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BUSINESS CYCLE ANALYSIS AND EXPECTATIONAL SURVEY DATA

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ABSTRACT

What is the role of foresight, and the significance of the lack of foresight under uncertainty, in the theory of business cycles? What relevant evidence on these questions can be extracted from the survey data on agents' expectations and experts' forecasts? To provide some answers, the recent work in this area is reviewed in the perspective of economic and doctrinal history. The address proceeds from (1) a discussion of the expectational aspects of modern business cycles theories and (2) a critique of the currently dominant approaches to (3) a summary of the evidence and (4) some illustrations and implications for further analysis. Of the conclusions drawn, perhaps the most general one is that expectations matter a great deal but are not all-important. They may be rational in the sense of effectively using the limited available knowledge and information, but they are also diversified and not always self-validating or stabilizing.

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BUSINESS CYCLE ANALYSIS AND EXPECTATIONAL SURVEY DATA

This paper is part of a project in progress, which attempts to survey the recent work on business cycles in historical perspective. It concentrates on one set of phenomena in the complex story of this main form of economic instability and its interpretations: What is the role of foresight and the lack thereof under uncertainty in the theory of business cycles? What is the evidence from survey data on expectations and forecasts? The subject is broad and the work is far from finished, but some provisional results seem worth reporting.

The paper has four substantive parts. Section 1 discusses the expectational aspects of modern business cycle theories. Section 2 reviews the criticisms of the treatment of expectations. Section 3 summarizes the evidence. Section 4 provides some illustrations from my own empirical work.

1. Expectations in the Theory of Business Cycles

The "Konjunkturgebundenheit" of contemporary economic thinking, i.e., its dependence on whether prosperous or depressed business conditions prevail, is in itself an argument in favor of the importance of the "psychological factor" (Haberler, 1964, p. 471 n.) Of the classics of business cycle literature, Pigou (1927, esp. chs. VI and VII) is most prominently associated with the theory that, under uncertainty, interdependent expectations of businessmen generate widespread errors of optimism in expansions and of pessimism in contractions. It is well known but still noteworthy that, for all their differences, Keynes (1936, esp. chs. 11, 12, 15 and 22) shared with Pigou the emphasis on these processes of error diffusion, discovery, and reversal. Later much further attention was given to the role of attitudes and expectations in business decisions (Hart, 1940; Shackle, 1949), consumer behavior (Katona,

1951; Juster, 1964), and the "contagious" cumulative processes of the business cycle (Jöhr 1952). Recently, Strigel (1981) examined the results of the Ifo business outlook surveys from a similar point of view.

During business expansions, most series on output, employment, real income, and spending, etc., increase so that "good news" dominate and their cumulation fosters optimism; during business contractions, the opposite happens. This is simply a consequence of the persistence and pervasiveness of the fluctuations and not necessarily a source. To be possibly invalid and provoke disagreement, a theory of the "psychological" type must argue that errors of excessive optimism (pessimism) play a major independent part in generating booms (slumps). Thus, prospective profits are being overestimated for some reason in certain periods and such errors spread and grow until discovered in the markets for the "overproduced" goods and replaced for a time by similarly infectious and partly self-validating underpredictions. For the classics, access to more and better information on industry fortunes would help reduce individual forecast errors and their cumulation; for Keynes, this could not help much, since there is little knowledge on which expectations of the future yield from investment could draw.[1]

The first generation of formal theoretical models of cycles in aggregate output slighted the expectational factors. This is true of the stochastic, linear, and stable models (Frisch, 1933) and the deterministic, nonlinear, and unstable ones (Hicks, 1950). But soon a reaction set in against the theories of the latter type. The dangers of volatile market psychology, investment collapse, etc., no longer loomed large in the midst of worldwide expansion and

[1]Such knowledge is "usually very slight and often negligible" and so the expectations "being based on shifting and unreliable evidence . . . are subject to sudden and violent changes" (Keynes, 1936, pp. 149 and 315). Cf. Alfred Marshall, Money, Credit, and Commerce, Macmillan, London, 1923, pp. 260-261, and Pigou, op. cit., pp. 66-69.

growing prosperity, even though "Keynesian" ideas were still ascendant. There was renewed recognition of the plurality of causes and diversity of elements in the individual business cycles (Duesenberry, 1958). New influential theories cast expectations in prominent roles and at the same time imputed much more stability to the private sector than Keynes and his early followers did. The permanent income and life cycle hypotheses made consumption forward-looking rather than merely reactive, broadly wealth-dependent rather than income-constrained (Friedman, 1957; Ando and Modigliani, 1963). The evolution of the investment function also pointed to the importance of longer-term expected ("permanent") output (Eisner, 1978, ch. 4), while relying as well on relative price variables such as the rental costs of capital (Jorgenson, 1963). All these developments reduced the perceived significance of the accelerator-multiplier interaction and the associated cumulative movements making for instability.

The original monetarist theory which challenged Keynesian economics in the 1960s asserts that changes in the supply of money are the main determinant of changes in nominal income. The long-run version of this hypothesis reduces to the old quantity theory of how trends in money produce trends in prices, but there is much less clarity and agreement about the nature and direction of the money-income relation in the short run. Here one critical element is a relatively stable demand function for real money balances. The other is lags in wage and price adjustments, which arise because expectations are taken to be "adaptive," that is, backward-looking and involving gradual learning from, and correction of, past errors. Given both these conditions, autocorrelated disturbances in the form of alternating sequences of high and low monetary growth rates produce, via changes in expected relative prices and rates of return, fluctuations in aggregate demand and real economic activity, i.e., business

cycles or growth cycles. The critical monetary impulses are treated as exogenous and mainly policy induced. The "feedback" influence from business activity to monetary growth is not analytically developed and integrated into a theory of how money, prices, and real factors interact in the short run. Instead, this is an essentially exogenous and monetary theory (Friedman and Schwartz 1963 a and b).

Under adaptive expectations (AE) short-term money changes are implicitly viewed as unanticipated and so are for some time the associated price changes. For example, people will tend to underestimate the rising prices caused by a sudden acceleration of monetary growth and hence overestimate their real money balances. This will induce portfolio adjustments in response to the altered relative prices or yields on a broad range of assets and then more transitory spending on goods and services to liquidate the extra amounts of "redundant" money. In the process, interest rates will first decline but then snap back as spending, income, and prices rise, overshooting the new equilibrium paths. This transmission process is seen as involving variable but on the average lengthy lags. As the adjustments in the price level are incomplete and those in wages may be particularly sluggish, employment and output react in a cyclical manner.

According to the "natural rate" hypothesis (Friedman, 1968; Phelps, 1967) the deviations of output, employment, and unemployment from their equilibrium levels can occur only if and as long as the expected rates of inflation differ from the actual ones. However, such differences are eliminated only in an ill-defined "long run," which in this context is often treated as if it meant "on the average over the business cycle." The process of discovery and elimination of the price forecast errors is sluggish in a world of frequent monetary and real shocks, in which it is difficult to distinguish signals from noise, that

is, absolute from relative price changes and persistent from temporary movements.

In the more recent equilibrium models, the hypothesis of AE is replaced by that of rational expectations (RE). Here expectations are basically like predictions of the relevant and valid economic theory: free of any bias and subject to random errors only (Muth, 1961; Lucas, 1972). Economic behavior is guided by subjective probabilities which on the average agree with the observed frequencies of the events in question. These frequencies have predictive value, the processes to which they refer being assumed stable and known from past learning experience. Unlike in Knight, 1921, or Keynes, 1936, there is no uncertainty here as to what the applicable objective probability disturbances are or whether they do in fact exist in any usable form.

Under RE, all persistent monetary changes, inasmuch as they are predictable, will be correctly anticipated and met directly by proportional changes in prices and related nominal variables. Only random monetary impulses can lead to surprises and miscalculations which, in this view, are necessary to explain any cyclical movements in real variables. It is the resulting errors in price expectations, which must themselves be random and short-lived, that act as the proximate cyclical impulses in this class of models.

It is assumed that economic agents have timely and complete information about their own markets but only incomplete or lagged information about other "island" markets (Phelps, 1970) and about the economy-wide aggregates such as the money stock and the overall price level. Supply and demand depend on perceived changes in a broad set of real variables, but that set is in practice limited to relative prices only. All agents are effectively treated as price takers, so quantity signals are disregarded. Suppliers compare their current price and wage opportunities with the expected (discounted future) opportun-

ities and react positively to the excess of the former over the latter. These intertemporal substitution effects are typically elastic, reflecting strong competitive incentives to take advantage of temporarily higher real rates of return. Now a general price rise due to an unanticipated monetary stimulus is misperceived by agents as signaling increases in relative prices, which prompts simultaneous upward adjustments of output and employment throughout the economy. Only in time, after having made their decisions, will the agents discover that their relative price estimates were distorted as prices rose in other markets as well. A retrenchment will then follow. When prices unexpectedly fall or, which is more likely in our times, the actual inflation rates decline below the anticipated rates, misperceptions of the opposite sign are predicted to occur, which again will not be recognized and cleared up until they have caused a retardation or recession in real economic activity. Thus these theories rest on several strong, maintained hypotheses: intertemporal substitution on the supply side, rational expectations, and lags of information (Lucas, 1975, 1977; Sargent and Wallace, 1976; Sargent, 1976; Barro, 1980).

The first generation of the RE models assumed flexibility of all prices and continuous clearing of all markets, including the labor market; they also implied the impotence of any monetary stabilization policy that is nonrandom and capable of being anticipated. These propositions are highly controversial and some critics regard them as entirely inconsistent with basic facts about the economy (Arrow, 1978; Solow, 1980; Tobin, 1977). Empirical studies of intertemporal substitution show that it is difficult to test this hypothesis directly; the evidence is mixed but for the most part unfavorable (Lucas and Rapping, 1969; Hall, 1980; Altonji, 1982; Altonji and Ashensfelter, 1980; Clark and Summers, 1979; Mankiw, Rotemberg, and Summers, 1982). The voluminous theoretical and empirical work on price determination and labor contracts

identifies a number of reasons why prices and wages adjust gradually to changes in aggregate demand (Azariadis, 1975; Baily, 1974; Gordon,1981; Okun, 1981). Some of the more recent RE models reflect these developments by introducing contracts which predetermine the course of wages over some future time period (Phelps and Taylor, 1977; Fischer, 1977; Taylor, 1980; 1982 McCallum, 1982). Other models with RE retain continuous market clearing but rely largely or exclusively on real, not monetary, disturbances to explain business fluctuations (Kydland and Prescott, 1982; Black, 1982; King and Plosser, 1982; Nelson and Plosser, 1982; Long and Plosser, 1983). The issues addressed in all these diverse studies are important for the analysis of business cycles but must be omitted from consideration in this paper which is limited to a single aspect of this work, namely the treatment of agents' expectations. The related problem of the accuracy of experts' forecasts will be noted later.

2. Critique

RE constitute the most common element in the recent theoretical work on business cycles at least in the U.S., and there is wide agreement that their use as a technical model-building principle has led to important developments and new insights, notably in the criticism of some aspects of macroeconometric models and the analysis of competitive markets with imperfect information (Lucas, 1976; Poole, 1976). Economics has always implicitly accepted the RE hypothesis in the analysis of steady states or stable market prototypes, where all active participants must be presumed to know the processes involved.

RE can be viewed as a condition of stochastic equilibrium, but general equilibrium theorists raise a number of sweeping objections against its application to macroeconomic dynamics (see Arrow, Solow, and Tobin). Contingent future markets are conspicuous by their absence. Information is

limited and unevenly diffused. The subjective probability distributions underlying the forecasts of the individual decision-makers differ. No one can predict the evolution of other people's expectations. The counter-argument is that such criticisms, though they may be observationally correct, are not helpful. Some apply to more than the RE models and would preclude much innovative (though of necessity highly aggregative and abstract) theorizing (Lucas, 1981). Some neglect the many advances in the understanding and applications of the RE method, e.g., to the problem of diffuse or "asymmetrical" information (S. Grossman, 1981).

The fundamental difficulty is not with the rationality of costly information uses, which it is only reasonable to assume, but with the availability of sufficient information, which certainly cannot be taken for granted. Two assumptions underlie what may be called the strong version of the REH: (1) that market incentives and penalties enforce continually and everywhere optimal, i.e., cost-efficient predictions, and (2) that economic agents generally possess adequate knowledge (data and models) so that their optimal predictions are at least unbiased (in practice, such knowledge should make most forecasts reasonably accurate). While (1) is presumably often well approximated, there seem to be no good a priori reasons why (2) should be always and everywhere true. It is the claim of <u>general</u> validity of the REH in its strong form (which is implicit in the macro-models built on this hypothesis) that many economists believe is greatly overstated.

The equilibrium RE models contain no learning processes: they assume that agents have already learned all that they can know about the probability distributions they face. This fits best a stochastically stationary environment that has persisted long enough for people to have acquired the knowledge of its operation. Learning is impeded in a stochastic nonstationary environment, even

without structural change, since nonstationary processes come in many varieties and may interact in complicated ways. Moreover, actions based on incorrect beliefs how the economy works cause outcomes that may themselves be misleading. Some authors have argued that the learning process, even if optimal in some (e.g., least squares) sense, may not converge to the rational-expectations equilibrium; however, convergence has been proven by others for some relatively simple situations. In any event, during the learning process, optimal predictions may be approximated by adaptive expectations (AE) with varying correction coefficients (Taylor, 1975; B. Friedman, 1979).

In a nonstationary world with structural changes and a mixture of random and autocorrelated disturbances, uncertainty in the sense of Knight and Keynes is prevalent. Here AE based on "experience," i.e., the observed frequencies of past events modified in the light of recent changes, will often prove unreliable, but they are apt to include the bulk of the available information. (Of course, optimal predictions will also incorporate any genuine information about the future, e.g., credible news on prospective policy actions and domestic and foreign economic trends, but such inputs are in short supply.) The amount of valuable insight that can thus be obtained may be quite limited, but anyone who uses it the best way he can in actions concerning the inherently uncertain future would conform to a common sense definition of rational behavior.

A closely related argument is that uncertainty is associated with variations in nonstationary means resulting from "permanent" changes in levels or growth rates; in contrast, transitory, random deviations around stable trends are connected with calculable risk. Uncertainty is held to be essential to the persistence of cyclical contractions and the current RE models err in ignoring it. They should allow permanent changes to occur but not to be identified immediately. Stochastic shocks in the markets for commodities, money, and

labor contain in each case a permanent and a transitory component. The two cannot be reliably separated: new information reduces but does not eliminate the confusion. The rational response to the shocks takes the form of gradual adjustments of beliefs about the permanent values of the endogenous variables, since the structure of information is such that adaptive or distributed-lag predictions are optimal (Brunner, Cukierman, and Meltzer 1980; Meltzer, 1982).

3. Evidence

Consider testing for the "rationality" of any set of expectations or forecasts. Several related criteria have been formulated and used. Let X_t be the actual value and X^e_{jt} be the forecast of X_t made at the time $t - j$. Then the common test of unbiasedness is that the regression

$$X_t = a_j + b_j X^e_{jt} + u_{jt} \tag{1}$$

should yield estimates of the coefficients a_j and b_j that are not significantly different from zero and one, respectively. This test is weak, since RE are not merely free of systematic error but also efficient in the use of all relevant information, I_{t-j} ; the strict requirement is that

$$E\ X_t = E(X^e_{jt} | I_{t-j}) \ , \tag{2}$$

where E is the expected value operator.

However, condition (2) is too general to be testable. The set I_{t-j} must be restricted and identified. For expectations or forecasts made regularly or by a replicable method, I_{t-j} includes importantly the past errors knowable to the source of X^e_{jt} . Here the requirement is that there be no significant autocorrelation among the errors u_{jt}, which could have been exploited to improve X^e_{jt} . Thus rationality can be rejected by the evidence of either bias or serially correlated residual errors or both. Of course, RE imply the equal-

ity of mean actual and predicted values; if $(a_j, b_j) = (0, 1)$ and $E(u_{jt}) = 0$, $E(X_t) = E(X^e_{jt})$.

Another efficiency test is to check whether the survey data reflect the autoregressive properties of the variable in question. For example, let $j = 1$ and compare the regressions

$$(3) \qquad X_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \varepsilon_t \quad \text{and} \quad X^e_{1t} = \sum_{i=1}^{n} \beta_i X_{t-i} + \eta_t .$$

For the expectation errors to be orthogonal, i.e., uncorrelated with the information available from the past history of X, α_i must equal β_i for all i.

Forecasts are often made in each successive period for several periods ahead. In this case, a test of consistency of such forecasts (or expectations) is available. Consider, for example,

$$(4) \qquad X^e_{2t} = \beta'_1 X^e_{1t} + \sum_{i=2}^{n} \beta'_i X_{t-i} + \eta'_t .$$

Here rationality requires that $\beta_i = \beta'_i$ for all i.

These tests have, of course, a common core and logic; they are simply different ways of checking on the properties of expectations conditional upon a certain set of information. If any exogenous variables generating X_t can be identified, further tests can be made to see whether their predictive power is fully reflected in X^e_{jt}.

Recent work using survey data has been preoccupied with tests for the rationality of inflation expectations. The most frequently used U.S. series are the one-step and two-steps ahead group average predictions from semiannual surveys of economic forecasters conducted since 1947 by Joseph A. Livingston, a syndicated financial columnist.

The balance of the evidence is that these data reject the REH according to at least some of the above tests. Thus failures to meet the criteria of effi-

ciency and/or consistency are reported by Pesando (1975) and Carlson (1977), failures to pass the unbiasedness tests by Wachtel (1974) and Gramlich, (1979). Pearce (1979) shows that univariate time-series (ARIMA) models would have predicted inflation better than the Livingston averages did, which also contradicts the rationality of the latter. Tests of individual forecasts predominantly fail the unbiasedness tests, confirming and amplifying the evidence for the aggregate forecasts, as shown by Figlewski and Wachtel (1981). Moore (1977b) notes the pronounced tendency of the Livingston averages to lag behind the actual inflation series. Most of the negative results relate to the 1970s, a decade of particularly large unpredictable inflationary shocks, but the earlier Livingston surveys do not fare much better. More favorable tests are reported by Mullineaux (1978).

Claims have been made that households predict inflation on the whole "more rationally" than economic and business forecasters, but the comparisons seem strained and inconclusive. The evidence comes from surveys of consumer attitudes which over time have dealt mainly with the direction, not the size, of the expected price changes. Some of the studies find that the hypothesis of unbiasedness cannot be rejected for these data, others merely that it is "not so decisively rejected" as the inflation forecasts by economists and business executives (Juster, 1979; Huizinga, 1980; Curtin, 1982; deLeeuw and McKelvey, 1981; Gramlich, 1983).[2] The conclusion that various surveys of price expectations produce as a rule mixed results, with a disturbingly large proportion of rejections, applies to European and Japanese as well as U.S. data (Aiginger, 1981; Papadia, 1982).

Relatively few authors have tested expectations data for variables other than inflation. For many early forecasts of U.S. aggregative series (GNP, con-

[2]The quotation on text is from Gramlich, 1983, p. 163.

sumption expenditures, business outlays on plant and equipment, and industrial production in the 1950s and 1960s), there is evidence of significant bias (Mincer and Zarnowitz, 1969). The most common pattern is underestimation of growth, i.e., of levels in upward-trending series, and somewhat less frequently of cyclical changes in general (Theil, 1958; Zarnowitz, 1967). There are indications of adaptive learning behavior, with forecast revisions which are a fraction of the observed error (the smaller the longer the span of the forecast error). The AE models go back to the 1950s and have been used with some success in empirical research; whether they are "ad hoc" or, on the contrary, entirely "rational," depends on the structure and uncertainty of the available information (Cagan, 1956; Nerlove, 1958; Mincer, 1969; Frenkel, 1975; Mussa, 1975; Meltzer, 1982).

Sales anticipations of U.S. manufacturing firms have been on the whole negatively assessed by Hirsch and Lovell (1969), more positively by Pashigian (1964) and Irvine (1981). The latter study finds that the data pass most of the rationality tests before 1973 but not thereafter, and considers the possibility of a structural change associated with the first OPEC oil price shock. However, these Commerce data were discontinued in 1976.

Underestimation of the mean actual change for 29 out of 39 variables covered is reported in a recent comprehensive compilation of tests on expectational survey data from several countries (Aiginger, 1981). These are surveys of businessmen covering a variety of operational variables (sales, orders, production, investment, inventories, selling prices); of consumers, concerning prices and financial situation; and of business analysts and economists, relating to GNP and its major components and the major price indexes. The prevalence of underprediction of average changes is attributed to asymmetries in the loss functions of economic agents: the loss from

overoptimistic expectations tends to be larger than that for overpessimistic expectations. Given these asymmetries, the apparent biases in the survey data are themselves "rational" (on losses from forecasting errors, see Theil, 1958; Brainard, 1967; Waud, 1976; Johansen, 1980).

The strongest evidence favorable to RE comes from the literature on "efficient markets" for financial assets and commodities. This is readily understandable since these are well-organized competitive auction markets with full price flexibility, where traders deal largely in standardized instruments, transaction costs are low, and prompt and general collection and dissemination of the information is vital and constitutes a central part of the functioning of the market itself (Fama, 1970; Poole, 1976). Nevertheless, in this area, too, some test results unfavorable to the REH have been reported, namely for the interest rate forecasts surveyed in the Goldsmith-Nagan Bond and Money Letter. These are forecasts of representative interest rates one and two quarters ahead, made by active market participants. They were found to be in large part not unbiased or efficient and not always consistent (B. Friedman, 1980).

However, survey data reflect average expectations whereas what matters in the marketplace are the expectations of marginal buyers and sellers. If the most resourceful participants succeed in eliminating unexpected profit opportunities, the market will behave in a way consistent with the REH, although many, perhaps even most, of the traders do not. Mishkin (1981) constructs forecasts of interest rate and inflation from bond market data and provides tests that fail to reject the rationality of the market interest rate forecasts. This is taken to suggest that "the Goldsmith-Nagan survey measures . . . are not an accurate description of the actual bond market forecasts" in the period 1959-69 (ibid., p. 300). But the concurrent bond-market predictions

of inflation fail the rationality test, and Mishkin's argument that the 1960s were an unusual historical period because of rising inflation is not really persuasive. (The inflation forecasts in the 1970s seem generally worse yet, and this decade was in many respects even more "unusual." Long periods of tranquility are hard to find.)

Clearly, the evidence from the surveys has certain important limitations and must be assessed with caution. But it is not good "positive economics" to dismiss it on the ground that only theories, not their assumptions, can be tested. Tests on the survey data focus on the issue of expectation formation. Where direct observations on expectations or forecasts are not used, the evidence generally consists of joint tests of an expectations hypothesis and the particular model incorporating that hypothesis. Diverse and rich expectational survey data are now available and in need of much careful exploration. Where independent tests based on such materials are in substantial agreement, they have lessons to impart that should be taken seriously.

4. Some Illustrations and Implications for Cyclical Analysis

Table 1 collects the evidence on cyclical turning-point and directional forecasts for U.S. income and output. The record of the annual end-of-year predictions of GNP is quite good, that of the earlier mid-year predictions much worse (section 1). However, few reversals occurred in this annual series during the period covered. Directional changes over sequences of two semiannual periods or four quarters are more frequent and much more difficult to anticipate and indeed these forecasts have not been much better than guesswork (sections 2 and 3). This and other evidence suggests that business analysts and economists are often able to recognize turns near the time they occur but not well ahead of the event (Zarnowitz, 1967 and 1968; Fels and Hinshaw, 1968; Moore, 1969).

Table 1

Forecasts of Turning Points and Directions of Change in GNP and Real GNP, 1947-1976.

1. Annual Data, GNP, 1947-1965

Correct forecasts of Turning Points (TP) as percentage of	Forecasts Made Near the End of Preceding Year	Forecasts Made Near the Middle of Preceding Year
All predicted TP	93 (34)	60 (42)
All actual TP	74 (27)	50 (35)
All periods covered	89 (57)	64 (51)

2. Semiannual Data, GNP, 1947-1964

Correct forecasts of directional change as percentage of	Semiannual Change Forecasts, 1947-64	
	0-6 months	6-12 months
All periods covered	73 (58)	62 (58)

3. Quarterly Data, GNP, 1959-1963

Correct forecasts of directional change as percentage of	Quarter-to Quarter Change Forecasts, 1959-63			
	0-3 months	3-6 months	6-9 months	9-12 months
All periods covered	68 (65)	78 (77)	69 (72)	82 (82)

4. Annual Data, Real GNP, 1959-1976

	Number	Mean Absolute Error, % Points	Percentage of Total Absolute Error
Underestimation errors	33	1.12	46.8
Overestimation errors	21	.92	24.4
Turning point errors	8	2.85	28.8

NOTE: Forecasts or actual observations of no change are counted as half TP and half no TP. Figures in parentheses are the expected values on the assumption of independence and fixed marginal totals. The span 0-3 months refers to the change from the current quarter to the one ending three months hence; 3-6 months refers to the change from quarter ending three months hence to the one ending six months hence; etc.

SOURCE: Zarnowitz (1968 and 1979); Moore (1969).

Turning-point errors account for only 13 percent of all errors in a collection of annual forecasts of real GNP, 1959-76, but they are on the average 2 1/2-3 times larger than other errors (Table 1, section 4). Real GNP is, of course, much more cyclical than nominal GNP and of central importance in business-cycle analysis and forecasting, but this analysis still understates the importance of turning points because it is limited to annual data. In the present-day practice of quarterly multiperiod forecasting, directional errors play a much larger and more adverse role yet, as shown by studies of recent U.S. forecasts (Zarnowitz, 1979, 1982). Widespread cumulative errors were associated with missing a downturn and projecting continued growth instead, as in 1973-74 and 1981, or with predicting an upturn prematurely, as in 1982.

Realistically judged, annual GNP forecasts in the U.S. earn good marks; moreover, they have improved, compared with the earlier post-World War II years, in the 1960s and even in the turbulent 1970s. However, quarterly changes beyond the first two quarters ahead are much more difficult to predict than the year ahead, and here the record is actually much worse. Errors of recent multiperiod predictions of real growth and inflation show a rapid buildup beyond the spans of 2-4 quarters. Underestimation of change is characteristic of most forecasts, but in periods of unanticipated retardations and recessions real growth tends to be overpredicted for some time as does the rate of price-level change in periods of unanticipated disinflation (Zarnowitz, 1967, 1979, 1983, 1984).

I have applied tests of unbiasedness (based on regression equations of type (1) above) to a large set of forecasts by individual participants in quarterly business outlook surveys conducted since 1968 by the American Statistical Association and the National Bureau of Economic Research (ASA-NBER). Table 2, column 1, shows that only about 20 percent or fewer of the forecasters fail these F tests at the 10 percent significance level for five selected variables: percentage changes in nominal GNP, real GNP, and nominal consumer expenditures for durable goods, and levels of the unemployment rate and

the changes in business inventories. In contrast, nearly 70 percent fail the tests for the forecasts of inflation (rate of change in the implicit price deflator). More detailed results (Zarnowitz, 1983) would show that this contrast extends to each horizon but is particularly sharp for the longer ones (the targets include the current quarter and the four successive future quarters following each survey date).

Table 2, column 2, shows that about two thirds of the inflation forecasts and one-half of the inventory investment forecasts had autocorrelated errors; the corresponding proportions for the other variables range from 24 to 42 percent. These tests use series of errors based exclusively on data for past predictions and realizations that were available to participants in the successive surveys. The underlying argument is that the forecasters could and should have used this information so as to exploit and thereby eliminate all systematic elements in it. However, it must be noted that these computations required creation of a comprehensive computer file of successive vintages of the data covered. Keeping track of the many successive revisions in complex data, particularly the quarterly national income and product accounts, is not a small or low-cost operation in which forecasters can be expected to engage routinely.

In sum, tests of the REH produce results that are predominantly negative for the forecasts of inflation but much more favorable for those of real growth and some other important variables. These findings are generally consistent with others reported in the literature (Figlewski and Wachtel,1981; McNees, 1978).

Table 2

Percentages of Individual Forecasts That Failed the Tests for Unbiasedness and Serially Uncorrelated Errors, 1968-1979

Variable	Percent of Forecasts with Significant	
	F tests	Q tests
Gross national product (GNP)	21.0	37.1
Implicit price deflator (IPD)	69.1	66.2
GNP in constant dollars (RGNP)	20.5	27.0
Unemployment rate (UR)	15.4	42.4
Consumer expenditures for durable goods (CEDG)	14.7	23.7
Change in business inventories (CBI)	17.2	50.0

NOTE: The level of significance is 10 percent. The F tests are for H_0: $(\alpha, \beta) = (0, 1)$, see eq. 1 and text above. These entries refer to all individuals who participated in at least 12 of the 42 quarterly surveys conducted in the period 1968:4-1979:1 (75 for CEDG, 79 each for each of the other variables). The Box-Pierce $Q = n(n + z) \sum_k^6 (n - k)^{-1} \rho_k^2$, where $\hat{\rho}_k = \text{cov}(u_t, u_{t-k})/\text{var}(u_t)$, tests for the presence of autocorrelation in the forecast errors. These entries refer to all individuals who participated in more than 12 consecutive surveys (18-20 depending on the target variable).

SOURCE: ASA-NBER Business Outlook Survey.

Inflation has been underestimated most of the time during the 1970s in both the short and, particularly, longer forecasts. Mainly for this reason, the mean errors are generally negative for all nominal variables covered. They tend to be positive for the predictions of rates of change in real GNP (and accordingly negative for the unemployment rate), mainly because of the missed downturns in this period of surprisingly frequent recessions and stagflation (slow growth and high inflation) coming after a long period of prosperity in the 1960s. The first two lines in Table 3 provide a summary of the evidence for the above statements.

The most biased predictions are not necessarily the least accurate. For example, the inflation forecasts compare favorably with the real growth forecasts in terms of the average measures of relative accuracy and correlation between the predicted and the actual values (Table 3, lines 3 and 4). These comparisons show the ASA-NBER survey participants on the whole in a reasonably good light.

The group mean forecasts from a series of surveys have smaller variances of errors and hence are on the average more accurate than most of the corresponding forecast series of the individual participants. This is a strong conclusion, which applies to all variables and predictive horizons covered and is consistent with evidence for different periods and from other studies (Zarnowitz, 1967, 1984). However, a small number of the more regular survey members did perform better in most respects than the composite forecasts (Table 3, lines 5 and 6).

As noted earlier, failures to pass tests for rationality have been blamed in some writings on special features of this or that sample period (e.g., the Vietnam war inflation in the 1960s; OPEC and the supply shocks in the 1970s). Tests for the stability of coefficients (the F tests associated with Chow) have been applied to regressions of type (1) for the individual inflation forecasts to compare periods before and after 1974. For large majorities of the forecasters, the hypothesis that the coefficients remained the same could not be rejected.[3]

[3]On the average across the different target quarters, the rejections accounted for 14 and 21 percent of the forecasters at the 5% and 10% significance levels, respectively.

Table 3

Selected Statistics on the Properties and Accuracy of Individual Forecasts from Business Outlook Surveys, 1968-1979

		GNP	IPD	RGNP	UR	CEDG	CBI
1.	Mean of mean errors $(\bar{\bar{\varepsilon}}_i)^a$	-0.1	-0.4	0.3	-0.1	-0.3	-1.7
2.	Underestimates, percent[b]	69	96	14	64	63	79
3.	Relative accuracy $(\bar{M}_i/M_a)^c$	.3	.5	.9	.1	.9	.7
4.	Mean correlation $(\bar{\bar{r}}_i)^d$	.5	.5	.5	.8	.4	.5
	Percent better than group:						
5.	Mean	20	26	22	29	24	33
6.	Range	13-35	11-37	18-27	8-42	19-31	29-38

NOTE: For symbols denoting the variables, see Table 2. All measures refer to the sample of 79 individual forecasters (75 for CEDG) who participated in at least 12 surveys. They are based on the corresponding statistics for the five target quarters Q0, . . . Q4 (where Q0 denotes the survey quarter, Q1-Q4 the four successive future quarters).

[a]Error ε is defined as predicted minus actual percentage change for GNP, IPD, RGNP, and CEDG, and as predicted minus actual level for UR and CBI. $\bar{\bar{\varepsilon}} = \frac{1}{n}\sum_i^n \bar{\varepsilon}_i$, where $\bar{\varepsilon}_i$ is the mean error of the i^{th} individual's forecasts ($i = 1, \ldots, n$).

[b]Percentage of individual forecasters with mean errors that are negative.

[c]Ratio of the average root mean square errors of forecasts to the root mean square value of the target series (the sum of its mean value squared and its variance).

[d] $\bar{r}_i$ = coefficient of correlation between predicted and actual values for the i^{th} individual, corrected for the degrees of freedom. $\bar{\bar{r}}_i = \frac{1}{n}\sum_i^n \bar{r}_i$.

[e]Percentage of individual forecasts with root mean square errors (M_i) smaller than the corresponding root mean square errors for all forecasters who responded to the same surveys (M_{gi}). Mean and range refer to the percentage of cases where $M_i/M_{gi} < 1$ across the forecasts for Q0, . . ., Q4.

SOURCE: ASA-NBER Business Outlook Survey.

If the government has prompter access to information and better forecasts than the private sector, then its monetary stabilization policies can be effective even in the presence of rational expectations and full price flexibility; otherwise, according to the same argument, agents and markets will anticipate and neutralize all such nonrandom discretionary policies. Comparisons of the annual January forecasts of the Council of Economic Advisors (published in the Economic Report of the President) with the more or less concurrent average forecasts from private surveys offer no evidence of any significant and consistent advantage on the side of the government. Thus the mean absolute error of GNP forecasts for 1962-68 was 1.3 percent for both the collected private predictions and those of the Economic Report (Zarnowitz, 1972, pp. 212-214). The median forecasts from the November ASA-NBER surveys had slightly higher, those from the February surveys slightly lower, mean absolute errors than the corresponding Economic Report forecasts for nominal GNP growth, real GNP growth, and inflation in 1969-76 (Moore, 1977a). It is usually not very difficult in retrospect to find plausible reasons why some government policies proved reasonably effective, others ineffective or even counterproductive. The record of the policies is indeed mixed and the reasons vary, including prominently errors of judgment and foresight but not differences in such errors between the government and the private economy.

Expectations or forecasts for the same aggregate variables are likely to draw upon common, publicly available information and knowledge of certain established techniques and models. Informal exchanges, opinion polls, predictions publicized in the media and sold as expert advice--all these are ways in which forecast makers and users interact and influence each other directly and indirectly. In the process, the differences among the individual forecasts are likely to be reduced as many risk-averters may not wish to deviate much from the

prevalent "consensus." Yet responsible forecasters will not simply imitate each other but use independent judgment so that their predictions will contain some independent information. Indeed, if simple or weighted averages of individual forecasts result in some net gains in accuracy, as is often the case, it is because these forecasts are to some extent diversified.

Table 4 compares the root mean square errors of the ASA-NBER group averages (M_s) with the corresponding measures for forecasts from a major corporation and two well-known econometric service bureaus (M_e). The ratios M_s/M_e vary between .84 to 1.59; when averaged across the target quarters, the range is narrowed to .95-1.11. There is considerable variation in the detail, but most of the ratios are close to one. IBM seems to be ahead of DRI, but gaps in reporting impair comparability here. The early Wharton forecasts often came out before the ASA-NBER surveys (and regularly precede the mid-quarter Wharton forecasts by approximately one month), so that they are at some informational disadvantage. The preponderance of $M_e/M_s > 1$ (except in the case of IBM) suggests that business economists' forecasts, which tend to be more judgmental, compare well with the forecasts constructed with the aid of large econometric models. However, it should be noted that the survey predictions benefit from the averaging of various inputs, including those from outside and inside econometric models (see below). To be sure, the model forecasts also include a large component of "judgmental adjustments," which have been shown to be on the average helpful. These findings are consistent with other evidence on the comparative accuracy of the leading corporate and econometric-model forecasters (McNees, 1975; Zarnowitz, 1979).

The participants in the ASA-NBER surveys have been asked to rank the methods they use, and Chart 1 sums up the evidence on the relative importance of the different approaches on the average and over time. The most widely used set of

Table 4

Forecasts from Business Outlook Surveys and Econometric Models, 1968-1979

Model Compared with ASA-NBER and Period Covered[a]	Statistic[b]	Ratios of Root Mean Square Errors: Model/ASA-NBER[c]					
		GNP	IPD	RGNP	UR	CEDG	CBI
IBM, 1968-1979	Mean	.98	.95	.95	.98	.97	.96
	Range	.89-1.09	.90-.98	.86-1.03	.86-1.09	.91-1.01	.90-1.01
DRI, 1968-1979	Mean	1.06	1.05	1.08	1.07	1.01	.96
	Range	.97-1.09	.97-1.18	.91-1.26	.89-1.59	.87-1.10	.86-1.03
Early Wharton, 1975-1979	Mean	1.00	1.05	1.08	n.a.	1.06	1.11
	Range	.85-1.18	.84-1.120	.99.1.18	n.a.	1.01-1.12	.81-1.36
Mid-quarter Wharton, 1975-1979	Mean	.96	1.11	1.04	n.a.	1.02	1.10
	Range	.88-1.02	.96-1.29	.99-1.11	n.a.	.94-1.10	.86-1.28

[a] IBM (International Business Machines Corp.) and DRI (Data Resources, Inc.) forecasts are those reported to the ASA-NBER surveys. Wharton Econometric Forecasting Associates, Inc. forecasts are those reported by the source in the first month of each quarter ("early") and in the second month ("mid-quarter"). The ASA-NBER forecasts used here are the mean group forecasts.

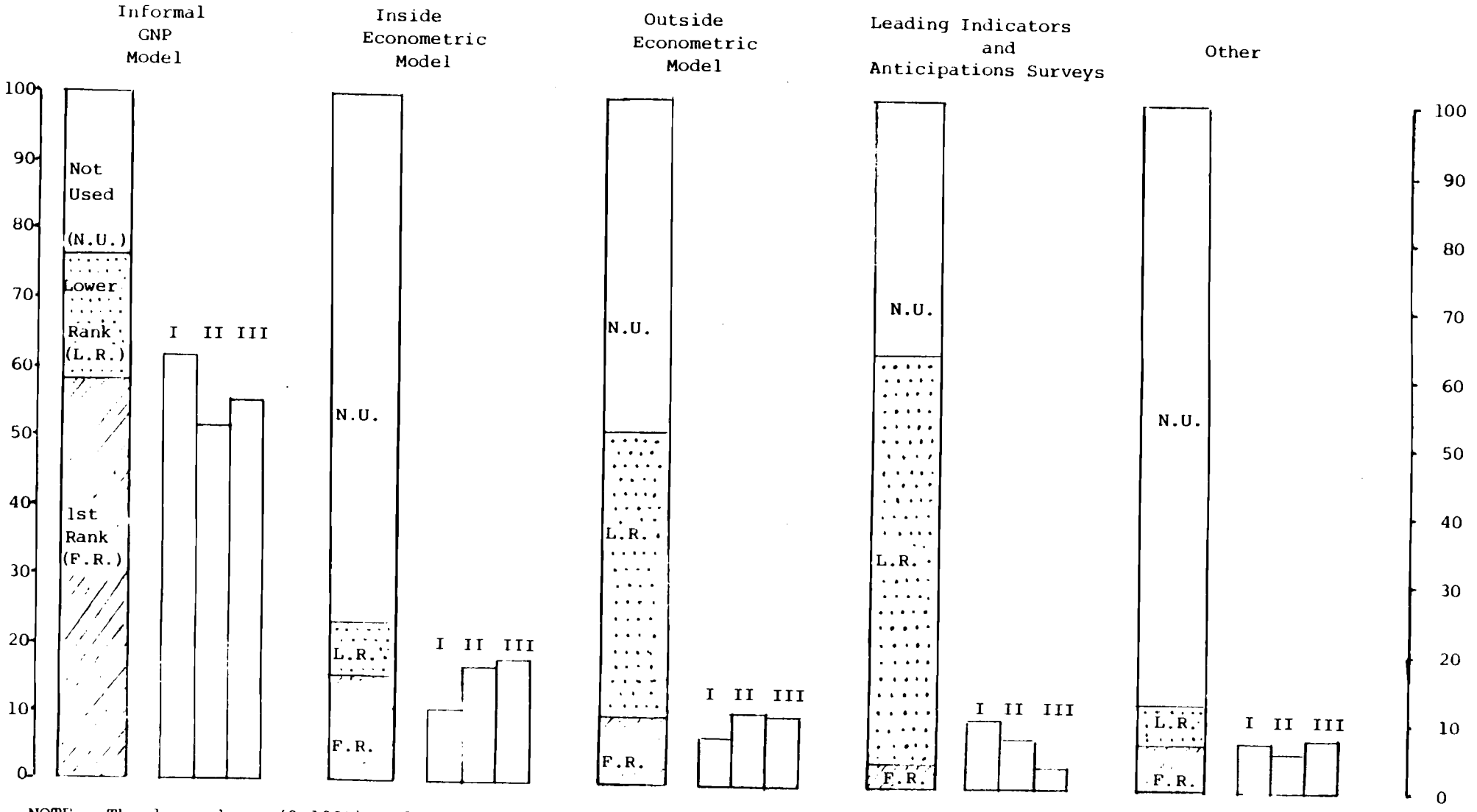
[b] Mean and range of the ratios for Q0-Q4.

[c] The ratios are of the form M_e/M_s, where M_e is the RMSE for the given model and M_s is the RMSE for the business survey (ASA/NBER). For symbols denoting the variables, see Table 2.

n.a. not available.

Chart 1

Seventy-nine Regular Participants in the ASA-NBER Quarterly Business Outlook Surveys, Percentage Distributions by Reported Methods, 1968:4-1979:1 and Subperiods



NOTE: The large bars (0-100%) refer to the total period 1968-1979. The small bars, marked I, II, and III, show the first-rank percentages only for the following subperiods, each containing 14 surveys: I, 1968:4-1972:1; II, 1972:2-1975:3; III, 1975:4-1979:1.

procedures labeled the "informa_ GNP model" consists of predicting the major expenditure components of GNP, adding these figures to obtain the overall forecast, and checking and adjusting the results for plausibility and consistency. It is an eclectic approach in which judgment typically plays a large role, although various models of macroeconomic relationships are often employed as well. About three quarters of the forecasters have used it and some 50 to 60 percent ranked it first. Between 10 and 18 percent of the survey members (the proportion has been rising) relied mainly on their own ("inside") econometric models. About half of all participants reported subscribing to services of "outside" econometric models and nearly one-tenth ranked them first. Leading indicators were ranked second by a large majority of the forecasters and used as a complementary approach along with anticipations surveys. "Other methods" (write-in) is a rather negligible category.

Mean forecasts and their accuracy measures were computed and compared for three subsets of the group of the 79 "regular" participants in the ASA-NBER surveys, namely those who ranked first the informal GNP model (INF), the inside econometric model (INS), and the outside econometric model (OUT), respectively. Chart 2 superimposes the series of root mean square errors of the average forecasts of real growth made by the groups INS and OUT (broken lines) on the corresponding series for all participants (solid lines). The subscribers (OUT) perform better most of the time and on the average than the model proprietors (INS), particularly for Q0 (panel A), by smaller differentials for Q3 (panel B). This may be explained by the fact that OUT is dominated by large corporations using well-known econometric service bureaus and their own professional staff, whereas INS includes not only some of the leading models maintained by teams of experts but also a few models used exclusively by the reporting individuals.

Chart 2

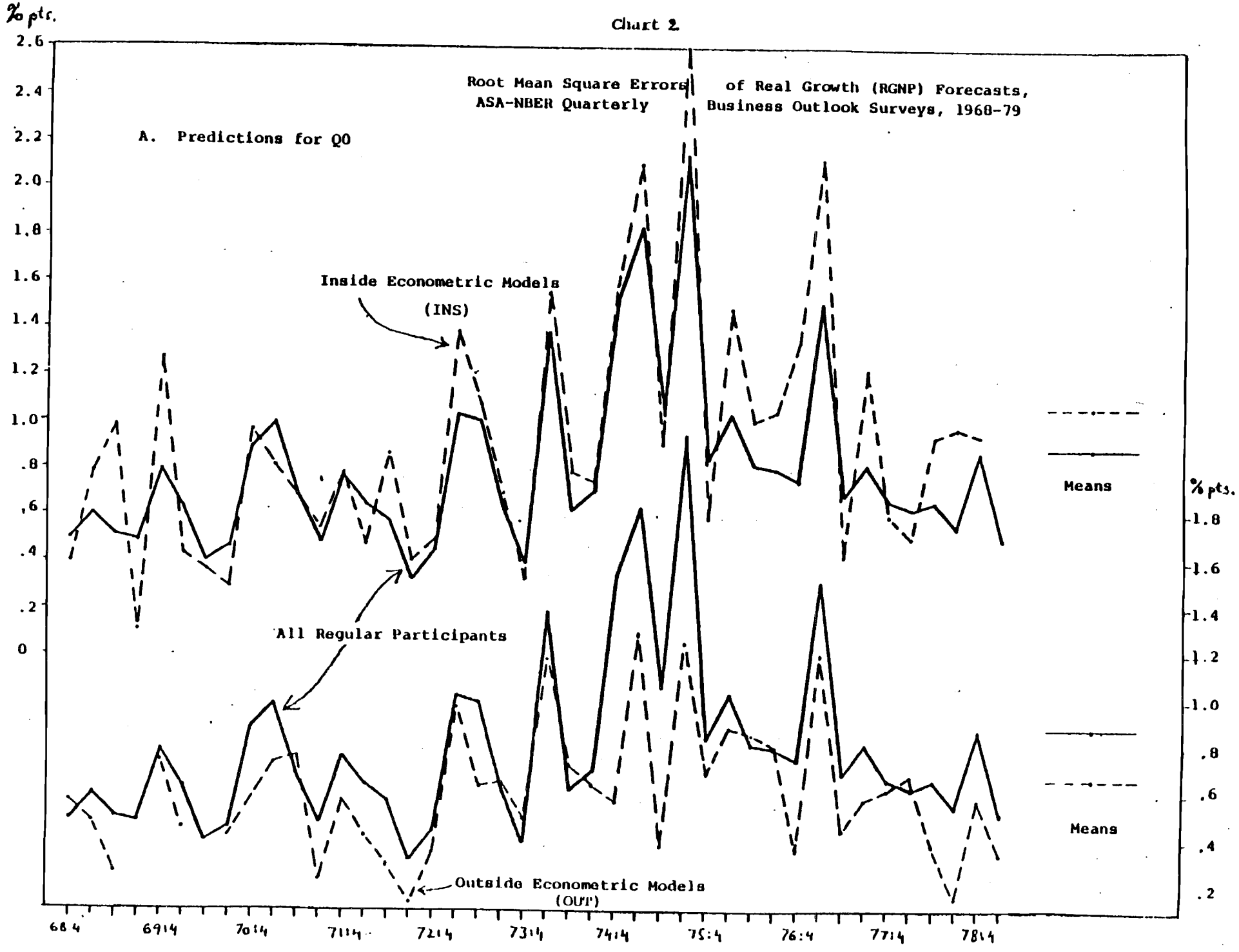

% pts.
Root Mean Square Errors of Real Growth (RGNP) Forecasts,
ASA-NBER Quarterly Business Outlook Surveys, 1968-79
A. Predictions for Q0
Inside Econometric Models
(INS)
All Regular Participants
Outside Econometric Models
(OUT)
Means
Means
% pts.
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
68:4
69:4
70:4
71:4
72:4
73:4
74:4
75:4
76:4
77:4
78:4

Chart 2
(concluded)

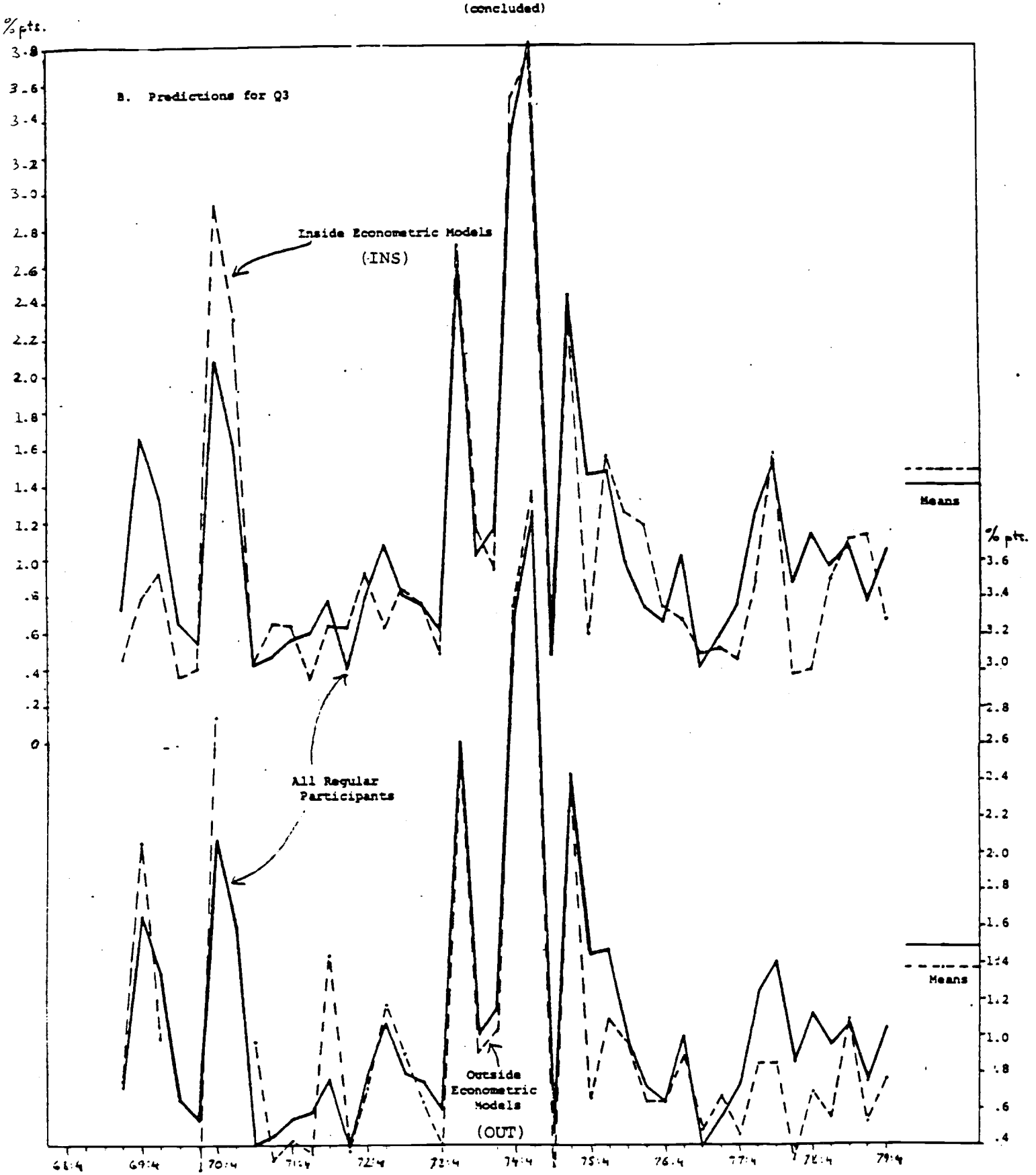


Chart 3 shows for inflation forecasts what Chart 2 did for the real growth forecasts, using the same format. Here again OUT is visibly better than INS for Q0 (panel A). For the longer Q3 forecasts, however (panel B), the overall RMSE levels are virtually the same for the two groups. (These levels are shown on each of these graphs as the short horizontal lines labeled "means" in the right-hand margins.)

Although these differentials are apparently systematic, they are small, particularly for the longer forecasts, and of uncertain significance (cf. Zarnowitz, 1971, esp. Table I-6). What is undoubtedly significant, even striking, are the high correlations among these forecasts and their errors, which are clearly demonstrated by these charts and others (not shown) for the different target variables covered. The averages for INF, the largest group, are not plotted in Charts 2 and 3 to avoid crowding, but their relative accuracy is high, close to that of OUT.

Finally, Table 5 provides detail on the relative accuracy and tests of unbiasedness for the real growth and inflation forecasts by the participants included in groups INS and OUT. It indicates that there is much differentiation among the individual forecasters. The group averages conceal this diversity. Sixteen of the 23 sources failed none of the F tests at the 5% significance level for their real GNP growth predictions, but only three (all in the OUT group) can boast of the same for their inflation predictions. The ratios of the individual to the overall group average RMS errors, M_i/M_{gi}, mostly exceed unity, reflecting the already noted gains from combining the forecasts, but 21 out of the total of 46 listed M_i/M_{gi} ranges include one or more ratios of less than one. The reader can locate a number of sources with excellent results for one or the other of the variables covered, and a few with very good results for both.

Chart 3

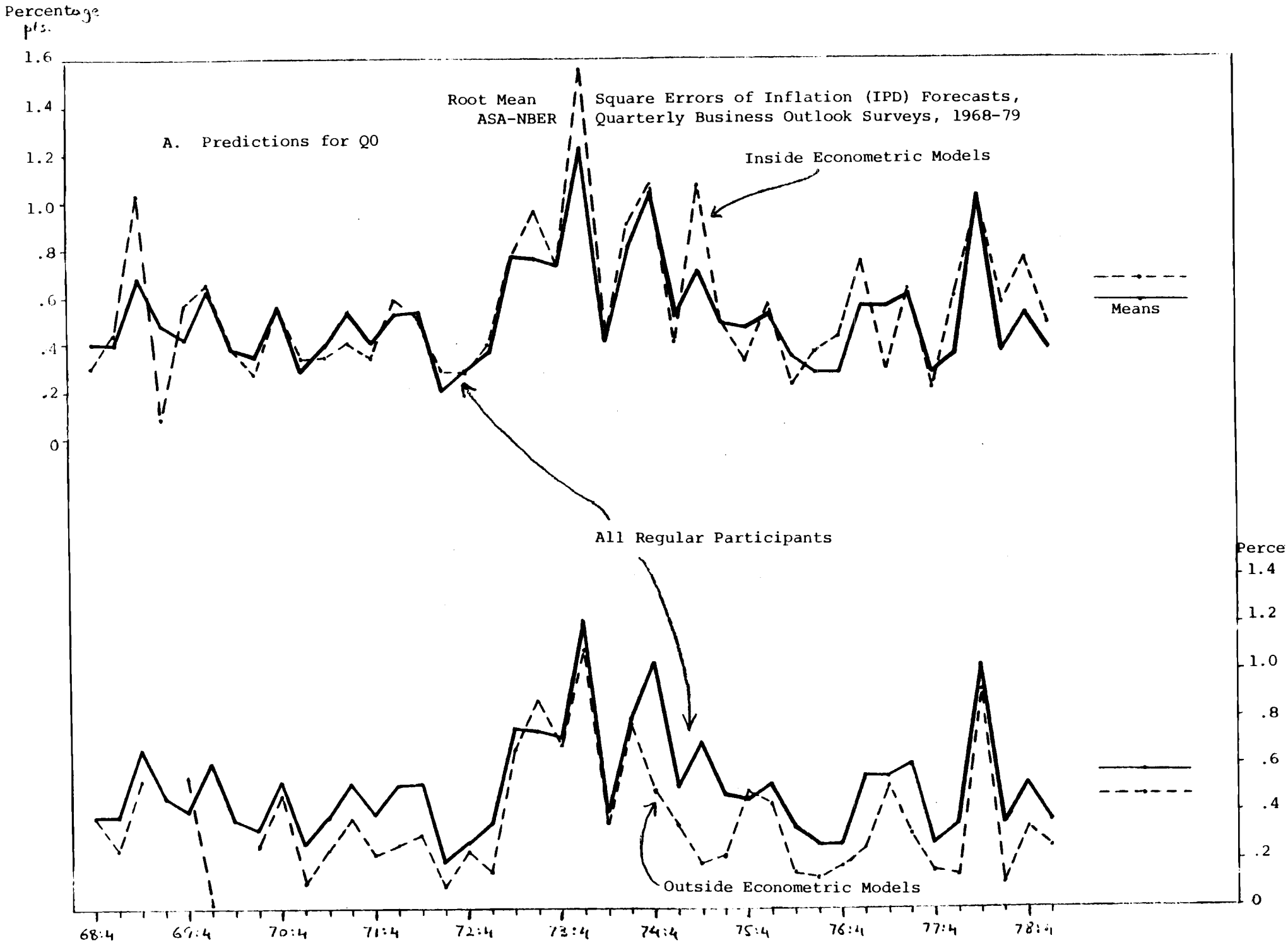

Percentage pts.
Root Mean Square Errors of Inflation (IPD) Forecasts,
ASA-NBER Quarterly Business Outlook Surveys, 1968-79
A. Predictions for Q0
Inside Econometric Models
Means
All Regular Participants
Outside Econometric Models
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
68:4
69:4
70:4
71:4
72:4
73:4
74:4
75:4
76:4
77:4
78:4

Chart 3
(concluded)

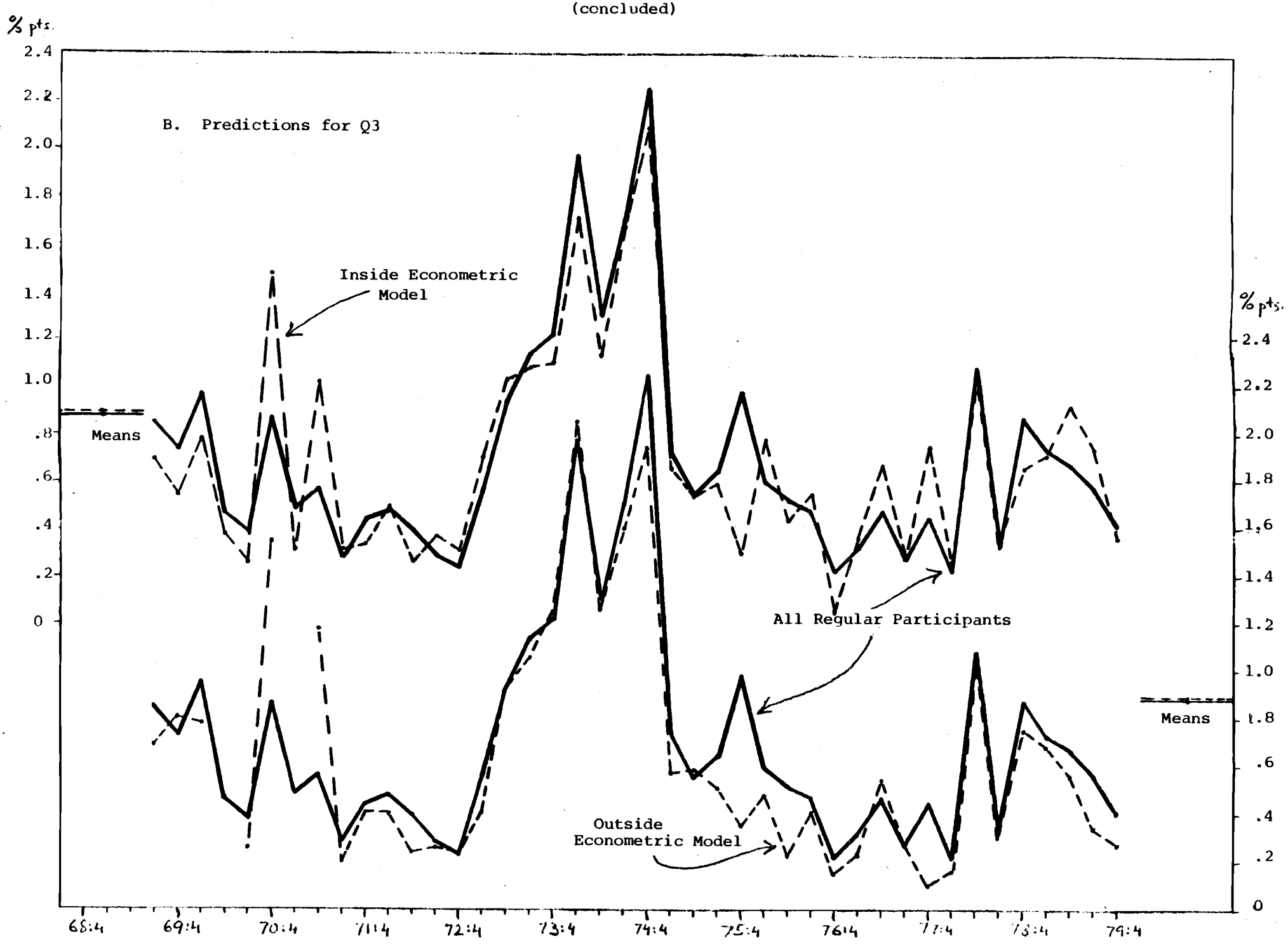


TABLE 5

TWENTY-THREE USERS OF ECONOMETRIC MODELS, SELECTED MEASURES OF RELATIVE ACCURACY AND TESTS OF BIAS, FORECASTS OF REAL GROWTH AND INFLATION, 1968-1979

Code #	Affiliation	Number of Surveys Covered	Forecasts of real growth (RGNP)		Forecasts of inflation (IPD)	
			Range of the M_i/M_{gi} ratios	F-tests significant at the 5% level	Range of the M_i/M_{gi} ratios	F-tests significant at the 5% level
		(1)	(2)	(3)	(4)	(5)
			Inside Econometric Model (INS)			
31	Academic*§	35	1.15-1.59	4	1.33-1.49	5
40	Academic	24	1.06-1.60	0	1.13-1.30	2
42	Large mfg. company*	24	.98-1.28	0	.91-1.30	3
54	Large bank	34	.96-1.11	0	1.00-1.14	5
60	Government employee	17	.98-1.23	0	1.00-1.42	1
65	Large consulting firm*	30	1.00-1.13	1	.97-1.16	4
78	Large mfg. company	24	1.01-1.39	3	1.04-1.24	3
82	Business	34	1.01-1.31	1	.98-1.46	5
89	Large mfg. company*	20	.94-1.03	0	.89-1.01	3
93	Government employee	20	1.05-1.84	0	.93-1.46	4
108	Private consultant	27	1.16-2.30	4	1.14-1.84	5
124	Academic	18	1.10-1.59	0	1.17-1.52	3
133	Government employee	22	.78-1,50	0	.85-1.04	2
148	Academic	23	1.08-1.45	2	1.36-2.65	5
			Outside Econometric Model (OUT)			
1	Large mfg. company	22	.89-1.15	0	.92-1.22	4
8	Business	33	.99-1.22	0	1.03-1.32	5
16	Business	12	1.01-1.16	0	1.20-1.53	0
22	Business	29	1.01-1.41	1	1.01-1.87	4
44	Large bank	25	.67-1.10	0	.90-1.00	0
49	Large bank	40	.96-1.06	0	.99-1.06	5
81	Public utility	19	1.06-1.24	0	.94-1.16	3
86	Business	28	.91-1.18	0	.96-1.20	3
96	Consulting	16	1.01-1.65	0	1.09-2.44	0

*A well-known model.

§No adjustments to the model or other methods used.

5. Concluding Observations

Recent theoretical work in macroeconomics has directed scholarly attention to the role of information and expectations in business cycles, which is certainly an important subject. What has been called the "rational expectations revolution" has stimulated much ingenious effort at model-building and -testing, which produced many interesting results. But the original claims on behalf of the new "classical" models with rational expectations and continuous market clearing have also encountered strong resistance by those who view them as greatly overstated or implausible. More importantly, there is considerable evidence that these models attribute to decision and policy makers more knowledge of how the economy works, better information and foresight, and prompter price adjustments in reaction to signals of change than people can have or make, given the complex dynamics of the modern world and the irreducible uncertainty about the future. Cyclical turning points in aggregate measures of economic activity more often than not surprise even expert forecasters, while lags in the public recognition of such events tend to be considerably longer yet. Early signals from leading indicators (which are generally sensitive and erratic series that are themselves difficult to predict) require confirmation and are sometimes ignored or disbelieved even after they get it. The speedups and slowdowns of inflation also usually arrive unanticipated. Indeed, the great majority of inflation predictions since the late 1960s fail the rationality tests and show a strong underestimation bias. This applies to both experts' forecasts and agents' expectations. Much less bias was found in the survey data for other variables of major importance for the analysis of business cycles.

It is probable that in many cases expectational data which fail to meet the strict rationality criteria in ex post tests would prove entirely consistent with optimizing ex ante behavior once the consequences of uncertainty, defective

models (knowledge), and incomplete, tardy, or costly information are taken into account. But the concept of rational expectations in this general or weak sense does not have the striking, definite implications of the original strong version.

Where expectations are not strictly "rational," it does not follow that they must be merely extrapolative, regressive, or adaptive. In fact, past studies have found that such time-series models explain statistically at best little more than half of the variance of the expectations reported in surveys (Aiginger, 1979). My own reading of survey data is that expectations are in general neither mere projections of the past nor flashes of intuition about the future. They are combinations of both extrapolative and autonomous components, which vary across individuals and change over time. The extrapolations are based on past data for both the variable to be predicted and other related factors: expectations are endogenous. But past developments and commitments, and current observations and news, also have implications for the future, which economic forecasters and agents try to extract and exploit.

Expectations matter a great deal but they are not all-important. Not all the past is bygones. The evidence that forecasts so often underestimate economic growth during recoveries and early expansions detracts from the hypothesis of excessive optimism (advanced in particular by Pigou and Jöhr). However, during the late expansion stages, when the high levels of activity suggest a "boom" but growth typically slows down, overoptimism does show up in that now the growth prospects tend to be overassessed. This continues a fortiori in the earliest stage of contraction as a consequence of the widespread failure to recognize the downturn. Later, after the recession becomes evident, more of it is commonly anticipated and expectations may turn overpessimistic for some time. If the depressed conditions persist, these negative attitudes are likely to deepen and become in part self-validating (Keynes' case). But normally expectations of

resumed growth soon assert themselves, sometimes prematurely as in 1981. As these observations suggest, predictions of the future almost inevitably contain strong elements of projections of the past: extrapolation of trends, regressivity toward the "normal," partial adjustments for recent errors. Expectations that affect the course of the economy can be presumed to be basically rational, that is, to use effectively the limited available knowledge and information, but they are diversified and need not always be self-validating.

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