts, the report of which will be published shortly by the National Bureau.

or style in these methodological matters, the fact remains that research and taxonomy in economics do adjust to changing circumstances, although sometimes with a considerable lag.

Alternative Business Cycle Taxonomies

As an approach to the classification of cyclical phenomena, both the shift in emphasis to real values and the development of the growth cycle concept are clearly improvements. Their utility, moreover, is likely to be enhanced with the passage of time. Nevertheless, they may not have met all the problems posed by the new departures in economic policy and cyclical behavior.

For example, modern discussions of the business cycle, perhaps best illustrated in forecasting exercises, increasingly stress the role of government in conditioning the course of events. Forecasts today tend to be *conditional* on certain fiscal or monetary policy assumptions. Concomitantly, we hear less about the automatic character of the cycle; that is, how the cycle emerges from the interaction or feedbacks between private decisions and their consequences. Private decisions are still involved, but the stress is on the ability, perhaps even responsibility, of government to offset or neutralize the more adverse consequences that might emerge from these private decisions. In short, the modern view tends to be that public policy should not allow private decisions to accumulate into adversity. In a very real sense, the cycle is less likely today to run its full course. Recessions are not permitted to retrogress into depressions. A full financial panic is, hopefully, not needed to cure the excesses of inflation and speculation.

In keeping with this new emphasis on the public policy role in achieving stabilization and growth objectives, one possible objective of cycle taxonomy might be (and actually is increasingly) on identifying or diagnosing the current state of the economy. Indeed, the identification of cyclical turning points ex *post* never was all that overwhelmingly important from a policy standpoint; rather, it was a device for facilitating scientific and historical study of economic fluctuations (e.g., improving the structural specification of an econometric model). The public, however, always has been and remains understandably interested in the identification of turning points. If any proof of this point is required, one can simply cite the National Bureau's experiences in 1970 when the economy seemed on the verge of or actually in an economic recession as important congressional elections drew near. Journalistic inquiries at the Bureau's offices have never been more frequent in recent years!

But even if we recognize a policy interest in cycle taxonomy, it is not clear that the current classification procedures are necessarily the best. If policy is uppermost in mind, then we should attempt to identify the "pathological condition" or state of the economy at different points in time and as recently as possible. (This "currency" aspect has, of course, long been recognized in Bureau research on "indicators.") It seems highly probable, moreover, that policymakers will want to know more than if the economy is simply in a state of expansion or contraction.[7] Furthermore, we should recognize that cycle taxonomy, like so many classifications of social phenomena, may not be distinct (that is, "either-or"). It is as likely that the economy may simply "glide" from one stage of the cycle to another as to make an abrupt transition.[8] Accordingly, in the diagnosis of the cyclical state at any point in time, the actuality may represent a considerable mix of different forces, influences, or conditions.

Nevertheless, conceptual clarity, if nothing else, suggests that we try to define certain circumstances or models of relatively "pure stages" of the cyclical condition. In fact, a "four-stage taxonomy" would seem to be identifiable (or at least implicit) in much, if not most, of current forecasting and cycle discussions. These four cyclical states might be defined to a first

[7] Indeed, such an emphasis is implicit, if not explicit, in much earlier Bureau work on business cycle phenomena: Burns and Mitchell's multiple (e.g., nine) stage partition of the basic cycle and their emphasis on the differences that exist between early and late stages of expansion and contraction; Ruth Mack's subcycles; and the use of diffusion indexes.

[8] Again, a gliding or phased transition would seem to be more consistent with the Burns and Mitchell emphasis on the evolutionary, constantly evolving character of business cycle phenomena.

approximation (and in their expected sequence starting from a recession) as follows:

1. *Recession*—considered (for the United States economy at least) to be more or less consonant with current National Bureau definitions; that is, a period in which total aggregate activity actually declines somewhat from previous peak levels.

2. *Recovery*—defined as the early expansion out of a recession and a state of economic affairs in which virtually everything is "going well" —unemployment is declining, prices are relatively stable, productivity is rising, and total output is expanding.

3. *Demand-Pull Inflation*—equated to the classic inflation situation in which "too much money chases too few goods"; that is, the forces of recovery are allowed somehow to achieve too much force with production forced up to capacity constraints, prices rising, rates of productivity improvement declining, and so on.

4. *Stagflation*—defined as a mix of stagnation at a high level of activity and inflation; i.e., a situation in which capacity utilization drops off from the strains of demand-pull, unemployment may begin to rise, and total monetary expansion diminishes but prices and wages nevertheless continue to increase (perhaps because productivity ceases to improve rapidly or for other yet to be defined reasons).

It doesn't require too much perception or insight to identify this cyclical phasing, at least implicitly, in many current forecasting discussions. Only the "stagflation" stage is likely to elicit much debate or argument. Even then the issue is not so much whether some separably definable stage sometimes does exist after the demand-pull and before the recession, but rather how to describe it, and particularly how to label its causes. Thus in many discussions it would be called "cost-push" inflation. Others, though, would insist that such a cost-push is simply a "winding down" of classical inflation.[9] This, in turn, leads to a policy debate about whether stagflation or cost-push is an entirely different breed of economic condition requiring new and different policies, such as incomes policy and price controls. In the best (or at least oldest and, hopefully, "tried and true") National Bureau tradition, no position will be adopted on these policy issues here; rather, the focus is on whether real empirical delineations corresponding to this four-stage scheme can be identified in the economy. The obvious time period to test first for such phenomena is post-World War II, or that period roughly corresponding to the new cyclical circumstances.

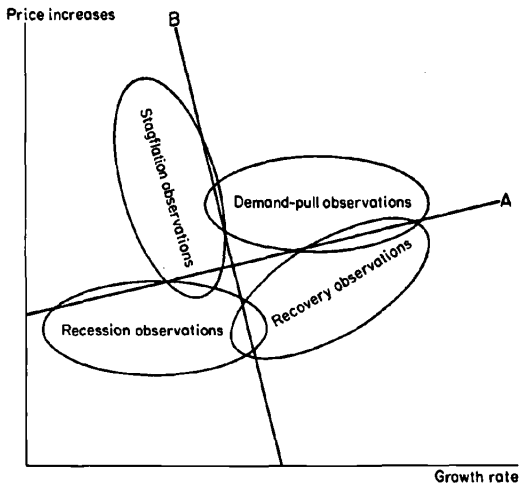
Some Empirical Evidence on a Four-Stage Cyclical Taxonomy

From an empirical standpoint, a four-stage taxonomy can be investigated as a reasonably straightforward problem in multivariate discriminant analysis. The basic objective of discriminant analysis is to classify an observation (for which the defining characteristic is not available or observable) into one of several groups on the basis of *available* data or variables. Strictly speaking, the definition of the classification function or procedure should be based on sample observations for which the correct classification has been established; that is, for which we know the basic defining characteristic. Clearly, a useful independent variable for performing a classification under these circumstances is one for which the average value in the different groups is substantially different. Conversely, if the values or average for a variable were essentially the same in all groups, such a variable would be of little use for classification purposes.

Graphically we might portray the situation as shown in Figure I-1. In this graph four hypothetical distributions corresponding to recession, recovery, stagflation, and demand-pull are shown with different central tendencies or mean values for price increase and growth rate characteristics. As drawn, stagflation is a situation characterized by price increases but low growth, recession as a period in which both growth and price increases are low, demand-pull as a situation in which both are high, and recovery as a period that combines low price increases with high growth rates. (Again, it should be stressed that at this point the example is strictly hypothetical and illustrative!) An obvious next step

[9] This is the view favored by Phillip Cagan as a result of a National Bureau study he now has underway of price behavior in the U.S. economy in the 1950s and 1960s. See his progress report on this research in Part II, Section 1.

Figure I-1



in any classification exercise would be to draw lines on the graph that divided the space into four regions that hopefully corresponded reasonably well to the underlying groups. Lines *A* and *B* in the graph illustrate such possibilities. Thus, if we obtained results like those shown in the graph for our sample observations about which we knew the defining characteristics, we would then have a basis for classifying new observations for which the defining characteristic was not evident. Specifically, if a new observation had values that fell in the northeast quadrant, as formed by the lines *A* and *B*, we would classify it as demand-pull, whereas the southwest quadrant observation would be characterized as recession, a northwest as stagflation, and a southeast as recovery. That is, you could simply classify any new observation for which the defining characteristic is not known into its most likely group according to the quadrant or region into which it fell, these quadrants or regions being determined by the original analysis. In essence, discriminant analysis is nothing more than simply applying these basic notions more strictly or formally, and often with many more dimensions or variables.

From a strictly formal standpoint, unfortunately, we really do not know *precisely* to which months or periods our four stages or classifications might apply. For the United States, though, it is not too difficult to approximate such a four-way cyclical classification for the postwar period. One can start with existing National Bureau definitions for recessions; these block out (define) five segments in the postwar period: November 1948 to October 1949, July 1953 to August 1954, July 1957 to April 1958, May 1960 to February 1961, and November 1969 to November 1970. For the other stages, a bit of common sense, reinforced by some knowledge of recent business cycle history, can carry the analysis a considerable distance. For example, the onset of demand-pull inflation is commonly associated both with the middle or third quarter of 1950 because of the Korean War and with mid-1965 because of the Viet Nam buildup that escalated sharply starting in July of that year. With somewhat less certainty, the second half of 1955 and all of 1956 might be termed as a period of demand-pull inflation; perhaps, too, some of early 1957 might be so characterized. It is more difficult to specify any period between the trough of 1958 and peak of mid-1960 as a demand-pull, but if it happened it was probably in 1959. By a process of elimination, recoveries have to be periods that occur before these demand-pull periods but *after* the preceding recessions; and stagflations must occur, if at all, after demand-pulls but *before* the next recession. The a priori classification of periods that I and a young researcher, Daniel Weinberg, worked out through such considerations is shown in Table I-1.

We have also tested these classifications experimentally using discriminant analysis. On the whole, our impressionistic or prior classifications stood up remarkably well to the discriminant tests or classifications. The only major instance in which the a priori specification seemed to fail totally was in the years 1958 through 1960. In that period the economy appears to have moved from recession to recovery to recession without passing through either a demand-pull or cost-push stage or any other type of major inflationary experience. But, as already mentioned, even this was not totally unexpected. Moreover, there is no reason why all four stages must occur. The "re-entry" problem, in fact, can be characterized as "figuring out" how to make the transition from demand-pull back to recovery without experiencing recession (a trick that our results suggest has not been achieved in the United States since 1947). Simi-

TABLE I-1

Preliminary (a priori) Classification of Post-World War II U.S. Business Cycles Into a Four-Stage Scheme

Starting Dates for			
Recession	Recovery	Demand-Pull	Stagflation
November 1948	November 1949	June 1950	March 1951
July 1953	September 1954	February 1956	October 1956
July 1957	May 1958	January 1959 (?)	January 1960 (?)
May 1960	March 1961	September 1965	January 1969
November 1969	December 1970	—	—

larly, there is nothing inevitable about applying so much stimulus that all recoveries must end in demand-pull inflations.

After some experimentation and modification, our discriminant analyses (which we hope to report more fully in a forthcoming National Bureau publication) identified or differentiated between two essentially complete four-stage cycles in the postwar period: 1949 through 1953 and 1960 through 1970. In addition, the period from 1953 to 1958 could be defined as either a four-stage cycle, in which the fourth, stagflation or cost-push, stage was extremely abbreviated, or as a three-stage cycle, in which the cost-push phase is totally eliminated. We incline toward the three-stage rather than the four-stage characterization for these years and tentatively have adopted it for subsequent work. Finally, there was the one truncated or two-stage cycle from 1958 through 1960. Our complete chronology for the period from 1949 through March 1972 (the last date for which we had adequate data when we started our analyses) can be found in Table I-2.

The variables used for carrying out the classification scheme were suggested by the policy and historical considerations already discussed. A listing of them, along with their average values for the stages defined in Table I-2, can be found in Table I-3. These averages more or less conform with prior expectations about the differences in the different cyclical stages. Prices and labor costs rise less rapidly on average in recession and recovery than in either of the inflationary periods. On the other hand, recovery and demand-pull are the periods in which the economy expands and grows more rapidly, whereas recession and stagflation are characterized by relative stagnation or even actual decline. Stagflation or cost-push also seems to be a period in which leading indications of incipient recession appear: rates of increase in

TABLE I-2

Final Classification of U.S. Business Cycles Into a Four-Stage Scheme (December 1948 through March 1972)

Starting Dates for			
Recession	Recovery	Demand-Pull	Stagflation
December 1948*	November 1949	August 1950	May 1951
December 1953	August 1954	February 1955	—
September 1957	June 1958	—	—
March 1960	February 1961	July 1965	January 1969
February 1970	December 1970	?	?

* November 1948, classified initially as a recession month following the standard National Bureau chronology, was designated as demand-pull by the discriminant analyses.

TABLE I-3

Average Value of Variables in Four Stages
(using quarterly and monthly data)

	Recession	Recovery	Demand-Pull	Stag-flation	Average, all Periods	Avail-ability[a]
Percentage change[b]						
Money GNP	–0.6	8.5	8.0	4.7	6.2	*Q*
Real GNP	–2.4	6.6	4.1	2.2	3.6	*Q*
Government surplus or deficit (indicated by a negative sign) as a percentage of GNP	–1.1	–0.6	0.5	–0.4	–0.3	*Q*
Percentage change[b] gross govt. expend.	6.6	4.6	12.6	10.6	8.2	*Q*
Unemployment rate	5.6	5.8	4.0	3.2	4.8	*M*
Percentage change[b]						
GNP price deflator	1.7	1.9	3.9	2.5	2.5	*Q*
Consumer price index	1.5	1.4	3.6	2.8	2.3	*M*
Wholesale price index	–0.8	1.4	3.8	–0.1	1.5	*M*
Percentage change[b]						
Compensation per man-hour	2.2	5.2	6.6	6.0	5.2	*Q*
Output per man-hour	1.6	4.7	2.2	2.1	3.0	*Q*
Unit labor cost	0.6	0.5	4.4	3.9	2.2	*Q*
Change per month						
Prime rate	–0.16	0.03	0.06	0.06	0.01	*M*
Corp. bond rate	–0.01	–0.002	0.04	0.04	0.02	*M*
Percentage change per month						
Stock price	0.2	1.0	0.9	–0.3	0.6	*M*
Percentage change[b]						
M1	1.1	3.6	3.7	3.5	3.2	*M*
M2	4.5	6.7	5.5	2.9	5.4	*M*

a. *Q* indicates a variable available on a quarterly basis; *M* indicates a variable available on a monthly basis. Variables available from source only on a quarterly basis (*Q*) were interpolated so as to be placed on a monthly basis for the discriminant analyses.

b. Seasonally adjusted annual rate.

New York Stock Exchange prices begin to decline even as output continues to grow, and rates of increase in wholesale prices turn negative although consumer prices continue upward at a vigorous rate.[10] In essence, the discriminant function is created by attaching different weights to these different variables so as to maximize the differences in the groups weighted mean differences (i.e., in the groups' mean discriminant scores). On a conventional *F*-test, these mean discriminant scores are significantly different for the different groups: As might be expected, the two inflation periods are the least differentiated, but even their *F*-test is at a level three times the *F*-value associated with 1 per

[10] The difference in the signs associated with the average values of the stock price change variable in cost-push and demand-pull inflations *may* have some relevance to the continuing debate about whether inflation is "bullish" or "bearish" for the stock market. Specifically, both positions may be correct. The bullish hypothesis during early or demand-pull inflation and the bearish during late or cost-push stages. For a provocative and thorough discussion of these issues see the report by John Lintner that follows Moore's report in this section.

TABLE I-4

Extrapolation of Discriminant Classifications to 1947, 1948, and 1972
(by posterior probabilities)

Date Yr.	Mo.	Group with Largest Probability on Discriminant Analysis	Posterior Probability of Recession	Recovery	Demand-Pull	Stagflation
'47	02	Demand-Pull	0.001	0.003	0.995	0.000
	03	Demand-Pull	0.131	0.145	0.715	0.009
	04	Recovery	0.003	0.927	0.071	0.000
	05	Demand-Pull	0.104	0.006	0.888	0.002
	06	Demand-Pull	0.010	0.000	0.982	0.008
	07	Demand-Pull	0.002	0.000	0.984	0.015
	08	Demand-Pull	0.007	0.001	0.988	0.003
	09	Demand-Pull	0.001	0.004	0.984	0.011
	10	Demand-Pull	0.000	0.000	0.999	0.000
	11	Demand-Pull	0.000	0.001	0.999	0.001
	12	Demand-Pull	0.000	0.000	0.997	0.003
'48	01	Demand-Pull	0.000	0.000	0.989	0.011
	02	Demand-Pull	0.028	0.029	0.943	0.000
	03	Demand-Pull	0.013	0.002	0.984	0.001
	04	Demand-Pull	0.008	0.001	0.956	0.035
	05	Demand-Pull	0.000	0.000	0.951	0.049
	06	Demand-Pull	0.000	0.000	0.977	0.023
	07	Demand-Pull	0.000	0.000	0.866	0.134
	08	Demand-Pull	0.000	0.000	0.962	0.038
	09	Demand-Pull	0.000	0.001	0.827	0.172
	10	Demand-Pull	0.000	0.001	0.703	0.295
	11*	Demand-Pull	0.277	0.039	0.583	0.102
'72	04	Recovery	0.000	0.999	0.001	0.000
	05	Recovery	0.024	0.976	0.000	0.000
	06	Recovery	0.002	0.998	0.000	0.000
	07	Recovery	0.006	0.094	0.000	0.000
	08	Recovery	0.051	0.941	0.008	0.000
	09	Recovery	0.005	0.912	0.083	0.000
	10	Recovery	0.000	0.996	0.004	0.000
	11	Recovery	0.004	0.657	0.338	0.001
	12	Recovery	0.010	0.965	0.024	0.000

* November and December 1948 were classified as demand-pull by the discriminant analysis, although originally (see a priori classification in Table I-1) identified as recession months following the National Bureau's previous definitions of turning points.

cent significance for such a sample.[11] Stagflation and recovery, on the other hand, are the most sharply delineated periods.

The basic discriminant analysis was Bayesian, using equal or diffuse priorities. Using the discriminant analyses, a chronological classification of the entire postwar period, month by month from late 1948 through early 1972, can be derived and will be included in the final report of our study. To anticipate just a bit, the

[11] One per cent significance would be associated with an *F*-value of approximately 2.78. The matrix of *F*-values for testing the differences in the average discriminant scores for the different groups is as follows:

Group	Recession	Recovery	Demand-Pull
Recovery	15.51744		
Demand-Pull	31.74266	35.96570	
Stagflation	40.22449	54.19418	9.29875

most remarkable result seemingly suggested by the posterior discriminant probabilities is the strong dominance of one particular classification for almost every monthly observation. This holds true even near the end of one cyclical phase and during the transition into the next, although there is usually some slight advance indication of an impending transition. In short, and in spite of the comments just made about the probable difficulties of making clear-cut classifications of cyclical status, our preliminary analyses seem to indicate that clear-cut classification is possible.

An interesting test of the basic discriminant concept is provided by extrapolating our analyses to periods beyond the historical data on which the original functional parameters were estimated; that is, to periods before November 1948 and after March 1972. The results of such extrapolations are shown in Table I-4. Again, there seems to be considerable agreement with the basic scheme. The year 1948 and the last part of 1947, for example, were mainly characterized by demand-pull and cost-push inflation. In the projection to late 1972, the recovery of 1971 is continued throughout most of the year but with some signs of incipient inflation appearing as the year proceeded. A summary of such results is shown in Table I-5.

Two canonical functions seem to be quite sufficient to perform the basic discrimination (as shown by the eigenvalues and the cumulative

TABLE I-5

Summary Table of Canonical Discriminant Analysis Results

Step Number	Variable Entered	*F*-Value to Enter	Coefficients for First and Second Canonical Variable	
			First	Second
1	Unemployment Rate	292.8347	1.77630	0.06440
2	% Δ Real GNP (1958 dollars)*	46.0021	−0.35772	0.41356
3	% Δ Unit labor cost*	9.3395	0.14937	0.41282
4	% Δ Money GNP*	7.4153	0.33239	−0.17561
5	% Δ Gross gov't. exp.*	9.0361	−0.01895	−0.00618
6	% Δ Prime r	8.8451	−0.06426	3.10785
7	% Δ *M*-2*	5.5809	0.13042	0.14026
8	% Δ *M*-1*	13.4650	−0.09056	−0.10308
9	Δ Gov't. surplus as % of GNP	5.6508	0.26277	0.08890
10	% Δ NYSE prices	4.1029	−0.07770	0.03947
11	Δ Average corporate r	3.7977	−1.09176	−2.09874
12	% Δ CPI*	1.1675	−0.00042	−0.00259
13	% Δ GNP price DEFL*	0.7048	−0.35973	0.09352
14	% Δ Output per man-hour	0.4204	0.19864	0.23696
15	% Δ WPI*	0.3459	−0.01065	−0.01534
16	% Δ Compensation per man-hour	1.6845	−0.21773	−0.24380

Eigenvalues Associated with Canonical Variates

First	Second	Third	Fourth
4.31646	0.99771	0.25089	0.00003

Cumulative Proportion of Total Dispersion Accounted for by Canonical Variables

First	Second	Third	Fourth
0.77564	0.95492	1.00000	1.00000

Notation:

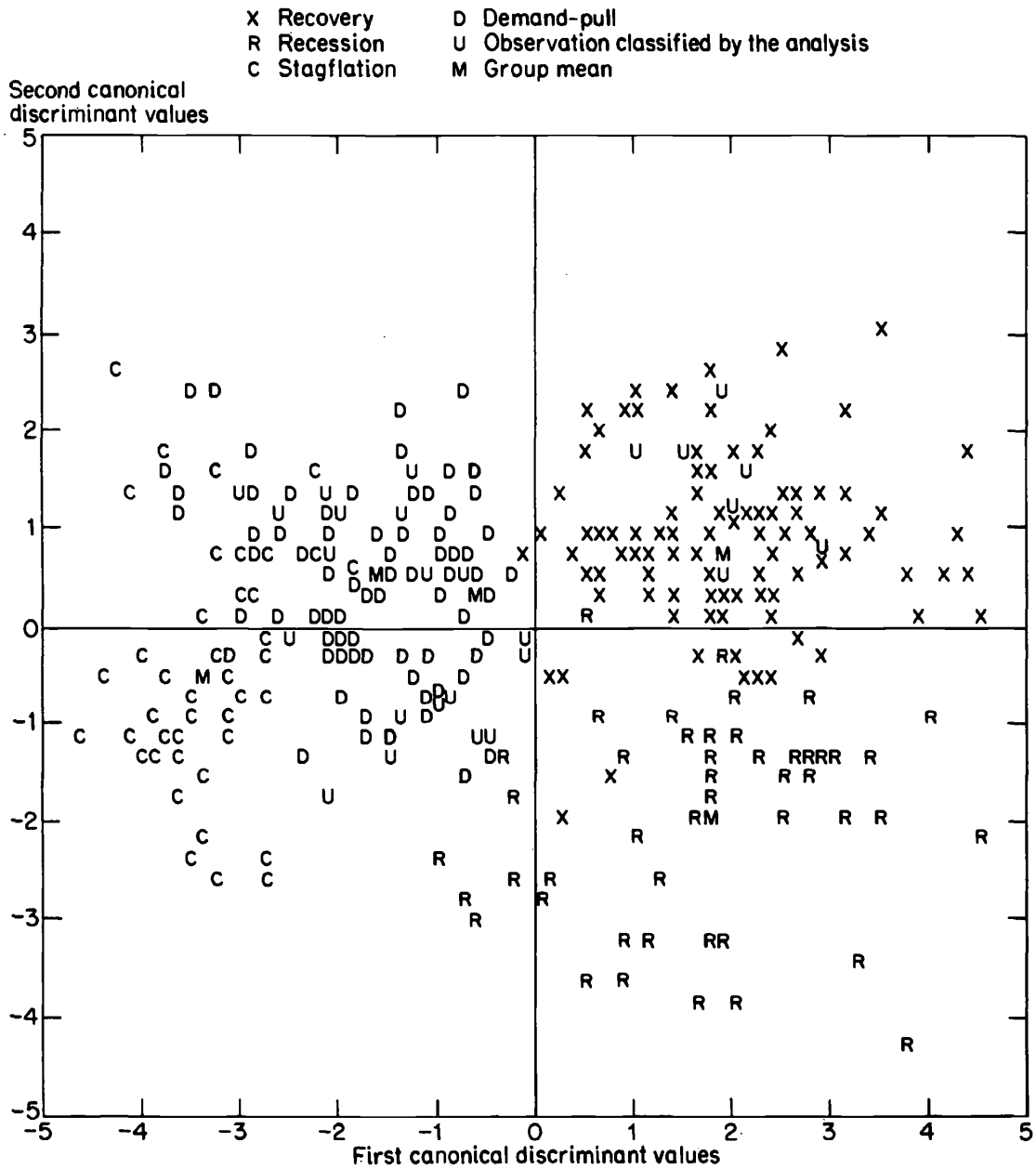
Δ = Change (month to month or quarter to quarter) in denoted variable.

% = Percentage.

* Seasonally adjusted annual rate.

proportions of "explained" dispersion as shown at the bottom of Table I-5). Moreover, the functions can be interpreted reasonably straightforwardly looking at the weights or coefficients shown in the right-hand columns of the table. The first function apparently differentiates by price behavior; that is, it separates recession and recovery from inflation periods. The second canonical function apparently differentiates by basic growth or expansion characteristics; that is, it separates the "real growth" stages, recovery and demand-pull, from the no-growth or monetary-only growth periods, recession and stagflation. This can be shown graphically by plotting the canonical variates of the different monthly observations, as shown in Figure I-2. The first canonical is plotted against the horizontal axis and the second canonical on the vertical

Figure I-2



axis. Thus, against the vertical axis (stagflation and recession), the slow-growth periods, will be in the upper half. For the first canonical plotted on the horizontal axis, the relatively price-stable periods of recession and recovery are on the right-hand side of the diagram, whereas the two inflationary periods are to the left.

One clear deficiency in the present scheme, especially for policy purposes, is our use of quarterly variables that will be available only after a time lag. Policy-making is perhaps facilitated if the state of the economy can be evaluated more contemporaneously or currently; e.g., on the basis of variables that are available with only a short time lag after the end of each month. With that goal in mind, Weinberg and I have tested our classification scheme using only the monthly variables employed in our original classification exercise and variables (as suggested by Ilsa Mintz' growth cycle study) that are available no later than a month and one-half after the end of each month. On the basis of these criteria, we were able to retain eight of our original sixteen variables (specifically, all the variables marked with an *M* in the final or "availability" column in Table I-3) and added ten more variables (from Mintz' list of eighteen). This set of variables we chose to call our "policy analysis" variables. To these variables, we then applied exactly the same discriminant analysis

TABLE I-6

Average Values of Variables for the Four Cyclical Stages
Using Readily Available Monthly Variables

	Recession	Recovery	Demand-Pull	Stagflation	Average All Periods
Unemployment rate*	5.56733	5.75899	3.95607	3.15000	4.78747
Percentage change					
Industrial production index	–9.10855	10.31529	5.53147	1.47929	4.12663
Personal income*	0.39181	7.15738	8.43166	5.96562	6.15931
Retail sales*	–0.03468	8.25472	4.40413	3.44946	4.92129
Percentage change					
Man-hours in non-agricultural establishments*	–4.59373	3.70242	3.22986	1.14246	1.70992
Employees in non-agricultural establishments*	–3.56501	3.33779	3.71563	1.77356	1.99464
Persons in non-agricultural activities*	–0.98702	2.57909	2.57909	1.51123	1.81321
Mining, manufacturing, construction Wages and salaries*	–8.00613	8.92445	8.97421	5.45598	5.43112
Change per month					
Treasury bill rate	–0.15202	0.03359	0.05611	0.04330	0.00923
Treasury bond rate	–0.04184	0.01029	0.03280	0.03409	0.01150
Prime rate	–0.15653	0.02638	0.06061	0.06114	0.00986
Corporate bond rate	–0.01469	0.00152	0.04378	0.04159	0.01621
Percentage change in					
Consumer price index	1.48290	1.44321	3.56626	2.80924	2.28657
Wholesale price index	–0.82736	1.36362	3.80265	–0.10441	1.46380
Indus. commodities*	–0.91752	1.50932	4.13841	0.51623	1.69746
NYSE composite price index	0.21583	1.02801	0.87376	–0.33689	0.62622
Percentage change					
In *M*1	1.12979	3.58940	3.65328	3.51795	3.16645
In *M*2	4.52061	6.67328	5.49375	2.89295	5.35707

* Seasonally adjusted annual rate.

techniques we had used before.

A listing of these eighteen variables, along with their average values for the different groups —recession, recovery, demand-pull, and stagflation—are shown in Table I-6. The mean values for the different cyclical stages or groups behave much as those reported in Table I-3. Again, we find that the two inflation periods are associated with more rapid or pronounced price increases than either recession or recovery. On the other hand, the two growth periods, recovery and demand-pull inflation, are more strongly associated with increases in output than the two more stagnant periods of recession and stagflation.

The discriminant classifications using the policy analysis set of variables are slightly worse for recessions and recoveries but not for the inflation periods. The point is illustrated by a comparison of the classification performance of the two analyses, as shown in Table I-7. Specifically, using the monthly or policy analysis variables, seven fewer recession months are classified correctly, with five of these showing up as recoveries and two as demand-pull. Similarly, eight fewer months of the recovery group are classified correctly, with four of these misclassifications showing up as recession and four as demand-pull. On the other hand, the policy analysis using the monthly variables is correct in one more demand-pull case than the original analysis and is wrong only in one more stagflation month. Somewhat paradoxically, however, when we test the policy analysis by backcasting and forecasting, it is not so obvious that the inflation classifications are performed any better than the recession or recovery classifications. Specifically, when using the monthly data only, the period between February and October 1948 is not so uniformly predicted as demand-pull using the monthly data as in the original analysis. However, when the monthly analysis is extrapolated to the period after April 1972, recoveries are predicted using the monthly data, just as they were when using the original quarterly and monthly variables. The potential usefulness of the policy analysis emerges, however, when one realizes that one can compile a quite current classification using the monthly data. On this basis, we find that January and February of 1973 can be classified as recovery periods, but with some probability of demand-pull beginning to emerge. January and February 1973 could not, of course, be classified as yet if we still relied on our quarterly data, since many of the first quarter numbers for 1973 are not yet available ("were not" at the time this paper was presented to the National Bureau's Board in mid-April) even on a preliminary basis.

TABLE I-7

Number of Cases Classified into Groups

I. Original Analysis Using Quarterly and Monthly Data

Original Group	Discriminant Analysis Classification			
	Recession	Recovery	Demand-Pull	Stagflation
Recession	44	4	1	0
Recovery	3	102	0	0
Demand-Pull	0	0	73	9
Stagflation	0	0	2	42

II. "Policy Analysis" Using Monthly Data Only

Original Group	Discriminant Analysis Classification			
	Recession	Recovery	Demand-Pull	Stagflation
Recession	37	9	3	0
Recovery	7	94	4	0
Demand-Pull	1	0	74	7
Stagflation	0	0	3	41

Obviously, these experiments with monthly data *might* have some implications for the development of leading indicators or other early warning mechanisms on which to base public policy decisions. It would be much too early, however, to make this claim. At this *very* preliminary stage of our investigation, we would be content merely to say that our exploration of these possibilities provides some promising but still ambiguous results. Moreover, the general utility for policy purposes of taxonomic devices such as these, compared to other forecasting and diagnostic techniques (such as econometric models), is at least debatable, although it would appear that the new techniques might have some role to play.

Summary and Conclusions

As in most aspects of economic affairs, the cyclical behavior of economies is constantly evolving and changing. The National Bureau, which has pioneered so much study of cyclical phenomena, has been adjusting its research program accordingly. Perhaps the two most dramatic of these new initiatives have been adjustments made in the Bureau's approach to business cycle taxonomy: an increasing emphasis on real (instead of monetary) measures and *experimentation* with a new cycle concept, the growth cycle.

The test of new ideas, however, need not stop there and, of course, will not. At the Bureau we have also undertaken other new initiatives in the study of the cycle. Thus, there are studies underway at the Bureau's Cambridge Computer Center and proposed new investigations by Geoffrey Moore that could have substantial implications for business cycle studies in the future. In this report, for illustrative purposes, I have dwelt mainly on one, very experimental, initiative: specifically, an attempt to define a four-stage cycle for the U.S. postwar economy, following definitions that seem more consistent with current convention and usage. This four-stage classification scheme, when applied to post-World War II economic fluctuations in the U.S., appears to work reasonably well. It conforms to "folk wisdom" and seems to be empirically definable.

Needless to say, before any such four-stage scheme should be widely accepted, it would need extensive testing and elaboration. For example, in keeping with the previous speculation about the complementarity of taxonomic exercises with attempts to improve structural specification, one might explore whether distinctly different relationships (as, for example, in regression or econometric parameter estimates) are apparent in different cycles or at different stages of various cycles; indeed, Weinberg and I have such investigations underway and will include them in our final report on this work. But at this point, no more should be claimed than that the potential seems to be there: namely, that a fresh approach to the entire question of cycle taxonomy *might* help illuminate the "new realities" of the business cycle as these have emerged from the policy revolution of recent years.

NEW WORK ON BUSINESS CYCLES

GEOFFREY H. MOORE

When I returned to the National Bureau in February 1973, I found a thriving interest in two subjects that I had been concerned with when I left 4 years ago; namely, business cycle chronologies and economic indicators. Ilse Mintz has constructed a "growth cycle" chronology for the United States. Her manuscript, *Dating U.S. Growth Cycles*, which describes and analyzes the chronology, is being readied for publication. John Meyer and Daniel Weinberg have been experimenting with another form of chronology, one that recognizes not only recessions and recoveries but also "demand-pull" and "stagflation" stages of economic expansions.

This interest dovetails with one that I am planning to pursue: developing a chronology for the rate of inflation in the United States that will distinguish historical periods of high and/or rising rates of inflation and intervening periods of low and/or declining rates. It will be a further development of the "rate of inflation" chronology used in my 1970 paper for the National Bureau's colloquium on *The Business Cycle Today*. With the current and continuing interest in the rate of inflation, it would appear worthwhile to give the subject a more searching examination, covering the behavior of various types of prices, wages, interest rates, costs of production, productivity, and profits during periods when the rate of inflation in the price level is advancing as well as when it is declining. The study will also examine in this context data on price expectations and price forecasts. It will take advantage of and, I hope, contribute something to the work on inflation that Fabricant, Cagan, Gordon, and others have been pursuing.

One of the ways in which this work will be related to my recent responsibilities in Washington is that the data to be studied are, for the most part, reported currently in the Bureau of Labor Statistics' monthly *Chartbook on Prices, Wages and Productivity*. Hence the results will provide some of the basic historical information that should be useful to users of that chartbook in interpreting the current figures, in much the same way that the National Bureau's studies of economic indicators have supplied background information helpful in the selection and interpretation of indicators in the Department of Commerce's *Business Conditions Digest*.

Although the value of much business cycle research depreciates over the course of time as institutional conditions change, as new evidence accumulates, and as new concepts and hypotheses are formulated, many findings have had an extremely long life. Wesley C. Mitchell's analytical description of the business cycle process, published in 1913, is a case in point. In particular, his account of the ways in which rising costs encroach on profits during a business expansion and the consequences of this development, seems applicable to the long period of expansion during 1961–69, as well as to its sequel. In a paper titled, "Productivity, Inflation and Growth," prepared for a conference of the National Commission on Productivity in April, I examined recent experience in the light of Mitchell's research. Some of the results are depicted in Figures I-3 and I-4, notably:

1. Movements in the rate of productivity growth during business cycles, which exercise a dominant influence on rates of change in unit labor costs (compare the top two lines in Figure I-3).

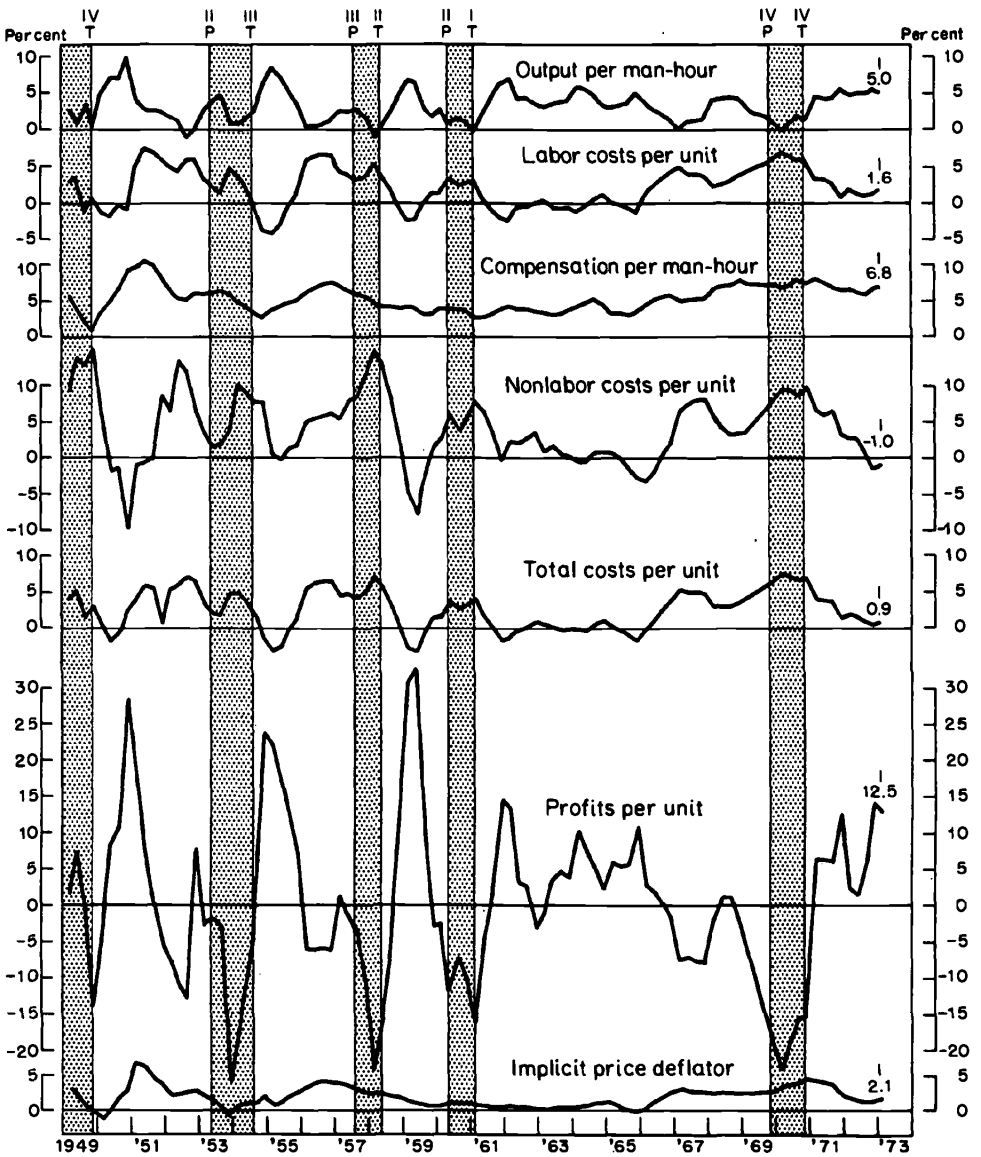
2. Productivity growth tends to decline as an expansion proceeds, while unit labor costs as well as other unit costs rise more rapidly.

3. Costs and prices both rise during an expansion, but costs rise less rapidly than prices at first, then more rapidly, with a consequent decline in profit margins (see Figure I-4).

4. These tendencies are reversed during business recession and the subsequent recovery.

All these tendencies were described and explained by Mitchell, on the basis of data far less adequate than we have now. Although it is rare that a man's research should help materially to explain events some 60 years later, the fact that this does happen is an inspiration to those who engage in, provide data for, and otherwise support new work on business cycles as well as on productivity. This example seemed particu-

Figure I-3

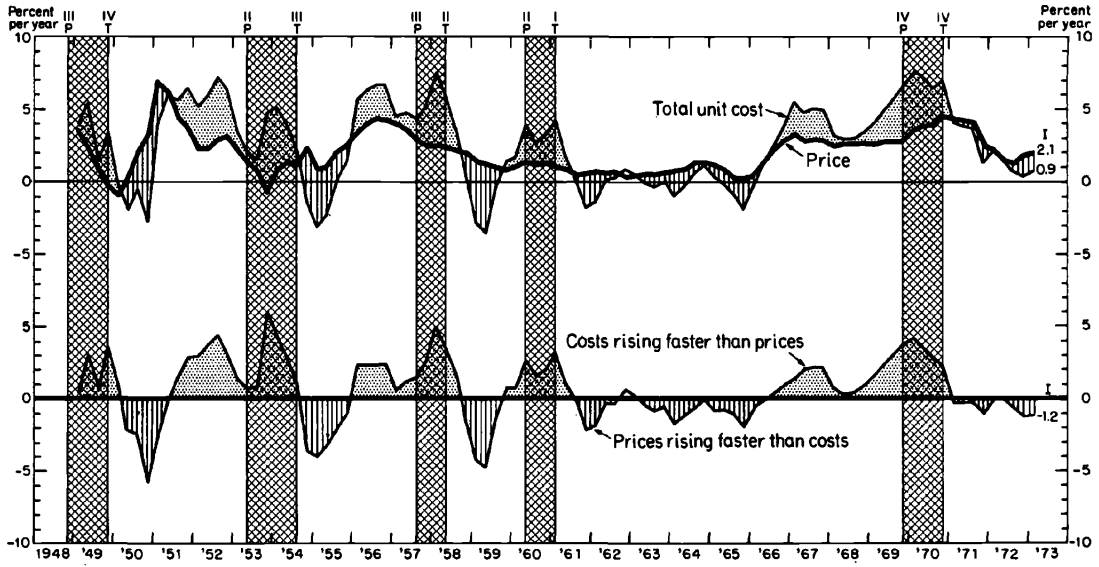


larly relevant for the National Commission's Conference, which was devoted to An Agenda for Economic Research on Productivity. One of the suggestions offered in my paper was that the Commission develop a quarterly report on productivity devoted to the dissemination of reseach findings, new efforts to improve productivity, current trends in productivity, and so forth. Philip Klein, Pennsylvania State University, has agreed to work on this project if it moves ahead.

A new evaluation of indicators, reported in Part II, Section 2, by Victor Zarnowitz, is underway—a project of the Bureau of Economic Analysis in the Department of Commerce. The last such study was published by the National Bureau in 1967. The advent of new statistical series, an additional business cycle, and new findings about and new interest in the cyclical process all point to the timeliness of another review. The business cycle peak and trough dates during the period since 1947 will be reviewed and new lists and classifications of economic indicators will be developed.

In this connection the results of a study of the

Figure I-4



behavior of economic indicators during 1969–71 that I completed about a year ago may be of interest. The report was prepared as part of a collection of essays in honor of Moses Abramovitz,[1] who himself was one of the initial contributors to the National Bureau's Studies of Business Cycles with his classic study of inventories. Tables I-8 and I-9 contain several findings from this review of the recent performance of the set of indicators selected in 1966 in the National Bureau report *Indicators of Business Expansions and Contractions* by Julius Shiskin and me.

The leads and lags of the twenty-six indicators at the business cycle peak of November 1969 and trough of November 1970 conformed quite well to the previous record. Among the twelve leading indicators, 71 per cent of the observations on timing in 1969–70 were leads, as compared with 86 per cent in 1948–61. Similar results are shown in Table I-8 for the coincident and lagging indicators, and for composite indices based on them.

Tables I-9 sets forth the results of an effort to measure, or at least rank, the severity of the 1969–70 recession while it was in progress. The method had been used with some success in the recessions of 1957–58 and 1960–61. The 1969–70 recession, when it finally ended late in 1970, turned out to be, by most measurements, one of the mildest recessions in the past 25 years. In Table I-9 (bottom line) it is rated as more severe than the "mini-recession" of 1967 and tied with the mild recession of 1960–61. Those of 1957–58, 1953–54, and 1948–49 were more serious on the whole. Now this result was not, of course, known when the recession began late in 1969. The procedure adopted early in 1970 was to compare the changes in the indicators following the tentative business cycle peak (which was then set at December 1969—the National Bureau later selected November 1969) with their changes over corresponding intervals in the earlier recessions. The initial result was that by February 1970, the second month after the tentative peak, the twelve leading indicators showed declines sharper than in 1967 and 1960–61, but less sharp than in the three preceding recessions (hence the rank of 3 in the top line of Table I-9). The eight coincident indicators showed smaller declines than in any of the previous recessions. Of course, since this was based on changes over a very brief interval—2 months—it was not too dependable. By and large, however, the relative mildness of the 1969–70 recession was confirmed in subsequent months, with the leading indicators initially suggesting a somewhat larger dip than the coincident indicators did. The General Motors strike in the autumn of 1970 affected the com-

[1] Paul A. David and Melvin Reder, eds., *Nations and Households in Economic Growth*, New York, Academic Press, Inc. (to be published December 1973).

TABLE I-8

Leads and Lags of Twenty-Six Indicators at Business Cycle Peaks and Troughs, 1969–70 and 1948–61

	Number of Business Cycle Turns		Number of Timing Observations			Percentage of Timing Observations in Appropriate Class	Average Lead (–) or Lag (+) in Months
	Covered (1)	Skipped (2)	Leads (3)	Rough (Exact) Coincidences (4)	Lags (5)	(6)	(7)
26 Individual Indicators							
At Nov. 1969 peak and Nov. 1970 trough							
12 leading indicators	24	0	17	10 (3)	4	71	–4.0
8 coincident indicators	16	6	4	7 (4)	2	70	–0.2
6 lagging indicators	12	6	1	1 (0)	5	83	+7.2
26 indicators	52	12	22	18 (7)	11	72	–1.4
At eight preceding peaks and troughs, 1948–61 [a]							
12 leading indicators	96	0	83	27 (10)	3	86	–7.7
8 coincident indicators	64	4	34	47 (15)	11	78	–1.4
6 lagging indicators	48	2	3	26 (5)	38	83	+3.3
26 indicators	208	6	120	100 (30)	52	83	–3.3
Composite Indexes [b]							
At Nov. 1969 peak and Nov. 1970 trough							
Ratio, coincident to lagging (820 ÷ 830)	2	0	2	1 (0)	0	100	–6.5
Leading, original trend (811)	2	0	1	1 (1)	0	50	–3.5
Leading, reverse trend–adj. (810)	2	0	2	1 (0)	0	100	–1.5
Coincident (820)	2	0	0	2 (1)	1	100	+0.5
Lagging (830)	2	0	0	0 (0)	2	100	+7.5
At eight preceding peaks and troughs, 1948–61 [a]							
Ratio, coincident to lagging (820 ÷ 830)	8	0	8	2 (0)	0	100	–9.2
Leading, original trend (811)	8	0	7	2 (1)	0	88	–7.6
Leading, reverse trend–adj. (810)	8	0	8	2 (0)	0	100	–5.1
Coincident (820)	8	0	2	8 (5)	1	100	–0.4
Lagging (830)	8	0	0	6 (2)	6	75	+2.1

a. The peaks are November 1948, July 1953, July 1957, May 1960. The troughs are October 1949, August 1954, April 1958, February 1961.

b. The leading index is based on the twelve leading indicators, the coincident index on five of the eight coincident indicators, and the lagging index on the six lagging indicators. The number in parentheses is the series number in *Business Conditions Digest.*

Note: The twenty-six indicators are those selected in 1966 (Geoffrey Moore and Julius Shiskin, *Indicators of Business Expansions and Contractions*, New York, Columbia University Press for the National Bureau of Economic Research, 1967) with one exception. Nonagricultural placements was replaced by initial claims for unemployment insurance. This substitution was made in September 1969, at which time nonagricultural placements was dropped from the short list of leading indicators in *Business Conditions Digest* (for the reasons, see *BCD,* September 1969).

Rough coincidences include exact coincidences (shown in parentheses) and leads or lags of 3 months or less. The total number of timing comparisons is the sum of the leads, exact coincidences, and lags. This, plus the number of turns skipped, is the total number of business cycle turns covered by the series. The "percentage in appropriate class" is based on the number of leads, rough coincidences, or lags, respectively, divided by the total number of timing observations for the corresponding groups of indicators.

Source: U.S. Department of Commerce, *Business Conditions Digest,* February 1973, Appendix F. Three additional specific cycle turns are used here: a trough (January 1948, lead 10 months) in the unemployment rate; a peak (February 1969, lead 9 months); and a trough (November 1971, lag 12 months) in the change in manufacturing and trade inventories.

TABLE I-9

Ranking of Six Periods of Business Contraction in Successive Months, Two Groups of Indicators

Months after Business Cycle Peak	Rank of Average Rank of 12 Leading Indicators: Business Cycle Peak Date[a] Dec. 1969	Jan. 1967	May 1960	Aug. 1957	July 1953	Oct. 1948	Correlation Coefficient[b]
2nd month	3	2	1	6	5	4	.80
3rd month	4	2	1	6	3	5	.80
4th month	3	1.5*	1.5	6	5	4	.86
5th month	3	1	2	5.5	4	5.5	.99
6th month	2	1	3	6	4	5	.94
7th month	2	1	3	6	4	5	.97
8th month	2	1	3	6*	4	5	.97
9th month	3	1	2*	6	4	5	.97
10th month	4	1	2	3	5	6	.71
11th month	4*	1	2	5	6	3	.63
12th month	5	1	2	3	4	6*	.63
	Rank of Average Rank of 8 Coincident Indicators						
2nd month	1	2	3	6	5	4	.80
3rd month	1	2	3	6	4	5	.89
4th month	1.5	1.5*	3	6	4	5	.94
5th month	2	1	3	6	5	4	.89
6th month	2	1	3	6	5	4	.89
7th month	2	1	3	6	4.5	4.5	.94
8th month	2	1	3	6*	5	4	.89
9th month	2	1	3*	6	4	5	.97
10th month	2	1	3	6	5	4	.89
11th month	2*	1	3	4	6	5	.80
12th month	2	1	3	4	5	6*	.89
	Rank of Business Cycle Contraction, Peak to Trough[c]						
	2.5	1	2.5	5.5	4	5.5	

* Business cycle trough date.

a. The reference peak dates are those used at the time the ranking of the 1969–70 contraction was carried out (beginning February 1970) and differ in some instances from the standard NBER dates. The NBER dates do not include a contraction from January 1967 to May 1967, and peaks are November 1969 instead of December 1969, July 1957 instead of August 1957, and November 1948 instead of October 1948.

b. With rank of business cycle contraction, peak to trough (bottom line). For six ranks the correlation coefficient should exceed .83 to be significant at the .05 level.

c. Based on changes from business cycle peak to trough in eight coincident indicators.

parisons later in the year.

The stability of the rankings in each column—i.e., during each of the earlier recessions—is worth noting, as well as the degree of correlation of each set of ranks with the "ultimate" ranking in the bottom line of the table. In most cases, the ultimate ranking could be rather closely approximated during the early months of a recession.

A final result reported in the paper concerns the use of leading indicators to forecast magnitudes of change in gross national product and other variables. In 1968 I explored one such scheme briefly, conceiving of it more as a mechanical standard against which other forecasting methods could be compared than as a forecasting method in its own right. The results of applying the method since 1968 are mixed, although it clearly remains a tougher standard to beat than the usual "naive model," in which either the recent level or recent change is simply extrapolated into the future. Table I-10 makes this comparison, in terms of both the mean absolute error of forecasting year-to-year percentage changes and the degree to which forecast and actual changes are correlated. The

TABLE I-10

Forecasts of Calendar Year Percentage Changes in Gross National Product

	GNP in current $			GNP in constant $		
	1962–67	1968–72	1962–72	1962–67	1968–72	1962–72
Mean absolute error (percentage)						
Leading index regression[a]	1.0	2.4	1.7	1.0	1.8	1.4
Economic report[b]	1.3	0.9	1.1	1.1	1.1	1.1
Naive model—same change[c]	1.8	2.5	2.1	1.6	2.9	2.2
Correlation coefficient, forecast and actual change						
Leading index regression[a]	.69	.51	.47	.97	.55	.66
Economic report[b]	.34	.80	.63	.48	.93	.76
Naive model—same change[c]	−.04	−.19	−.04	−.45	0	.08

a. Regression fitted to data for 1952–61, with the percentage change in index of twelve leading indicators, reverse trend-adjusted, measured from fiscal year average to July–December average.

b. *Economic Report of the President,* January 1962 through January 1972. Some percentage changes, not given in the *Report,* were inferred from statements in the *Report.*

c. Forecasts made on the assumption that next year's percentage change will be the same as last year's.

naive model yields larger average errors (discrepancies averaging between 2 and 3 percentage points between forecast and actual percentage changes) and forecasts that are uncorrelated with the actual changes. The leading index regression does better than this, both in 1962–67 and 1968–72, but not so well as the set of actual forecasts shown in the table, taken from successive issues of the *Economic Report of the President.* In this case, the mean error has been in the neighborhood of 1 percentage point. It is interesting, in view of the concern about the GNP forecast of $1,065 billions for 1971, which involved an error of 1.5 percentage points, that the average forecast error during 1968–72 was smaller than that during 1962–67, and that the correlation between forecast and actual changes was substantially higher. Hence there is some evidence of an improvement in the *Economic Report* forecasts in recent years, both in an absolute sense and relative to either the naive model or leading index regression standards.

The current study of U.S. indicators being directed by Zarnowitz is closely related to another project that I hope can soon be launched; namely, a study of international economic indicators. As presently envisaged, this would be a demonstration project designed to show how selected lists of monthly and quarterly indicators for the major developed countries can be effectively organized to throw light on the current state of the business cycle in each country. The study will bring together work that has been and is underway in several countries—especially Canada, Japan, Great Britain, and West Germany—and will utilize existing compilations by the National Bureau, the Organization for Economic Cooperation and Development, and other agencies. The immediate objective is to produce a graphic and tabular arrangement of the principal leading, coincident, and lagging indicators, demonstrating the potential value of a current publication of this type, produced regularly by some governmental or international organization. Figures I-5 and I-6, reproduced from a quarterly publication of the Japanese Economic Planning Agency, illustrates what is now being done in that country. Over the next few years, if the project is successful in generating interest and support, a large amount of analytical work should be done for each country to set forth the properties of the data; their cyclical behavior; their significance, limitations, and comparability; and their international interrelations. The importance of research along these lines is underlined by the profound consequences for international monetary relations, trade, capital flows, and the balance of payments that appear to result from the presence

Figure I-5

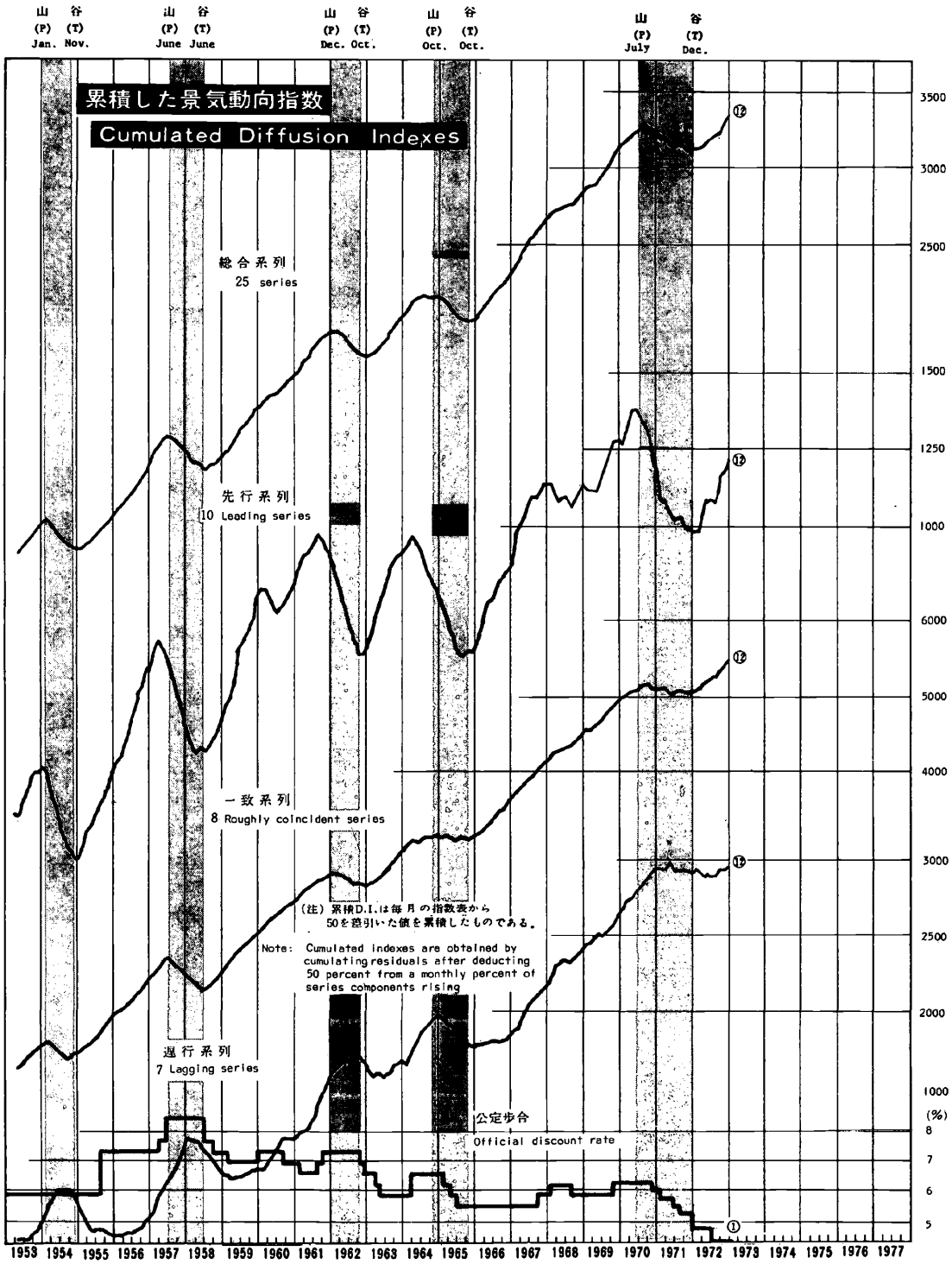
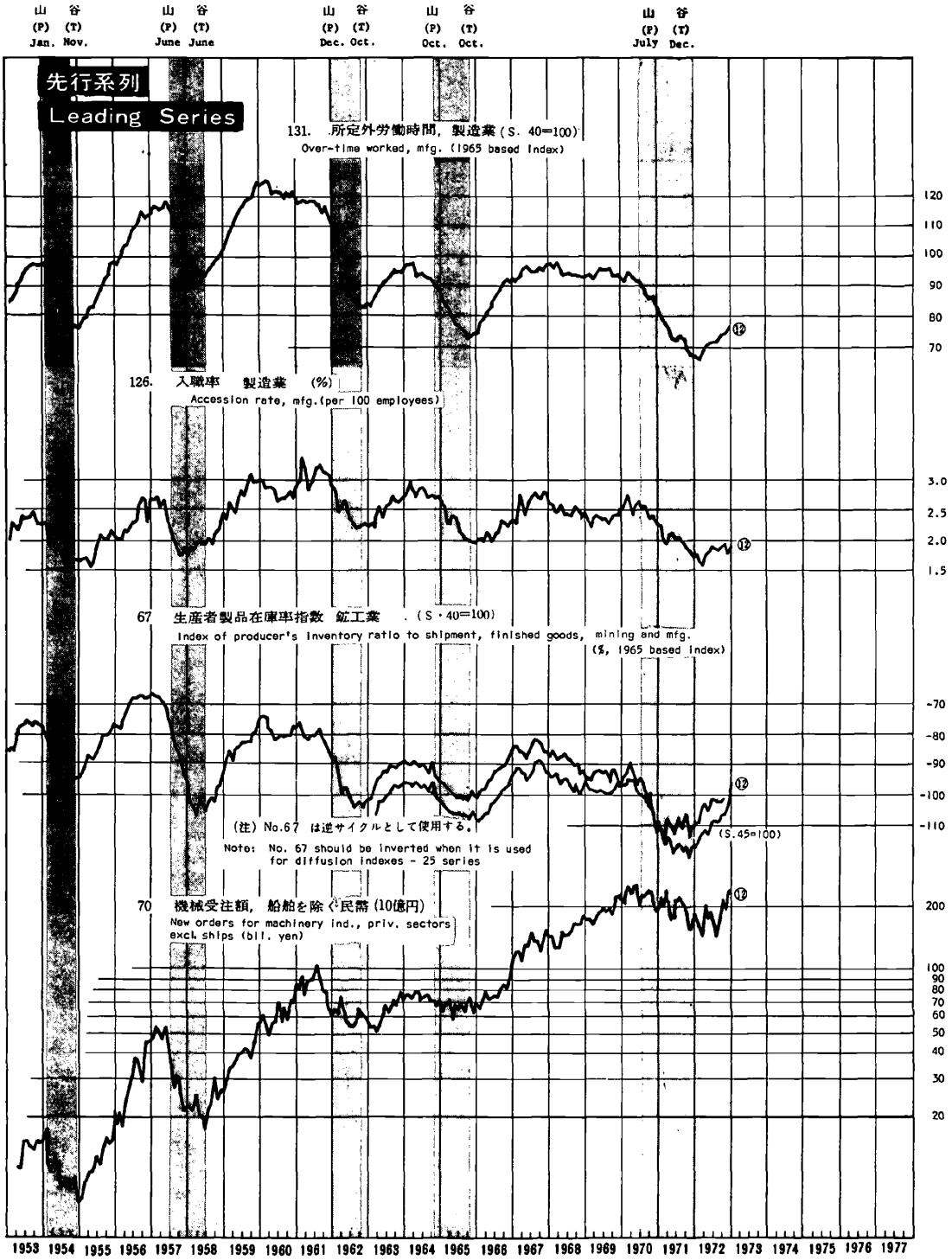

山 谷 (P) (T) Jan. Nov.
山 谷 (P) (T) June June
山 谷 (P) (T) Dec. Oct.
山 谷 (P) (T) Oct. Oct.
山 谷 (P) (T) July Dec.
累積した景気動向指数
Cumulated Diffusion Indexes
総合系列 25 series
先行系列 10 Leading series
一致系列 8 Roughly coincident series
遅行系列 7 Lagging series
(注) 累積D.I.は毎月の指数表から 50を差引いた値を累積したものである。
Note: Cumulated indexes are obtained by cumulating residuals after deducting 50 percent from a monthly percent of series components rising
公定歩合
Official discount rate
(%)
1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977

Figure I-6


山 谷 (P) (T) Jan. Nov.
山 谷 (P) (T) June June
山 谷 (P) (T) Dec. Oct.
山 谷 (P) (T) Oct. Oct.
山 谷 (P) (T) July Dec.
先行系列
Leading Series
131. 所定外労働時間, 製造業 (S. 40=100)
Over-time worked, mfg. (1965 based index)
126. 入職率 製造業 (%)
Accession rate, mfg.(per 100 employees)
67 生産者製品在庫率指数 鉱工業 (S・40=100)
Index of producer's inventory ratio to shipment, finished goods, mining and mfg. (%, 1965 based index)
(注) No.67 は逆サイクルとして使用する。
Note: No. 67 should be inverted when it is used for diffusion indexes - 25 series
(S.45=100)
70 機械受注額, 船舶を除く民需 (10億円)
New orders for machinery ind., priv. sectors excl. ships (bil. yen)
120
110
100
90
80
70
3.0
2.5
2.0
1.5
-70
-80
-90
-100
-110
200
100
90
80
70
60
50
40
30
20
1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977

or absence of divergencies among countries in the state of the business cycle in which they find themselves at any given time.

I expect that Ilse Mintz' work on growth cycles in the United States and Germany will prove highly useful in this program of research, not only because of the methods and standards she has developed, but also because it appears that retardations in growth have international repercussions similar to those of business cycles. For example, during each of the U.S. "growth recessions" that, according to Mintz' new chronology, occurred during U.S. business cycle expansions (namely, in 1951–52, 1962–63, and 1966–67), growth recessions or cyclical contractions occurred in Great Britain, Germany, and possibly other European nations. This in itself seems to imply a higher degree of international sensitivity to cyclical movements than one would infer from the U.S. business cycle chronology alone. Moreover, since each of the U.S. growth recessions were marked by significant declines in U.S. leading indicators, it would be useful to inquire into the corresponding behavior of leading indicators in Europe.

My initial activities at the National Bureau, which are being supported in part by a grant by the Hoover Institution, Stanford University, have been aimed at completing some short papers that were in various stages of preparation while I was in Washington. Four of them pertain to unemployment. "On the 'Statistical Significance' of Changes in Employment and Unemployment" appeared in the March issue of *The Statistical Reporter* (U.S. Office of Management and Budget). This essay, together with "How Full Is Full Employment?," "A New Measure of the Severity of Unemployment," and "Sources of Change in Unemployment," is being published by the American Enterprise Institute. Another paper, "The Importance of Productivity," was in the May issue of *Business Economics*. "The Current Recovery in Productivity: Its Role in Costs, Price and Profit Margins," was presented in May at a conference sponsored by The Conference Board and was published in *The Conference Board Record,* July 1973. Julius Shiskin and I have written a brief essay on "Why the Leading Indicators Lead," expanding on a still briefer version that was published in the *New York Times,* November 19, 1972.

Other business cycle studies in progress reported in Part II, Section 2 are those on Money by Milton Friedman and Anna Schwartz, on the Determinants of Investment by Robert Eisner, and on Household Capital Formation by Thomas Juster and Paul Wachtel. A manuscript on *Forecasts with Quarterly Macroeconometric Models* by Yoel Haitovsky, George Treyz, and Vincent Su is being readied for press. Su has started to bring the record of econometric model forecasts up to date in order to extend this analysis. Victor Zarnowitz' volume, *Orders, Production and Investment,* was published this spring.

Geoffrey H. Moore

INFLATION AND COMMON STOCK PRICES IN A CYCLICAL CONTEXT[1]

JOHN LINTNER

Judgments of portfolio managers, investment officers of major financial institutions, and other observers regarding the impact of inflation on the returns from common stock investments have fluctuated widely over the last 25 years. Whenever there has been concern about inflation as a market factor, there has also been a currently fashionable judgment regarding the impact of inflation on prospective stock prices and thereby on the attractiveness of stocks as an investment. But a review of the record shows that these judgments have shifted repeatedly between the view that inflation would depress the returns on equity investments and the opposite view that inflation would enhance the returns on common stocks.

A review of the record suggests that this vacillation essentially generalized recent market experience. If stocks had been rising in the face of inflationary concern, inflation was regarded as good for stock prices; but if inflationary general price movements had been accompanied by falling stock prices, then inflation was an evil omen. Recall that during the inflationary surge of 1947–48, earnings considerably more than doubled, but stock prices were sluggish and price/earnings ratios fell to roughly half their prewar levels. The dominant view was that inflation had been and *would be* a major depressant on stock values because of transient inventory profits and understatements of proper charges for depreciation that impaired the quality of reported earnings. Nevertheless, during the boom in stock prices in the mid-1950s, the quickening pace of inflation was widely used as a major justification for the purchase of common stock (and mutual funds) by individuals and for increased investments of insurance company assets and pension reserves in common stocks, specifically on the grounds that equities would be a good hedge because further inflation would raise stock prices.

Similar generalizations that further inflation would enhance equity values were again widely current from 1965 to 1968. But again, in 1969–70, there was a very high inverse correlation between changes in stock prices and the most recent news or pronouncement on how the current battle against inflation was going. If the current month's annualized rate of change in the Consumer's (or the Wholesale) Price Index was higher (or lower) than the last month's, the stock market would be down (or up) after the announcement. In 1971 and 1972 there continued to be a general coincidence of periods of strongly improving stock prices with intervals of declining inflation, which undoubtedly reinforced the view that inflation is bad for the stock market. In keeping with this view, the stock market turned lower in early 1973 immediately after the announcement of a weakened price-wage control program and continued to fall as rates of inflation increased.

Although this current version of the conventional wisdom agrees with the pessimistic conclusions prevalent in the late forties, it stands in marked contrast to the optimistic conclusions of the mid-fifties and of 1965–68 when inflation was generally thought to favor equity investments as stock prices were rising along with the cost of living and product prices. This pessimistic view also runs directly counter to the traditional and widely accepted classical economic theory of the relation between inflation and stock prices.

The Classical Theory of the Relation Between Inflation and Equity Prices

Standard economic theory, from its classical origins in the last century on up into modern times, has always regarded the *real* value of unlevered equity as being invariant to inflationary or deflationary changes in the price level,

[1] This material represents one of the chapters in a larger study of the effects of inflation and inflationary expectations on common stocks, which in turn is one of five studies now underway covering different aspects of the effects of inflation on financial markets. The other related studies are reported in Part II, Section 4.

so that in principle its current *money* value will rise or fall in proportion to relative changes in the general index of prices of goods and services. In the classical formulations, this conclusion rested on essentially three basic propositions in a context of standard comparative static equilibrium analysis.

First, the *real* returns from ownership of capital goods will be invariant to the general price level, since these returns depend fundamentally on production functions or input-output relations and factor proportions that are invariant to the general level of prices. Second, the (real) market value (V^*) of these ownership claims would be equal to these real returns (X^*) on capital goods capitalized at the real rate of interest (r^*). That is,

$$V_0^* = \sum_{t=1}^{t=\infty} \frac{X^*}{(1 + r^*)^t} = X^*/r^* \qquad (1)$$

Third, the real rate of interest, r^*, is invariant to the price level per se because, as Irving Fisher demonstrated near the turn of the century,[2] market clearing equilibrium conditions require that r^* must be *simultaneously* equal (1) to the marginal real product of capital goods, and (2) to the marginal rate of substitution of real goods between adjacent time periods (which Fisher called the marginal rate of "time preference"). The second condition must be satisfied in equilibrium because self-interest ensures that consumers will have adjusted their spending and saving out of current income until they are indifferent about having x less goods and services during the current period if they can get $x\ (1 + r^*)$ more goods and services during the next period, and vice versa; correspondingly, profit-maximizing self-interest ensures that firm's capital stocks will have been adjusted to eliminate any discrepancy between the marginal product of their use in production and r^*. Because consumers (and producers) have no "money illusion" and act solely on the basis of exchange ratios (or "terms of trade") between *real* goods and services at different points in time, the *real* rate of interest, r^*, is invariant to the price level as such in any period and consequently is invariant to the rate of inflation per se.

Since the real returns, X^*, are invariant to inflation by the first proposition, and the real rate of interest, r^*, is correspondingly invariant by proposition three, the *real* value of the equity V^* in proposition two and equation (1) must also be invariant to inflation per se (and *ceteris paribus!*). Finally, the constancy of the real value V^* of course means that the current money value $\$V_t = P_t \cdot V^*$ will vary in direct proportion to P_t, the index of the general price level. Higher or lower rates of inflation imply capital gains (in before-tax percentage terms) on unlevered equity equal to the rate of inflation.

It is instructive to notice a perhaps surprising corollary, also based on Fisher's work at the turn of the century. Fisher showed that the *nominal* or money rate of interest at any given time would be equal to the interest rate in real terms adjusted upward by the *expected* future rate of inflation.[3] It follows that the money value of unlevered common stocks at any point in time—i.e., their real value restated in terms of the prevailing price level—is *independent* of the amount of inflation *expected in the future*. In particular, as John Burr Williams argued,[4] "No common stock in a company free from debt is worth more today merely because the price level is going to go up tomorrow."

[2] *The Nature of Capital and Income*, Macmillan, New York, 1906; *The Rate of Interest*, Macmillan, New York, 1907; as well as the later *Theory of Interest*, Macmillan, New York, 1930, Chapters II, XV, XIX, and XX.

[3] Specifically, if in the current period money prices are expected to increase 100 p^e per cent per year, a current dollar return t years in the future would be discounted at a rate of $(1 + r^*)^t\ (1 + p^e)^t$. But if prices are expected to increase at 100 p^e per cent per year, the constant real returns X^* will be expected to amount to $X^*(1 + p^e)^t$ when stated in the then-current money units. Since $X^*(1 + p^e)^t/(1 + r^*)^t\ (1 + p^e)^t = X^*/(1 + r^*)$, *every term* in the summation on the right side of equation (1) is invariant to the value assigned to the expected inflation rate p^e.

[4] *Theory of Investment Value*, Harvard University Press, Cambridge, 1938. The quotation is from page 103. As Williams observed: "Because inflation itself makes stocks go up, most people think that the mere prospect of inflation should do so too. Yet this is not true . . . after all, why should an investor pay more in sound money today simply because a stock is going to be quoted higher in depreciated money tomorrow? Furthermore, how can stocks be a hedge against inflation, protecting their owners during inflation, if they go up before inflation? They cannot discount the same event twice. No, they should respond but once to inflation, and that during inflation, step by step, dollar for dollar, with the rise in general prices."

But notice that Williams' conclusion with respect to unlevered common stock is just a special case of the more general and fundamental conclusions that follow from the classical analysis. In particular, X^* is defined as the *total real* return to the ownership of capital goods—and the capitalization of these returns by the real rate of interest, r^*, identifies V^* in equation (1) as the *real* market value of the *total of ownership claims* against the entire real returns provided by capital goods. The invariances of real returns X^* and the real interest rate r^* from the first and third propositions thus makes (1) the total *real* market value of *all* ownership claims against the returns from capital goods invariant with respect to (a) current rates of inflation, and (b) expected future rates of inflation; (2) the total *current* market value of all these claims (a) will vary in proportion to the current realized rates of inflation, but (b) will be invariant to expected future rates of inflation. These conclusions apply directly to the value of unlevered common stock, because in the absence of debt the equity holders receive the entire return to the ownership of capital goods.

When ownership of the underlying capital goods is partially financed by debt, however, the classicists regarded the impact of inflation on the market values of equity as being even more favorable.[5] Debtors gain and creditors lose whenever there is an increase in the anticipated rate of inflation over the remaining life of the outstanding debt. But the loss in the real market value of these debts ($V_{\hat{0}}^*$) when the *expected future* rates of inflation increase must be matched by an *increase* in the *real* value of levered equity ($V_{\hat{0}}^*$), since $V_{\hat{0}}^* + V_{\hat{0}}^* = V^*$, the *invariant* real capitalized value of the *total real* return to the ownership of the underlying capital goods themselves. Moreover, when this increased real value of levered equity is restated in current market prices, its market value in nominal dollars will of course also fully reflect any increase in the general price level. Consequently, in the classical framework, owners of levered equities benefit from a capital gain in *real* terms whenever the expected rate of inflation increases; they also receive a capital gain in nominal money equal to the full current rate of inflation in general prices.[6]

Later work in the classical tradition has of course substituted the more refined concept of "net-debtor position" (which offsets the financial assets held by a company against its debts) for leverage in the sense of long-term debt,[7] but the analysis carries through without substantive change as long as financial liabilities are larger than financial assets. Firms in a net-creditor position, however, will incur real capital losses on their net financial asset position that will at least partially offset and reduce the capital gains in current money terms otherwise associated with inflation. Kessel's classic study[8] found (in an admittedly small but random sample) that industrial firms were about evenly divided between net debtors and net creditors. More important, he found that the market equity

[5] For specific references, see Harry Gunnison Brown, "Rising Prices and Investments" (esp. pp. 46-49), Chapter III, in *How to Invest When Prices are Rising*, Irving Fisher, ed., 1912. Brown, then an Assistant Professor at Yale, had been a student of Fisher's. See also Irving Fisher, *The Purchasing Power of Money*, Macmillan, New York, 1920, pp. 58-59 and 170-171; J. M. Keynes, *Tract on Monetary Reform*, Macmillan, London, 1923, p. 18; and Irving Fisher, *The Money Illusion*, Adelphi, New York, 1928, esp. pp. 78-81.

It is significant that these early authors, like J. B. Williams later, specifically determined the *total* value of the firm and then subtracted the value of the debt to determine the value of the equity, precisely as required by the famous Modigliani–Miller "Proposition I," which proved that this classical relation could under certain conditions be extended to models in which risk was incorporated rigorously. (Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review*, June 1958.)

[6] The classical arguments in this paragraph were most fully and explicitly developed in Williams, *op. cit.*, pp. 107-109, 111-114. Williams provides the following summary of the relevant conclusions on page 107: "Only for equities without leverage, however, does the rule that stocks should not rise in anticipation of inflation hold true. If senior issues are outstanding, then stocks should respond twice, or rather in two steps, to inflation; first on the promise, and second during the fulfillment, of inflation. The first response should be abrupt, and should reflect the gain by stockholders of the prospective loss by bondholders, while the second should be gradual, and should reflect the change in the purchasing power of money from month to month."

[7] Classical writers had either ignored the financial assets held by business firms, or more generally they just implicitly assumed that financial liabilities were larger than financial assets.

[8] Reuben A. Kessel, "Inflation-Caused Wealth Redistribution: A Test of a Hypothesis," *American Economic Review* (March 1956), pp. 128-141.

values of net debtors gained relative to those of net creditors during inflationary periods and fell behind relatively during deflation.[9] This confirmation of the classical expectation has generally been supported by subsequent work.[10]

The Federal Reserve's Flow of Funds data show that the consolidated balance sheet of nonfinancial corporations has consistently been in a net-debtor position since 1945. Their net financial liabilities grew from about $50 billion in the late 1950s to nearly $57 billion in 1965 and jumped to over $200 billion by 1971. Conversion of bonds and mortgages to current market values would not alter the fact of a substantial consolidated net-debtor position,[11] nor the general pattern of its strong increase in recent years. It is thus evident that economists working within the framework of the classical analysis would predict that the current market value of the equity of the large majority of corporations would at least vary directly with changes in general price levels, even though the capital gains in current money terms would not necessarily be fully proportional to current rates of inflation; and the common stock of firms in a substantial net-debtor position should show a more than proportionate capital gain in current money terms.

TABLE I-11

Financial Assets and Liabilities
U.S. Non-Financial Corporations

Selected Years, 1945–71
(amounts in billions)

Year	Total Financial Assets	Long-term Debt[a]	Other Financial Liabilities	Net Financial Assets
1945	$ 69.3	$ 32.1	$ 43.1	$ –5.9
1948	82.0	44.0	63.6	–25.6
1951	110.9	54.1	92.9	–36.1
1955	142.2	73.6	110.2	–41.6
1958	163.4	95.4	121.9	–53.9
1962	206.5	125.0	146.0	–64.5
1965	258.7	150.6	195.0	–86.9
1968	317.1	202.9	261.2	–147.0
1969	341.0	219.7	300.0	–178.7
1970	354.5	245.2	315.6	–206.3
1971	379.8	276.3	324.1	–220.6

a. Bonds plus all mortgage debt.

Source: Flow of Funds Accounts: *Financial Assets and Liabilities Outstanding, 1945–1971,* Federal Reserve System, June 1972.

More Modern Theoretical Writings

The classical economists viewed the economy as seeking and reaching an equilibrium in real terms, and this "real" equilibrium was *independent* of the current *levels* of money prices, which depended, by way of the classical Quantity Theory of Money, on the actions of the monetary authorities. More modern theoretical (and econometric) work, building on the early insights of Keynes and Hicks in the mid-1930s, has developed increasingly complex and more realistic models of the economy in which (1) the level and equilibrium structure of activity in all the real sectors involving production, goods, and services; (2) the level and structure of money prices for all of these goods and services; and (3) the interest rates, yields, and market prices of a rich menu of financial assets are *all interrelated, interdependent, and mutually determined.* Similarly, the latter-day "monetarists" of the Friedman–Chicago–St. Louis School have also moved significantly beyond the simple dichotomies of the strict classical structure.

Most of these elaborations and developments are not directly germane to our present concerns. What needs to be recognized and em-

[9] Kessel also pointed out that although commercial banks were extraordinarily heavy debtors, with ratios of debts to equity several times larger than industrial corporations, their monetary assets were still larger—and as net creditors, the real value of their equity fell between 1942 and 1948, both absolutely and relative to industrial firms.

[10] G. L. Bach and Albert Ando, "The Redistributional Effects of Inflation," *Review of Economics and Statistics* (February 1957), find that "the debtor-creditor effect does occur, [although] income statement effects were generally more dominant" (p. 12)—and we return to these "other factors" later. Much stronger evidence in favor of the debtor-creditor effect is found in R. A. Kessel and A. A. Alchian, "The Meaning and Validity of the Inflation-Induced Lag of Wages Behind Prices," *American Economic Review* (March 1960). See also most recently G. L. Bach, *The New Inflation: Causes, Effects, Cures,* Brown University Press, Providence, 1972, esp. pp. 31-43.

[11] The New York Stock Exchange *Fact Book* (1972), p. 79, shows that the year-end ratios of the market values of all listed bonds as a percentage of par (face) values were:

1966: 91.50	1968: 86.69	1970: 83.60
1967: 87.94	1969: 77.80	1971: 89.10

Applying the discounts implied by these prices to all mortgages as well as bonds in Table I-11 clearly leaves non-financial corporations in a substantial net-debtor position throughout.

phasized here is that the basic conclusion of the classical economists that *the nominal prices of common stocks will vary directly with changes in* (the appropriate index of) *general prices*—even though not necessarily in strict proportion—is still retained and found in the more modern and sophisticated models. For instance, Lloyd Metzler in his seminal paper "Wealth, Saving and the Rate of Inflation"[12] focused on common stock as the primary security in his model and argued that "in the absence of movements in real interest rates, common stock prices rise or fall to the same extent that other prices rise or fall, so that in general inflation or deflation does not affect the real value of securities."[13] Similarly, Martin J. Bailey includes "corporate shares and other [real] assets whose [market] values tend to move with the general price level" and points out that the ownership of "real assets . . . are a significant part of the community's wealth, and other things equal, their total real value is independent of the money price level."[14]

James Tobin's various progressively more general models break the automatic tie between prices of capital stocks and consumers goods found in earlier classical models, but he too argues that "The main sources of inflation or deflation cause both capital goods and consumption goods and consumption prices to rise. Ownership of capital goods (and common stocks) is therefore a good though incomplete hedge against the risks of changes in the consumer price index."[15] Although Tobin's models emphasize the primary importance of any divergence between the rates of return provided in the stock market to the ownership of existing capital assets and the marginal productivity of these capital assets as a primary driving force in the system,[16] the commodity price level per se "does not affect the real rate of return on capital, calculated either on reproduction cost or on current market value."[17] Franco Modigliani also explicitly retains this same classical "building-block" at the core of his model underlying the stock market equation[18] in the MIT–FRB–PENN model, which is one of the most sophisticated of the modern large-scale econometric models.

Finally, although our references to Metzler, Tobin, and Modigliani illustrate the prevalence of earlier classical judgments concerning the favorable impact of inflation on stock markets in the recent work of leading neo-Keynesians, the same premise or anterior conclusion is also retained in the work of modern neo-monetarists. For instance, Friedman and Schwartz seek to infer the expected rate of inflation by examining the difference between the current market yields of stocks and bonds;[19] such an inference is valid only if, among other things, the capital markets

[12] *Journal of Political Economy* (April 1951), pp. 93-116.

[13] The quotation is from page 99. In the Metzler model, if the central bank holds a constant fraction of outstanding securities at all times, the real interest rate and the real value of the common stock outstanding will be invariant to the price level as long as the nominal money supply varies in proportion (i.e., the real value of private money holdings is constant).

[14] Martin J. Bailey, *National Income and the Price Level*, McGraw-Hill, New York, 1962, pp. 106, 107.

[15] This conclusion immediately follows his observation that "Whether in the stock market or in the markets for real capital goods, the terms of trade between capital ownership and consumption goods may turn in favor of owners of capital or against them. But what happens to these terms of trade is quite independent of what happens to the terms of trade between consumption goods and money." See "An Essay on the Principles of Debt Management," in *Fiscal and Debt Management Policies*, published by the Committee on Money and Credit, 1963, and reprinted in James Tobin, *Essays in Economics*, Vol. I, Markham, Chicago, 1971. The quotation is from pages 401-402 in the second source.

[16] See his "Money, Capital and Other Stores of Value," *American Economic Review* (May 1961), reprinted in *Essays in Economics, op. cit.*, where on page 226 he writes "The strategic variable—the ultimate gauge of expansion or deflation, of monetary tightness or ease—is the rate of return that the community of wealth-owners require in order to absorb the existing capital stock (valued at current prices), no more no less, into their portfolios and balance sheets. This rate may be termed the supply price of capital. If it is lower than the marginal productivity of capital, there will be excess demand for capital, stimulating increases in prices of capital goods and additions to the stock. If the supply price of capital is higher than its marginal productivity, demand for capital will be insufficient to absorb the existing stock; its valuation will tend to fall, discouraging production of new capital goods." See also his "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit, and Banking* (February 1969), reprinted as Chapter 18 in *Essays in Economics*. Sections 4 and 9 of this reference are especially relevant to the text above.

[17] Tobin, "General Equilibrium Approach," in *Essays in Economics*, p. 328.

[18] See Franco Modigliani, "The Valuation of Corporate Stock," mimeo., 1973, prepared for the forthcoming volume developing the econometrics of the entire model.

[19] Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960*, National Bureau of Economic Research, New York, 1963. And see also the discussion of similar studies in Richard Roll, "Interest Rates on Monetary Assets and Commodity Price Index Changes," *The Journal of Finance* (May 1972).

are equilibrated in terms of expected real, as distinct from expected nominal, returns. The most recent study relying on this classical premise is a paper by Hendershott and Van Horne.[20]

The authors of the more recent work cited have of course abandoned the simple classical assumption that the structure of prices and returns in financial markets do not affect the equilibrium of the real sectors of the economy, and they also have moved beyond the classical preoccupation with an essentially long-run static equilibrium to deal with shorter-term equilibria and the dynamic adjustment of the economy. Especially in view of the added complexity and flexibility being introduced into their models in other respects, it is indeed striking that they still continue to rely on the classical premise that the real returns to the ownership of capital goods will be invariant to the price level—and that stock prices will consequently rise more or less in proportion to the commodity price level determined elsewhere in the system.

To be sure, there was a considerable body of other research available while these models were being developed that tended to support these conclusions. In particular, there was an impressive array of historical research covering a wide variety of countries and time periods that had uniformly concluded that wages had usually lagged behind price increases and that real wages generally had fallen during inflation.[21] In addition, during World War II and on through the early 1960s researchers focused their models on a "demand-pull" inflation and inferred such a lag[22] that increases the real rates of return to capital, and thereby should make stock market prices stated in current dollars rise *more* than proportionately to the increase in the general price level. Notice that this is very similar in substance to the transfer of resources from creditors to debtors that made the stocks of companies in a net-debtor position rise more than the general price level in the classical analysis. But Kessel and Alchian's later careful review[23] of the evidence found that either wages had not "lagged" over any significant period as alleged, or that lagging wages could be readily explained by shifts in underlying real factor supplies and demands rather than by inflation itself.[24] Similarly, Cargill's still more recent analysis using spectral methods on the same bodies of data found "no agreement with the wage-lag hypothesis in the frequency range identified as the short run *since wages and prices appear to be coincident* here."[25] Interestingly enough, Cargill did find weak support for a wage *lag* in the long-run frequency range.[26]

Beginning in the late 1950s, and especially in the last few years, the focus of theoretical work has shifted to the contrary "cost-push" situation in which wage increases lead price increases and in a sense may be "responsible" for them. Wages of course can "lead" and rise faster than prices without putting pressure on commodity and product prices if the increase in real wages is less than the increase in productivity—in this case, the ratio of price to unit labor cost and the gross margin before capital charges are widened. But wage increases greater than gains in productivity increase labor cost per unit of output and create a cost-push that impairs gross profit margins unless prices are raised in tandem. We will review the research dealing with cost-push and other work casting doubt on the adequacy of the classical analysis after we examine the direct evidence available on the relation between inflation and stock prices.

[20] Patric H. Hendershott and James C. Van Horne, "Expected Inflation Implied by Capital Market Rates," *The Journal of Finance* (May 1973).

[21] This earlier work is reviewed in Kessel and Alchian, *op. cit.*, and includes several studies of different countries and times by E. S. Hamilton, Wesley Mitchell, Alvin Hansen, Bresciani-Turroni, Irving Fisher, and others.

[22] J. M. Keynes, *How to Pay for the War,* Macmillan, London, 1940, pp. 61-70; A. Smithies, "The Behavior of Money National Income Under Inflationary Conditions," *Quarterly Journal of Economics,* Vol. 56 (1942), pp. 113-229; F. D. Holzman, "Income Determination in Open Inflation," *Review of Economics and Statistics,* Vol. 32 (1950), pp. 150-158.

[23] Kessel and Alchian, *op. cit.*

[24] In a separate analysis, however, they found that the relative increases in equity value of fifty-six large industrial companies between 1940 and 1952 were negatively and significantly related to the ratios of their outlays for wages to their (market) equity, contrary to the positive relation expected on the wage-lag hypothesis.

[25] T. Cargill, "An Empirical Investigation of the Wage-Lag Hypothesis," *American Economic Review* (December 1969). The quotation is from the summary, page 811 (italics added).

[26] "At the long run frequency components where *coherence* is significant only about half of the components indicate a significant time difference between prices and wages. At these components, the timing relationship is predominantly a wage-lag" (p. 811).

A Brief Review of Some Evidence

There has been surprisingly little statistical work directly relevant to the impact of inflation on stock prices. William C. Greenough's studies of United States data from 1880 to 1950 showed that common stocks had "provided a considerably better protection against inflation than debt obligations" but that it is "unwise to commit all of one's retirement savings to equity investment, since variations in prices of common stocks are much too pronounced to permit full reliance on them for the stable (real) income needed during retirement."[27] Passing over other studies (all of which, so far as is known, tend to support Greenough's conclusions), the most relevant work is Phillip Cagan's analysis of the long-term performance of the common stocks of various countries.[28] Cagan found that the common stocks represented in the comprehensive indices of stock market values in most countries tended to maintain their real values over intervals of 10 or 15 years or more in spite of inflation. I.M.F. data for almost thirty countries over the period 1939–69 show a positive relation between the percentage change in nominal equity prices and inflation, although most of the "explanatory power" depends on observations for a few severe inflations.

Michael W. Keran's study of "Expectations, Money and the Stock Market"[29] developed an econometric model of stock market prices fitted to quarterly data from the first quarter of 1953 through the second quarter of 1970. He concluded that "Expectations of increasing inflation were found to lower the level of stock prices and not to raise it as is commonly argued. Inflationary expectations increase both expected corporate earnings and the interest rate at which these earnings are discounted . . . [but] changes in inflation expectations exert a much greater influence on the rate of discount than on expected earnings. This explains the negative relationship found between the general level of stock prices and expectations of inflation." Interestingly enough, Keran's model determines the level of stock prices by the level of the current expected real corporate earnings (estimated by a 5-year distributed lag) and another (additive!) term for the long-term rate of interest. In the actual fitting, however, this interest rate is replaced by its determinants, as developed in the earlier St. Louis study[30] of interest rates—specifically distributed lags of varying length on the rates of change of the real money stock, real output, and past inflation rates—and his conclusions on the adverse effects of expected inflation on stock prices rest entirely on the negative coefficient on the inflation rate in this "reduced form" equation. Symmetry of treatment to allow for the net effects of inflationary expectations on expected earnings as well as interest rates would have suggested entering price expectations in an equation with current nominal interest rates and current nominal normalized earnings.[31]

Modigliani's more rigorous and sophisticated study previously cited leads to substantially different conclusions. Since current cash dividend payments were well estimated elsewhere in the overall MIT–FRB model, the dependent variable in the stock price equation was the current dividend yield in the market. The resulting equation was fitted to quarterly data for the seventeen years 1953 through 1969.[32] Highly significant positive coefficients were found on a risk premium term (proxied by a 15-year moving average of the absolute deviations of unemployment rates from a 4 per cent norm), and a significantly negative coefficient was found on the current "earnings cover" (E/D) of the dividend. Dividend yields, also as expected, varied strongly and very significantly with currently expected long-term interest rates, estimated as a distributed lag over the current and previous four quarter rates.

---

[27] William C. Greenough, *A New Approach to Retirement Income*, TIAA, New York, 1951. The quotations are from pages 13-14. Greenough's earlier studies may also be cited.

[28] See the brief description in Part II, Section 4, of this report.

[29] *St. Louis Federal Reserve Bank Review*, January 1971, pp. 16-31. The quotation is from Keran's summary, page 16.

[30] W. P. Yohe and D. S. Karnovsky, "Interest Rates and Price Level Changes, 1952–69," *St. Louis Federal Reserve Bank Review*, December 1969.

[31] This would have normalized the expected future real returns to the current price level.

[32] The equation had a standard error of estimate on dividend yields of only fifteen basic points, with low residual autocorrelation.

But of more direct relevance here, currently expected rates of inflation had a very significant *negative* effect on dividend yields—the higher the expected rate of inflation, the lower the dividend yield, and hence the higher the stock price for a given current dividend, assuming that risk premium, earnings cover, and nominal interest rates are the same. Moreover, the negative coefficient estimated on price expectations is larger in absolute terms than the positive parameter on the nominal interest rate. The fitted equations therefore suggest that even if *real* interest rates (nominal rates less price expectations) instead of nominal rates had been entered directly in the equation, the *ceteris paribus* impact of increased expectations of future price increases would still reduce dividend yields (i.e., higher expected future inflation rates raise stock prices).

For at least three reasons, however, this inference must be drawn with caution from Modigliani's work. The absolute difference in the coefficients on nominal interest rates and price expectations is less than the sum of the standard errors of the two estimates in each of his fitted equations; the respective distributed lags are five quarters for nominal rates but twelve quarters for price expectations; and as noted previously, at an early critical stage of his theoretical development, Modigliani builds on the classical proposition that the market value at current real price levels of unlevered securities is independent of the expected rate of inflation. But if this work does not justify any strong inference that greater expectations of inflation produce higher current stock prices, the good fits produced at the least cast serious doubt on Keran's contrary conclusion.

Finally, the Modigliani study justified no conclusions at all with respect to the effect of *current* realized rates of inflation on stock prices (as distinct from changes in expectations of future inflation). To some extent, of course, more serious current inflation raises expectations of future inflation, but in the fitted equations this effect is very minor, since the weights on recent inflation in Modigliani's distributed lag are small both absolutely and relative to the dominant weights found on price changes three to eight quarters back. Of most direct relevance is the strong negative relation between dividend yields and the ratio of current earnings to dividends. Even waiving the potential biases in correlating D/P with E/D, Modigliani simply used current earnings as reported and for his purposes did not need to examine the impact of current inflation rates on stock prices. If we otherwise knew that higher current rates of inflation reduce current earnings, then his fitted equations would imply higher dividend yields and lower stock prices; on the other hand, if or when more current inflation raises current earnings, his coefficients imply that more current inflations would raise stock prices. But these inferences that stock prices move with current earnings are only to be expected and are surely not novel. It remains to examine the relations to be expected between more or less inflation and the concurrent changes in corporate earnings and profits, a matter we examine in some detail later.

The evidence reviewed to this point leads to the following conclusions:

1. Cagan's work establishes that common stocks have provided a hedge in the more advanced countries against all but very extreme inflations in the long run in the sense that their real returns are positive, but he did not undertake any extensive analysis of the short-run or intermediate term effects, nor did he attempt to determine whether even the long-term positive returns were larger or smaller because of inflation than they would otherwise have been.

2. Keran's conclusion that greater expectations of future inflation depress stock prices was based entirely on their adverse effects through interest rates, and the form of the fitted equation is likely to have biased the conclusion. Modigliani's work suggests better than even odds that the *net* effect of expected future rates of inflation on current stock market prices is no worse than neutral, as the classical economists would have expected. But his study focused on the other issues, and this inference drawn from his equations would not pass standard tests of statistical significance (even though all elements of his equation did so for his own purposes).

3. These studies simply did not examine the effects of current realized inflation (as distinct from expectations of future inflation) on stock prices, although the internal evidence of these

TABLE I-12

Stock Price Trends According to Commodity Price Fluctuations

Annual Commodity Price Changes	Number of Years	Average Annual Stock Price Change	Number of Years that Stocks Decline	Advance
		1900 to 1966 (1971)		
−6% to −37%	7 (7)	−25.9% (25.9)	7 (7)	0 (0)
−2 to −5	8 (8)	+7.9 (7.9)	3 (3)	5 (5)
−1 to +1	21 (23)	+15.5 (14.9)	4 (4)	17 (19)
+2 to +5	14 (17)	+8.9 (7.5)	4 (6)	10 (11)
+6 to +38	16 (16)	+7.4 (7.4)	7 (7)	9 (9)
Average +2% (2.4%)	66 (71)	Average +6.8% (6.6%)	25 (27)	41 (44)
		1946 to 1966 (1971)		
−2% to −5%	2	−4.6% (4.6)	1 (1)	1 (1)
−1 to +1	10 (11)	+12.8 (12.4)	2 (2)	8 (9)
+2 to +23	9 (13)	+10.2 (8.0)	3 (5)	6 (8)
Average +3%	21 (26)	Average +10.0% (8.9%)	6 (8)	15 (18)

Source: See footnote in text. We have added data through 1971 in parentheses and recomputed the entire table.

studies suggests that *this* issue turns essentially on the impact of realized inflation on contemporary corporate earnings.

The Short-Term Impact of Inflation on Stock Prices as Shown in Annual Data

In the mid-1960s, when "the Street" was most bullish on purchases of common stocks as inflation hedges, Sydney Homer, a partner in Salomon Brothers and Hutzler, argued strongly against the then common assumption that inflation is good for common stocks.[33] Using tabulations of percentage changes in annual indexes of wholesale prices and common stock prices (see Table I-12) Homer showed that in the 21 years between 1900 and 1966 when wholesale prices were essentially stable, the average gain in stock prices was 15 per cent, but that average gains were reduced to 9 per cent in the 14 years of moderate inflation (2 per cent–5 per cent) and had averaged only 7 per cent (with capital losses in *real* terms) in the 16 years of more serious inflation. When the years through 1971 are added, the average market gains in the 33 years of substantial inflation (over 2 per cent wholesale) are only about half the 15 per cent average gain in the 23 years of essential stability in general prices; within the last quarter-century, the years of substantial inflation have shown average market gains only about two-thirds as large as those in years of price stability.

However, the stock price action in every group of years in the table was quite variable. Indeed, the within-cell standard deviation of changes in stock prices in the 11 postwar years of negligible inflation and in the 13 years of sizable inflation were, respectively, 13.1 per cent and 15.9 per cent. With so much unexplained variation in the data, the difference in the average return in these groups of years (12.4 per cent–8.0 per cent) could very easily reflect no more than chance variations in drawings from a universe in which stock price changes were really independent of changes in wholesale prices.[34] Thus the evidence that inflation is unfavorable to stock prices is weak. The evidence against the hypothesis that inflation is good for stock prices is somewhat stronger, but still far from statistically significant with such coarse groupings of the

[33] See "Inflation and the Stock Market," an address given before the Security Analysts of San Francisco, January 19, 1967.

[34] Further confirmation is provided by the non-parametric Mann–Whitney test of association. The rank sums differ from their expected value in drawing from a random ordering by less than one (.87) standard deviation. (For a description of the Mann–Whitney test see, for instance, Irwin Miller and John E. Freund, *Probability and Statistics for Engineers*, Prentice-Hall, Englewood Cliffs, N. J., 1965, pp. 214-217).

data, however suggestive they may be. Clearly, more refined regression analysis is required.[35]

1. When a simple regression between the annual percentage change in stock prices and the annual percentage change in the wholesale price index is run over the 70 years of data, there is no correlation at all. (The R^2 corrected for degrees of freedom is in fact negative.) But the results may be due to the indication shown in the table that both serious deflation and serious inflation hurt common stock returns. The deflation period would tend to produce a positive coefficient of the (negative) wholesale price change; the inflation period would tend to produce a negative coefficient on the (positive) inflation term—and the two effects may have just been offsetting each other.

In order to test the possibility that *both* deflation and serious inflation depress common stock returns, we split the wholesale price series into two separate variables. We defined $W+$ as the actual percentage change in the wholesale price index when it was algebraically greater than –2 per cent, and a constant otherwise. Correspondingly, $W-$ was the actual amount of price change when it was algebraically less (negatively greater) than –2 per cent and a constant otherwise. When these variables were entered separately in a regression to explain stock price changes, the fraction of variance in changes in stock prices explained jumped to 13 per cent and the deflation variable $W-$ was highly significant (with a t-ratio of 3.62), showing that a 10 per cent deflation would reduce stock market return by 15 per cent. The inflation term $W+$ was considerably weaker, with a submarginal t-statistic of 1.44, and the regression coefficient showed that a 10 per cent inflation would reduce stock returns by only 4.1 per cent.

2. Earnings and interest rates, of course, also affect stock prices.[36] Indeed, a simple regression of percentage stock price changes ($\dot{P}$) on contemporary percentage earnings changes ($\dot{E}$) does about as well as our more refined tests of wholesale prices. Earnings alone explain 12 per cent of the variance in $\dot{P}$, and have an impressive t-ratio of 3.35. In the simple correlation of annual data, a 10 per cent increase in earnings would increase stock prices 1.8 per cent. Moreover, an extensive series of tests adding or substituting lagged-earnings change, or moving averages, did not significantly improve these results.

3. We tested both commercial paper rates (*CP*) and long-term bond rates (*BR*) in equations to explain stock prices. Rather surprisingly, a simple regression on *CP* changes explained none of the stock price variance in these regressions with annual data, nor did lags or moving averages of this variable. Changes in *BR*, however, explained 7 per cent of the variance in stock price change, with a significant t of –2.67 and a simple regression coefficient, implying that a 20 per cent increase in *BR* (e.g., from 4 per cent to 4.8 per cent) would reduce stock prices by 15.3 per cent. Once again, lags and moving averages added nothing to the explanatory power of the long-bond rate in annual data.

4. When all of these variables are entered simultaneously in the regression, the following results were obtained when, as in all the above, all variables refer to percentage changes:

$$\dot{P} = 16.93 + 0.115\dot{E} + 3.301\dot{W}- \quad -0.669\dot{W}+ \quad -0.542\dot{BR}$$

t:		2.19		−2.85		−2.09
partial:[37]		.268		−.341		−.257

All variables are significant and have the expected sign; and 33.4 per cent of the variance of stock price changes is explained. Deflation is the strongest variable when it is active; and, in particular, a 5 per cent deflation would reduce stock prices by 16.5 per cent, whereas a 5 per cent inflation reduces them by 3.35 per cent. What is perhaps most significant in this equation is that these strong deflationary impacts of inflation and deflation are *net* effects after allow-

[35] Peter Fortune provided able assistance in carrying through this econometric work.

[36] Since our variables are defined as percentage changes, it was necessary to drop both 1921 and 1932 (which had negative earnings), and also 1922 and 1933, from all the regressions involving the earnings variable.

[37] This line gives the partial correlation coefficient of each variable with the dependent variable.

ing for their simultaneous effects on earnings and long-term interest rates, which are also statistically significant variables in the equation.

5. As a final test, the last regression was rerun simply over the 52 years in which wholesale price changes were *positive*, with the following outcome:

$$\dot{P} = 10.10 + 0.11\dot{E} - 0.64\dot{W}^{+} - 0.60\dot{BR}$$
$$t: \quad 1.86 \quad -2.48 \quad -2.10$$
$$\text{partial:} \quad .27 \quad -.33 \quad -.31$$

These results are very similar to those obtained before with respect to each variable included, and the value of each separate variable continues to be significant at the 5 per cent level. Although the regression as a whole remains very significant,[38] the powerful effect of W^{-} in years of severe deflation is no longer included and the percentage of the variance of stock price changes that is explained falls to 20 per cent. We also see that the Durbin–Watson statistic[39] indicates a significant degree of autocorrelation in the residuals over the 52 years of stable or rising prices. Although no lagged variables were significant when each variable was introduced separately in our preliminary analysis, we are testing for such lags in the full model excluding years of deflation. We are also examining whether such other variables as commercial paper rates, dividends, and growth rates may also be significant factors in determining percentage changes in average stock prices in years of stable or increasing commodity prices.

It is common practice to regard percentage changes and logarithmic first-differences as interchangeable in regression analysis, but study of the data in logarithmic form permits more flexibility and we are concurrently pursuing this approach. One significant result we have confirms the appropriateness of concentrating on the simple relative first-differences in the data.[40] The resulting regression over the 52 years of stable or rising prices, with the change in the log of the stock price index ($\Delta \ln P$) as the dependent variable, gives

$$\Delta \ln P = \underset{.09}{4.22} + \underset{3.81}{0.27}\,\Delta \ln E - \underset{-1.30}{0.28}\,\Delta \ln W^{+} - \underset{0.71}{0.18}\,\Delta \ln BR$$

A comparison of this equation with the preceding one covering the same years shows marked differences. The percentage of variance of stock price changes explained is 16 per cent (instead of 20 per cent), although the F-statistic (4.69) is still very significant at the .01 level and the standard error of estimate is .109 (instead of .133). In addition, the Durbin–Watson statistic again is respectable[41] and shows no significant autocorrelation (at the 5 per cent level) of the residuals in our logarithmic equation. Even more significant, the coefficient on the earnings-change variable has more than doubled, whereas that on "inflation" has fallen to less than half its percentage-change value; and the coefficient for the long-bond rate has fallen by over two-thirds. The values of the respective t-statistics have all changed in the same proportions.

The correlation matrices in the two forms of variable measurement suggest that the stronger effect of inflation in the percentage-change analysis primarily reflects the impact of a few outlying observations,[42] which in turn suggests that some higher-order term in logarithmic inflation may be more (or additionally) significant. We are also testing for the effects of other variables suggested by theory and previous empirical work in this logarithmic equation, but these further results will have to be reported later.

Interpretations, Related Research, and Further Work

The results of our work with annual data so far indicate that the structure and conclusions of

[38] The F-statistic is 5.55, far above the value (4.22) required for significance at the 1 per cent level.

[39] The value has fallen from an acceptable level of 1.70 when deflation years were included to 1.30.

[40] Specifically, when we regressed the levels of all variables in logarithmic form, we found the maximum likelihood value of the Cochran–Orcutt adjustment parameter to be 1.0, which reduces the data to first-differences in the logarithms.

[41] Up to 1.64 from 1.3 in percentage-change form.

[42] These 52 years of stable or rising prices included 10 years of inflation between 10 per cent and 38 per cent and 29 years of stock price changes between 10 per cent and 45 per cent; Δ logarithm grows much less rapidly than the percentage change. For instance, when Δ is .10, $\Delta \ln$ is .0953; when Δ is .25, $\Delta \ln$ is .223; and when Δ is .45, $\Delta \ln$ is .372, or about one sixth smaller.

models used by both the classical and modern neo-classical economists may be substantially in error with respect to the relation between inflation and stock market prices. Assuming that our further work with annual and quarterly models continues to support this conclusion, we may appropriately consider some of the apparent reasons for such a finding.

As we saw earlier, apart from allowance for gains or losses from its net-debtor-creditor position, the classical conclusion that stock prices would rise in proportion to other prices rested essentially on the invariance to inflation of (1) the *real* returns to the ownership of capital goods, and (2) the *real* interest rate. There are substantial reasons to doubt the validity of *both* of these major premises, quite apart from the impacts of important *expectational* considerations ignored in the classical analysis, along with the implications of the theories of portfolio adjustment and multi-market equilibria that have been developed more recently.

In any given year or quarter, the *real* returns to the ownership of capital goods (a company's real after-tax earnings plus interest charges) will be invariant to inflation *only if* (1) its physical output, (2) its real gross margin per unit of output, and (3) the real after-tax value of its capital-consumption allowances are *all unaffected* by inflation.[43] Correspondingly, in a dynamic growth context, these real returns will be invariant to the current inflation rate only if the rate of growth in real output and the gross and net percentage profit margins are similarly unaffected. But we must recognize that inflation is not an exogenous force imposed on the "real" elements of an economy, but rather is a highly endogenous variable. The root cause of an inflationary "cycle" must be an increased demand for goods and services arising from a stimulating shift in the fiscal (tax and public expenditure) posture, or an easing of monetary policy, or conceivably from a spontaneous surge in private demands.

The initial acceleration and later deceleration (or decline) in the rate of change in real output will obviously induce corresponding fluctuations in earnings (and dividends with a lag), even if gross and net (percentage) profit margins are constant. But gross (and therefore net) margins will *not* be constant. The work of Hultgren, Fabricant, Kendrick, Kuh, and Eckstein and Wilson[44] shows that the growth in productivity fluctuates about its long-term trend in resonance with the fluctuations in output growth. The resulting fluctuations in gross margins produce still larger fluctuations in profit, other things equal. But other things are not invariant because prices respond to changing demands and costs, and wages respond to changing prices, labor market tightness, induced expectations of further inflation, and other factors.

Drawing on and adapting the substantial amount of work over the last decade on the determinants of industrial prices[45] and wages,[46] one important part of our continuing research is a simulation (based on equations fitted to the last 20 years of American data) of the fluctuations in prices, wages, productivity, gross profits margins, and rates of change in gross profits that are implied by imposing different patterns of accelerating (and later stable or falling) output change on an economy otherwise in a non-

[43] We of course ignore the possibility of coincidentally offsetting changes in these elements. Also, for simplicity we will simply assume that the prices of variable inputs other than wages are proportional to sales (output) prices.

[44] Thor Hultgren, *Changes in Labor Cost During Cycles of Production and Business,* National Bureau of Economic Research, New York, 1960; Solomon Fabricant, *Basic Facts About Productivity Change,* National Bureau of Economic Research, New York, 1959; John W. Kendrick, *Productivity Trends: Capital and Labor,* National Bureau of Economic Research, New York, 1956, and *Productivity Trends in the United States,* National Bureau of Economic Research, New York, 1961; Edwin Kuh, *Profits, Profit Markups and Productivity,* U. S. Congress, Joint Economic Committee, 1960; Thomas A. Wilson and Otto Eckstein, "Short-Run Productivity Behavior in U.S. Manufacturing," *Review of Economics and Statistics* (February 1964).

[45] C. L. Schultze and J. L. Tryon, "Prices and Wages," *Brookings Quarterly Econometric Model of the U.S.,* 1965; Otto Eckstein and Gary Fromm, "The Price Equation," *American Economic Review* (December 1968); and the papers in *The Econometrics of Price Determination,* a conference, Board of Governors, Federal Reserve System, 1970 (published 1972).

[46] See relevant papers in preceding footnotes; Edwin Kuh, "A Productivity Theory of Wage Levels—An Alternative to the Phillips Curve," *Review of Economic Studies* (October 1967); Otto Eckstein and Roger Brinner, *The Inflation Process in the U.S.,* U.S. Congress, Joint Economic Committee, 1972; George L. Perry, "Changing Labor Markets and Inflation," *Brookings Papers on Economic Activity,* No. 3 (1970); Robert J. Gordon, "Inflation in Recession and Recovery," *Brookings Papers,* No. 1 (1971); "Wage-Price Controls and the Shifting Phillips Curve," *Brookings Papers,* No. 2 (1972); and his staff progress report appearing later in this volume.

inflationary, steady-state growth posture. The results are showing that the gross returns to capital initially are increased very substantially in an inflationary "cycle" but they later stabilize and then are sharply impaired for a considerable period. At the moment, we need only emphasize that the classical analysis of the effect of inflation on stock prices was substantially in error because all such fluctuations in gross returns were ignored.

In addition, the classical premise that the total returns to capital are invariant also requires that the real after-tax value of capital consumption allowances be unaffected by inflation. But *even if* gross margins were to be constant, as assumed in the classical framework, and if the prices of capital goods and product prices move in tandem, *net* profit margins in real terms will be impaired by increases in general price levels when taxes have to be paid on nominal profits after deducting depreciation on the basis of original costs rather than current replacement costs. *Even in a long-run steady-state,* the classical premise of constant real returns to the owners of capital goods has to be adjusted downward to allow for the reduction in the real value of the "tax shield" for depreciation under inflationary conditions. After corporate income taxes reached high levels during World War II, this matter began to receive extensive attention in the literature[47] and must surely be incorporated along with fluctuations in gross margins in an analysis of the effects of inflation on equity values.

Recall that in our work with annual data we have found a highly significant *negative* impact of inflation on the percentage changes in stock market prices, *even after* its effects on earnings and interest rates have been allowed for—and the odds are still about 9:1 that the *net* impact of inflation is negative in the logarithmic form tested. Allowance for the stream of discrepancies between historical and replacement cost depreciation under inflationary conditions for tax purposes is surely one major factor that would explain such a *net* depressing effect of a well-established inflation on stock prices. But this depressant is at least partially offset by the favorable impact of the predominantly net-debtor position of nonfinancial corporations, especially in recent years, and both of these considerations should be examined in more detail.

Recent research has shown that the classical premise of a long-term *real* rate of interest invariant to the rate of inflation is an unwarranted simplification.[48] Also, the nominal rate is not simply the real rate plus a premium equal to the expected rate of inflation during all intervals or periods when the Federal Reserve is pursuing an *active* policy of either ease or tightness. In addition, there has been growing public acceptance of the fact that restrictive fiscal and monetary policy can effectively dampen the pace of economic activity; and, based to some extent on experience of the late fifties and especially on 1966 and 1969–70, there has been a growing public *expectation* that monetary policy in particular (with at least some support from fiscal policy) *will* in fact be used to cut back the volume of activity. Although tax rates, government expenditures, and Federal Reserve actions are usually treated as exogenous variables by economists, private expectations of these exogenous responses to ongoing inflationary pressures must surely be introduced into any fully satisfactory analysis of the relation of inflation to equity values.

[47] See especially E. Cary Brown, *Effects of Taxation: Depreciation Adjustments for Price Changes,* Graduate School of Business, Division of Research, Harvard University, Cambridge, 1952; and George Terborgh, *Realistic Depreciation Policy* (1954), esp. Chapter 12; and *Essays on Inflation* (1971), esp. Chapter 2, Machinery and Allied Products Institute, Chicago. Also see Donald A. Nichols, "A Note on Inflation and Common Stock Values," *Journal of Finance* (September 1968); pp. 655-657; Brian Motley, "Inflation and Common Stock Values: Comment," *Journal of Finance* (June 1969), pp. 530-535; and most recently, James C. Van Horne and William E. Glassmire, Jr., "The Impact of Unanticipated Changes in Inflation on the Value of Common Stocks," *Journal of Finance* (December 1972), pp. 1081-1092.

[48] See Thomas Sargent, "Commodity Price Expectations and the Interest Rate," *Quarterly Journal of Economics* (February 1969); and "Interest Rates and Prices in the Long Run: A Study of the Gibson Paradox," for the Universities–National Bureau Conference on Secular Inflation, published in the *Journal of Money, Credit, and Banking,* Vol. V, No. 1, Part II (February 1973); and his papers summarized in Part II, Section 4 in this report. Also, Milton Friedman, "Factors Affecting the Level of Interest Rates," *1968 Conference Proceedings of the Conference on Savings and Residential Financing;* William E. Gibson, "Price Expectations Effects on Interest Rates," *Journal of Finance* (March 1970); and Martin Feldstein and Otto Eckstein, "The Fundamental Determinants of Interest Rates," *Review of Economics and Statistics* (November 1970).

Major developments in portfolio and capital market theory in recent years show that the adjustments of market values to changing conditions are much more subtle and complex than suspected in earlier models.[49] As part of our continuing research, we are developing a broader portfolio adjustment model simultaneously including the stock market, bond market, and short-term funds market. Among other things, this work suggests that levels, first-differences, and uncertainties regarding short-term commercial paper rates, bond rates, and equity yields, as well as expected inflation rates, be included in the market clearing equations for each interrelated sector. In particular, the insights from these efforts and related work are being incorporated in a new quarterly model of the stock market. Consistent with the known efficiency and submartingale properties of the market,[50] this model cannot provide the basis for any extraordinary risk-adjusted returns but it will hopefully add significantly to our understanding of the determinants of stock market prices and returns, including specifically the effects of inflation and of inflationary expectations.

On the basis of this work and the other work mentioned above, it would appear that our overall conclusions will finally be that *both* the unalloyed optimism of traditional economic theory and the flat pessimism of the current version of conventional wisdom are quite unjustified as *generalizations* of the relation between inflation and stock prices. In a non-inflationary setting, equity values are likely to be enhanced (in both nominal and real terms) quite significantly during the earlier stages of an inflation; in other circumstances and at other stages of a full inflation "cycle," the effects will probably be about neutral; and in still other circumstances the effects of more inflation on stock prices will surely be adverse, and very severely so for a time. But these projections of our probable conclusions will of course have to be confirmed by the detailed results of our work still underway.

[49] See Section V in John Lintner, *Finance and Capital Markets*, 50th Anniversary Colloquium II, National Bureau of Economic Research, New York, 1972, and references there cited.

[50] Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance* (May 1970).