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Survey Measures of Expected Inflation and Their Potential Usefulness

Economists have often treated expectations of price change with benign neglect—acknowledged but largely ignored. However, the inflationary experience of recent years has led to an increased interest in the role of inflationary expectations. It is by now standard procedure to use distributed lag techniques to generate a ready proxy for expectations from past experience. My contention in this paper is that these procedures are often inadequate and that alternatives do exist, namely, the measures of inflationary expectations based on survey data which have begun to attract some research interest in the last few years. This paper is essentially a review of the state of the art of those measures.

The use of past price inflation rates to generate measures of expected rates is both intuitively appealing and easy to implement. Since information about past price change is available at little cost, it is likely to have an important influence on the formation of price expectations. Consequently, adaptive or extrapolative hypotheses

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frequently provide adequate proxies for expectations. However, it is erroneous to assume that past price information will always be used in the same fashion or that other information is not used in the formation of expectations.[1] In particular, when the economic situation is changing or unstable, we would expect that additional information would be used in the formation of expectations and that the process by which past history is filtered into an expectation would vary. In either case fixed expectational structures based on past history would be inadequate. However, relevant additional information is available in the price expectations surveys.

In this paper the sources of survey data on price expectations are discussed and the data presented. Then some simple comparisons of the data and their predictive accuracy are presented. The potential usefulness of the data is then demonstrated by showing how price expectations improve upon some standard specifications of price, wage, and interest rate equations and how prices affect consumption behavior. The results do not indicate that expectations series based on survey data can always be substituted for expectations based on simple models of the formation of expectations but they do suggest that the survey data include important additional information. This is particularly true in the period of increasing and variable inflation since 1965.

SOURCES OF SURVEY DATA: LIVINGSTON DATA

The data on inflationary expectations that have attracted considerable attention from researchers are from the survey conducted by Joseph Livingston. Shortly after the Second World War, he began to conduct a semiannual survey of business and academic economists. Their forecasts of economic activity have been published regularly in Livingston's newspaper column, which appears in the Philadelphia *Bulletin*. (However, the data used here were compiled from the actual responses, which were made available by Livingston.) Among other measures of economic conditions, the survey has requested forecasts of the BLS consumer price index (CPI) and wholesale price index (WPI) at six-, twelve-, and sometimes eighteen-month horizons.

The Livingston data have been used in studies of the formation of price expectations (Turnovsky 1970), the effect of price expectations on wages and the Phillips curve (Turnovsky and Wachter 1972), and of Fisher-type interest rate models (Gibson 1972 and

Pyle 1972).[2] In this section, I examine and discuss some of the properties of the data. To keep things manageable, the discussion is restricted to the twelve-month expectations of the CPI. The Livingston survey requests forecasts of the price level and supplies the forecaster with a preliminary figure for two or three months prior to the survey date. As indicated above, Livingston made these figures available to me, as well as the individual responses to the surveys.

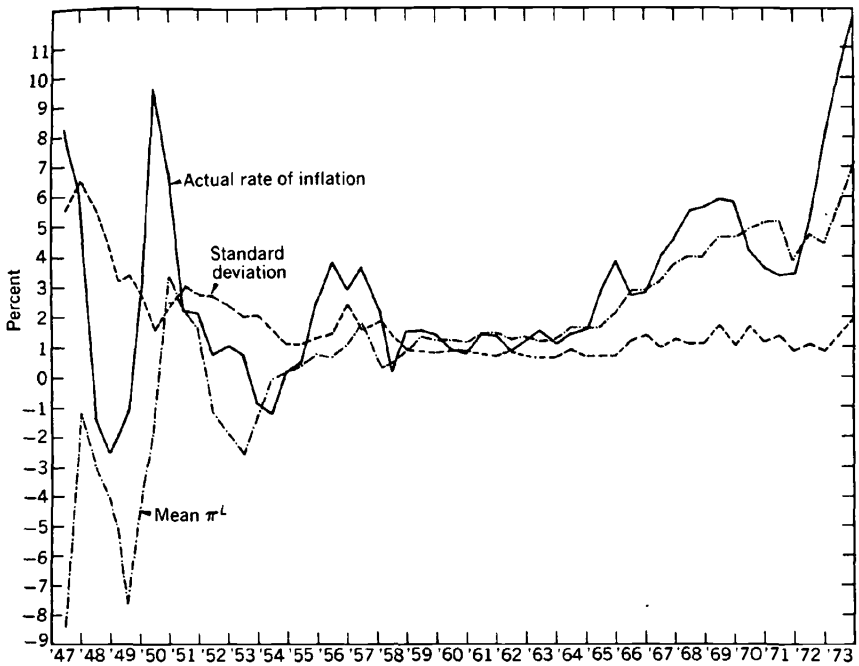
Before examining the data a few comments about the survey are in order. First, the number of responses is fairly small and variable. Second, the individuals surveyed have necessarily changed over the twenty-five-year period covered, but a number of economists have been faithful respondents for long periods of time. Third, the individuals chosen are professional economists, often intimately involved in forecasting. They are therefore likely to have more information about prices and should have greater skill in interpreting it than the general public.

Furthermore, it is not a simple matter to calculate the expected rates of inflation from the survey forecasts of the price level. Carlson (1975) has explored this issue, and his observations are worth mentioning. The difficulties can be illustrated by summarizing the survey procedure. For example, in order to prepare a late-December newspaper article Livingston distributes his survey in late November. The questionnaire includes the most recent CPI figures available at that time—originally for September, now for October. It is possible that the respondents have access to a later figure before replying. Livingston tabulates the responses and prepares his article in late December. By that time he is aware of a later CPI figure (now for November), and he often makes an ad hoc correction of the forecasts. The respondents are asked to forecast the level of the CPI for the next December, so responses are really thirteen- or fourteen-month forecasts rather than for one year.

Thus, there are different versions of expected inflation rates as derived from the Livingston survey because of, first, Livingston's adjustments of the data before they are published; and second, the choice of a base figure for calculating the expected rate of inflation. The Livingston-survey expected rates of inflation shown below are based on the following procedures: (a) forecaster responses are used without any corrections; (b) the base figure for calculating the rate of inflation is the figure provided by Livingston on the questionnaire (for a few surveys, Livingston's figure is not available, and the CPI for the month two months prior to the survey is used); (c) it is assumed that the price level forecasts are for a twelve-month horizon. If the forecasts are actually for a fourteen-month period, the rate of inflation is understated by constant proportion (one-sixth).

The one-year expectations of the rate of inflation in the CPI are shown in Table 1. There were 55 semiannual surveys from 1947 through 1973. The mean expected rate of inflation (π^L), the actual inflation rate, and the standard deviation are shown in Figure 1.

FIGURE 1 Livingston Survey: Expectations of One-Year Rate of Inflation in Consumer Price Index, Semiannually, July 1947–December 1973



SOURCE: See Table 1.

The first thing to be noticed is the persistence of expectations of price declines from 1947 through June 1954 (except for three surveys taken during the Korean War). The stability of expectations from 1958 to 1965 is also noteworthy. As forecasts of actual inflation the mean expectations do very poorly. Actual inflation exceeds expectations in all but 16 of the 55 surveys (and two of these are due to underpredictions of the effects of the 1971 price freeze). However, it is not at all clear that expectations should, even on average, be unbiased predictors. The expectations held by individuals may well be systematically wrong.

The standard deviation of the distribution can be considered as a proxy for the dispersion of individuals' expectations. It declines throughout the early postwar period, and from 1954–1973 it is under 1.5 percent in all but six surveys. It tends to increase with π^L, but not appreciably. Thus it is not clear from these data that there is a monotonic relationship between the level and dispersion of inflationary expectations. On the other hand, there may be a relationship between the dispersion and the change in expectations. In 1956, 1966, 1967, and 1973 sharp increases in inflationary expectations were followed by a widening dispersion of expectations.

TABLE 1 Livingston Survey: Expectations of One-Year Rate of Inflation in Consumer Price Index, Semiannually, July 1947–December 1973

Survey Date	π^L Mean	Standard Deviation	Skewness	Kurtosis	Number of Respondents	Actual Rate of Inflation
7/47	−8.70	5.56	0.97	−0.24	28	8.37
12/47	−1.12	6.57	−0.79	−0.21	32	6.10
7/48	−2.86	5.72	1.34	−0.90	28	−0.42
12/48	−4.05	4.31	−0.46	0.55	32	−2.74
3/49	−5.10	3.24	−0.55	0.31	34	−2.08
7/49	−7.68	3.45	0.04	−0.37	34	−1.12
1/50	−3.99	2.75	−0.42	−0.11	34	3.52
6/50	−1.55	1.60	−0.00	−0.46	43	9.48
12/50	3.45	2.38	−0.88	−0.12	36	6.79
6/51	2.20	3.07	0.39	−0.55	42	2.20
12/51	1.56	2.77	1.80	−0.33	49	1.91
6/52	−1.13	2.72	−0.64	−0.05	44	0.76
12/52	−1.90	2.43	1.28	0.19	53	1.00
6/53	2.52	2.01	2.29	0.18	44	0.75
12/53	−1.26	2.09	0.18	0.24	52	−0.87
6/54	−0.04	1.55	1.49	0.09	48	−0.25
12/54	0.15	1.11	−0.05	−0.30	46	0.37
6/55	0.32	1.03	−0.05	−0.21	48	0.50
12/55	0.72	1.31	7.17	−1.46	51	2.48
6/56	0.67	1.45	4.85	−0.91	45	3.85
12/56	1.01	2.46	7.74	0.99	48	2.91
6/57	1.73	1.53	9.28	−2.13	52	3.59
1/58	0.27	1.80	3.54	−0.75	60	2.12

TABLE 1 (concluded)

Survey Date	π^L Mean	Standard Deviation	Skewness	Kurtosis	Number of Respon-dents	Actual Rate of Inflation
6/58	0.38	1.30	−0.15	−0.19	58	0.23
12/58	0.93	0.93	0.58	−0.17	60	1.50
6/59	1.33	0.87	0.76	0.81	60	1.50
12/59	1.22	0.76	0.39	0.38	56	1.36
6/60	1.22	0.77	1.28	0.82	52	0.90
12/60	1.14	0.87	1.82	0.38	60	0.78
6/61	1.34	0.75	0.05	0.78	56	1.34
12/61	1.49	0.73	−0.14	0.41	62	1.33
6/62	1.24	0.87	1.39	0.38	57	0.88
12/62	1.34	0.66	2.20	0.94	62	1.21
6/63	1.23	0.57	0.65	0.45	53	1.53
12/63	1.24	0.56	0.32	0.15	58	1.19
6/64	1.54	0.88	3.11	1.33	54	1.40
12/64	1.53	0.61	2.22	0.13	57	1.71
6/65	1.53	0.70	2.37	1.42	52	2.87
12/65	2.14	0.70	0.34	0.57	63	3.79
6/66	2.80	1.15	−0.01	0.73	49	2.48
12/66	2.92	1.33	5.45	−0.91	59	2.54
6/67	3.07	0.99	−0.31	−0.03	49	4.04
12/67	3.75	1.18	3.40	−0.68	56	4.65
6/68	4.00	1.03	1.33	0.73	53	5.43
12/68	4.00	1.01	1.81	−0.04	57	5.58
6/69	4.65	1.64	5.95	1.34	42	5.98
12/69	4.62	1.00	0.04	0.07	49	5.82
6/70	4.89	1.61	−0.24	−0.64	47	4.34
12/70	5.06	1.12	1.15	0.30	49	3.64
6/71	5.12	1.28	1.17	0.80	44	3.41
12/71	3.76	0.79	−0.21	−0.01	57	3.43
6/72	4.70	1.01	0.79	0.76	47	5.15
12/72	4.40	0.78	0.46	0.23	58	7.90
6/73	5.66	1.44	−0.64	3.24	48	10.18
12/73	7.14	1.97	−0.56	1.27	52	12.01

NOTE: Rate of inflation is calculated using the base dates supplied by Livingston when available. Otherwise, the April CPI is used for summer surveys and the October CPI for winter surveys (7/47 to 12/56, 12/59, 12/62 and 12/67). It is assumed to be a twelve-month expectation from this date.

The actual rate of inflation is in each case calculated for the next twelve months from the April prior to summer surveys and the October prior to winter surveys.

The shape of the distribution fluctuates widely. In the early period it tends to be skewed negatively because of the persistence of deflationary expectations. These disappeared by the late 1950s and 1960s, and the distribution becomes peaked, narrowly dispersed, and somewhat skewed to the right. The peakedness remained in most later distributions, although a growing expectation in the late 1960s that the inflation rate would decline led to some negative skewness. The broader dispersion of the distribution in the postwar period, 1947–1950, was accompanied by negative kurtosis (fat tails).

The long-run behavior of the series is suggestive of the way in which forecasters learn from inflation. From 1947 to 1954, expectations were dominated by the lack of any comparable recent experience on which to base them and by fear of the recurrence of deflation. After the 1958 recession, however, expectations adapted rather quickly to the price stability that persisted until 1965. Since 1965, expectations have accelerated with inflation but have not been very accurate forecasts. The mean expectation has been very optimistic in forecasting declines in the inflation rate. There have been large errors in the direction of change in the rate of inflation which has been accompanied by a considerable widening in the dispersion of expectations. From the end of 1968 to the price freeze of 1971 inflationary expectations increased and the dispersion remained narrow, but the forecasted rates never reached the level of actual inflation. All in all, on the basis of this casual examination of the data, I agree substantially with Turnovsky's conclusion that there have been several distinct eras in the postwar history of inflation expectations.

NBER-ASA DATA

Another source of price expectations data, similar to the Livingston series, is the American Statistical Association–NBER survey of forecasters. Forecasts of the implicit GNP price deflator are derived from the real and nominal GNP forecasts. Participants are asked to forecast the current quarter and up to four quarters into the future. A summary of the survey is published by NBER and ASA; the individual survey responses were not readily available.

For comparison with the Livingston series, I present in Table 2 the expected rate of inflation for the next year calculated from the ASA-NBER surveys. However, the data are available for too short a period of time to be used further in this study. The level of the series is often below that of the Livingston series—more than can be accounted for by the difference between the CPI and the im-

TABLE 2 ASA-NBER Survey: Expected Annual Rate of Inflation in GNP Deflator, 1968–1974

Survey Month	Number of Forecasters	Mean	Standard Deviation	Actual Inflation in Next Year
12/68	84	2.99%	0.76%	5.01%
2/69	61	3.08	0.73	5.33
5/69	56	2.96	0.72	5.86
7/69	118	3.33	1.57	5.64
12/69	57	3.88	0.78	5.13
2/70[a]	–	3.98	–	5.35
5/70	48	3.71	2.05	4.94
7/70	53	3.33	0.76	5.00
12/70	121	3.79	1.41	4.61
2/71	53	3.61	0.70	3.50
5/71	56	3.56	0.79	3.69
7/71	74	4.04	1.70 }	2.96
9/71	62	3.09	0.80 }	
12/71	76	3.29	0.91	3.15
2/72	66	3.54	0.73	3.69
5/72	69	3.57	0.94	3.69
8/72	66	3.69	0.84	5.02
12/72	62	3.45	0.78	6.26
2/73	61	3.95	0.99	7.41
5/73	63	4.04	1.09	9.11
8/73	42	4.73	1.30	9.63
12/73[a]	–	5.49	–	10.54
2/74	62	5.79	1.60	11.80
5/74[a]	–	6.18	–	
8/74	53	7.25	1.45	
12/74	52	8.02	1.32	

NOTE: The expected rate of inflation at annual rates for survey quarter t is defined as 80 $(IPD^e_{t+4} - IPD^p_{t-1})/IPD^p_{t-1}$, where IPD^p_{t-1} is the value of the implicit price deflator shown in the issue of the *Survey of Current Business* of the survey month and IPD^e_{t+4} is the expected price level. In 2/69, 5/69, 7/69 and 8/74, IPD^e_{t+3} is the last forecast available.

The actual inflation rate is defined as 100 $(IPD_{t+3} - IPD_{t-1})/IPD_{t-1}$. Revised price data are used.

[a]The individual survey responses were not available, and the rate of inflation was calculated from the median expected price level shown in the ASA-NBER releases.

plicit price deflator (IPD). The series also shows a relatively constant standard deviation.

SURVEY RESEARCH CENTER DATA

A major source of price expectations data that has begun to attract the attention of reseachers in the last two years is the Survey of Consumer Finances (SCF) conducted by the Survey Research Center (SRC). It is fundamentally different from the previously mentioned data in that it is based on a survey of the general public rather than professional forecasters.[3] The SRC has included price expectations questions since the inception of the surveys in 1946.

The SRC surveys were initially annual, but throughout the 1950s at least two or three were held each year, and since the early 1960s they have been held on a quarterly basis. The form of the survey questions has changed somewhat over the years. Furthermore, up to 1966, only directional responses were obtained, but since then point estimates of inflationary expectations have been requested as well. Nevertheless, the SRC data can be used in several ways to construct long time series of inflationary expectations. Series have been analyzed by Juster and Wachtel (1972a, 1972b), Wachtel (1973), Juster (1973), de Menil and Bhalla (1975), and de Menil (1973).

Initially, the SRC survey question was: "What do you think will happen to the prices of the things you buy during the next year [for mid-year surveys: "between now and the end of the year"]—do you think they will go up or down or stay like they are now?" In 1952 the question was changed to "What do you expect prices of household items and clothing will do during the next year or so—stay where they are, go up or go down?" Finally in 1959 the phrasing was changed to: "Now speaking of prices in general, I mean the prices of the things you buy—do you think they will go up in the next year or go down or stay where they are now?" Starting in 1966, respondents expecting price increases were asked, "How large a price increase do you expect? Of course, nobody can know for sure, but would you say that a year from now prices will be about 1 or 2 percent higher or 5 percent or closer to 10 percent than now or what?" These point estimates are not very reliable because respondents tend to agree with one of the suggested answers.

Two basic approaches have been used in the studies noted earlier to construct consistent time series for the expected rate of inflation.

Juster and Wachtel (1972a, 1972b) present a series that is based on the point estimates of the size of expected price increases since 1966. Median values were assigned to each class as presented in the SCF tables. The mean expected increase was used for those who did not know how much of an increase was expected; and zero, for those who expected prices to remain the same or go down, and for don't-know responses. The series was then linked to the pre-1966 data by using the difference between the percentages expecting increases and expecting decreases. Series based on other linking procedures can be found in de Menil and Bhalla and in Juster. The various series differ before 1966 because two basically different types of data are being linked. Therefore, only the post-1966 point estimates are used in this study. The series is shown in Table 3 and is called π^S

TABLE 3 SRC Price Expectations Data, Quarterly, 1946–1967 (percent)

Survey Date	π^S	π^N	σ^N	Actual Inflation in CPI 12 Mos. After Survey Date
1946I		3.83	2.51	
1947I		−2.99	2.81	6.85
1947III		0.23	2.78	9.76
1948I		0.46	3.18	1.71
1948III		2.26	2.64	−2.87
1949I		−4.12	2.61	−1.12
1949III		−2.43	1.75	1.55
1950I		−1.60	2.06	9.49
1951I		5.65	2.28	1.94
1952I		3.03	1.93	1.02
1952IV		−1.16	1.75	0.62
1953I		−0.78	1.77	1.13
1953III		−0.62	1.98	−0.37
1954I		−1.13	1.87	−0.50
1954II		−0.90	1.91	−0.74
1954IV		−1.04	1.99	0.37
1955II		0.43	2.01	1.62
1955IV		1.03	2.09	2.48
1956II		1.63	2.19	3.58
1956IV		2.10	2.02	3.15

TABLE 3 (continued)

Survey Date	π^S	π^N	σ^N	Actual Inflation in CPI in 12 Mos. After Survey Date
1957II		1.53	2.62	2.85
1957IV		1.89	2.83	1.82
1958II		0.53	2.56	0.52
1958IV		1.86	2.33	1.50
1959I		2.15	2.24	1.39
1959II		2.67	2.43	1.72
1959IV		2.99	2.43	1.42
1960I		3.20	2.59	1.54
1960II		2.71	2.60	0.90
1961I		2.29	2.59	0.79
1961II		2.06	2.09	1.29
1961IV		2.07	1.96	1.33
1962I		2.21	2.00	1.27
1962II		2.07	1.96	0.88
1962III		1.79	1.91	1.54
1962IV		2.05	1.95	1.32
1963I		2.74	2.15	1.54
1963II		2.36	1.96	1.53
1963III		2.25	1.89	0.98
1963IV		1.97	1.59	1.30
1964I		2.58	2.08	1.14
1964II		2.32	1.55	1.78
1965I		2.62	1.69	1.92
1965III		2.56	1.66	3.49
1965IV		2.56	1.88	3.58
1966I		4.24	2.37	2.81
1966II	2.74	3.39	2.48	2.69
1966III	3.33	4.91	3.01	2.66
1966IV	[a]	3.09	2.52	2.84
1967I	2.91	3.75	2.44	3.65
1967II		4.28	2.38	4.02
1967III	3.12	4.00	2.26	4.28
1967IV	3.44	5.02	2.70	4.74
1968II	3.32	4.00	2.26	5.42
1968III	3.47	4.61	2.53	5.63
1968IV	2.99	3.06	2.11	5.93
1969I	3.07	4.03	2.81	6.35
1969II	3.73	5.92	3.50	6.15
1969III	3.74	4.56	2.84	5.63

TABLE 3 (concluded)

Survey Date	π^S	π^N	σ^N	Actual Inflation in CPI in 12 Mos. After Survey Date
1969IV	2.80	3.54	2.94	5.71
1970I	3.53	4.13	2.91	4.83
1970II	3.73	4.65	3.43	4.37
1970III	3.06	3.51	2.94	4.45
1970IV	3.47	4.10	2.90	3.55
1971I	3.50	4.41	3.27	3.69
1971II	3.25	4.09	3.09	3.23
1971III	2.39	1.93	1.99	2.95
1971IV	2.41	2.02	1.92	3.47
1972I	3.04	2.50	1.84	3.88
1972II	2.42	1.90	2.16	5.45
1972III	2.77	2.45	2.13	7.42
1972IV	2.85	2.67	2.10	7.90
1973I	4.19	4.78	3.47	10.03
1973II	3.93	3.02	2.63	10.72
1973III	4.54	3.63	3.53	10.96
1973IV	3.61	2.46	2.69	12.01
1974I	5.44	4.52	2.83	11.10
1974II	4.96	4.29	3.40	9.48
1974III	4.97	3.55	2.57	8.22

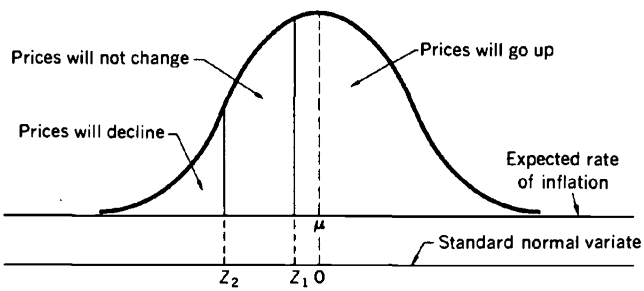
NOTE: π^S = Juster-Wachtel series; π^N = SRC data based on normality assumption; σ^N = standard deviation of π^N

[a]Not available; question not asked.

The behavior of π^S from 1966 to 1973 is similar to that of the Livingston series. The forecasts of inflation are consistently too low, and there are several large and erratic declines in π^S without any corresponding decline in the actual rate. In addition, expectations are fairly slow to change. In only 6 of the 34 surveys (1966II–1974III) do expectations increase by 0.5 percent. Examination of the series suggests that expectations can be viewed as extrapolations of a very optimistic perception of current experience. For example, when current economic conditions and policy are perceived to be anti-inflationary, expectations, if not inflation itself, do moderate.

An alternative procedure for constructing a series on inflationary expectations is to use only the qualitative survey data—the proportion of survey respondents who expect prices to go up, down, or remain the same. The procedure has been used by Shuford (1970), by Carlson and Parkin (1975), employing British data from a similar survey question, and by de Menil (1973). Very briefly, if we assume that the distribution of expectations among respondents can be described by a two-parameter distribution, the proportions of respondents who assume, respectively, that prices will go up and that they will go down are sufficient information to identify those parameters. This is illustrated with a normal distribution in Figure 2. To solve for the mean and standard deviation μ and σ, we need to

FIGURE 2



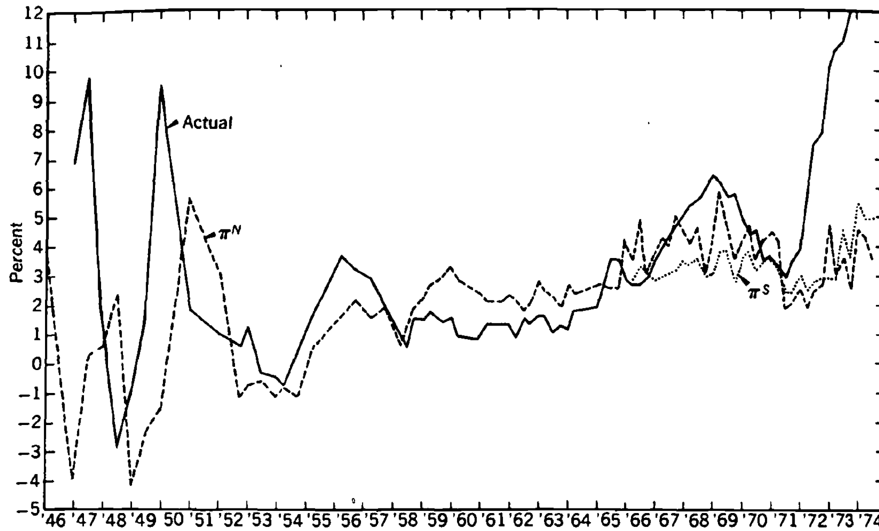
assume the shape of the distribution and the bounds of the remain-the-same category.[4] Nonresponses can either be ignored or allocated among the three relevant groups (see Carlson and Parkin for an elaborate allocation procedure). The bounds of the nonresponse category can either be chosen arbitrarily or chosen to scale the resultant expectations series in any way (for example, so that on average expectations equal actual inflation).

The formal procedure used will be outlined very quickly. Nonresponses were ignored, with the result that the areas in Figure 2 represent proportions of those responding and sum to 100 percent. Those proportions identify points z_1 and z_2 on the standard normal variate. Those points are the bounds of the remain-the-same category (unperceived price change) and are assumed to correspond to ± 1.25 percent. The relationship between those points on the standard normal variate and on the expected inflation rate variable is given by two equations: $z_i = (k_i - \mu)/\sigma$, where $i = 1, 2$ and $k_1 = 1.25$, $k_2 = -1.25$. They can be easily solved for the mean and standard deviation of the distribution of expectations:

$$\mu = \frac{1.25(z_2 + z_1)}{z_2 - z_1} \text{ and } \sigma = \frac{2(1.25)}{z_1 - z_2}$$

It is clear from the above that since the bounds of the don't-know category are assumed to be symmetrical, they enter as a scale factor only. The series estimated in this way are shown in Table 3 (π^N and σ^N for the mean and standard deviation, respectively) and plotted in Figure 3. As noted earlier the phrasing of the survey question

FIGURE 3 SRC Price Expectations Data, Quarterly, 1946–1967



SOURCE: See Table 3.

changed twice. In both cases there are overlaps for which interpolations can be made to obtain two values for a few quarters, and these are used to make a level adjustment.

The normality assumption is useful because it is a two-parameter distribution but it also imposes a rather rigid form on the distribution. My analysis of the actual distribution of responses to the Livingston survey suggests that the distribution is probably not symmetric. The log-normal distribution is therefore used as an alternative.

If x is inflationary expectations in percentages, it is assumed that $(100 + x)$ is log-normal or that $y = \log(100 + x)$ is normally distributed. As before, we can solve for the mean and standard deviation of y. It can be shown (see Naylor et al. 1966) that

$$\mu_x = [\exp(\mu_y + \sigma_y^2)] - 100$$

$$\sigma_x^2 = (\mu_x + 100)^2[\exp(\sigma_y^2) - 1]$$

Although the series based on the log-normal distribution is very close to the one based on the normality assumption, the former did marginally better in most of the tests run. (The mean of the log-normal series is called π^O and the standard deviation is designated σ^O.)

The expectations data based on the SRC surveys exhibit some characteristics which differ from those of the Livingston series. Expectations of deflation are not as strong in the postwar period, although the expectations series do change erratically. Furthermore, π^N exceeds the actual rate of inflation in the late 1950s.[5] Throughout the 1960s the expected inflation rate based on the normality assumption keeps pace with the actual inflation rate, while π^S lags behind. More recently, both series indicate expectations of more moderate inflation in the recession of 1969. However, these were reversed by the time inflation actually did moderate (prior to the price freeze). The effect of the freeze was overestimated and the current acceleration of inflation completely unpredicted.

FORECAST PERFORMANCE OF EXPECTATIONS

Some simple tests of the predictive accuracy of the various expectations series are shown in Table 4. For these and other tests linear interpolations of the expectations series are used to provide complete series. The forecast test is very simply the regression of the actual inflation rate on the expected rate: $p = \alpha + \beta\pi + u$. Forecasts are unbiased if $\hat{\alpha} = 0$ and $\hat{\beta} = 1$. This is the same as saying that Muth's rational expectations hypothesis holds because rationality is defined by: $p = \pi + \epsilon$.

The equations for π^S show that expectations of inflation derived from the direct responses to the SRC surveys have been a very poor predictor of inflation. However, when the postfreeze period is excluded, the forecasts are not obviously biased, although the relationship disintegrates. The next set of equations tests the forecast reliability of the Livingston series, which is found consistently to underestimate price change. The third set, for π^O, indicates that the behavior of the series is extremely erratic in the various subperiods shown. It is interesting, however, that both the Livingston and SRC data can support the rationality of forecasts hypotheses when the test is restricted to one particular period.[6] It is this particular result that is used by de Menil to argue that expectations are unbiased.

That result is only true of a peculiar time period that spans the relative price stability of the post-Korean War phase and the Vietnam era of price acceleration. The evidence here lends support to the idea that the nature of price expectations changes profoundly from one era to another.

TABLE 4 Forecast Tests of Inflationary Expectations Data (figures in parentheses are standard errors)

	α	β	$\bar{R}^2$	DW	SE
SRC price expectations series (π^S)					
1966II–1973III	−2.96	2.53	.2922	.51	1.91
	(2.31)	(0.70)			
1966II–1971II	1.46	0.92	.0082	.32	1.15
	(2.81)	(0.85)			
Livingston series (π^L)					
1948I–1973IV	2.05	0.57	.2976	.20	2.33
	(0.26)	(0.09)			
1957I–1973IV	−0.16	1.32	.7386	.16	1.34
	(0.30)	(0.10)			
1965I–1973IV	−0.68	1.44	.5089	.14	1.77
	(0.99)	(0.24)			
1957I–1971II	0.46	0.96	.7350	.23	0.86
	(0.21)	(0.08)			
SRC series with log-normal assumption (π^O)					
1948I–1973III	1.47	0.60	.1963	.24	2.36
	(0.34)	(0.12)			
1948I–1955IV	1.46	0.28	.0245	.33	2.85
	(0.51)	(0.21)			
1956I–1973III	0.19	1.06	.2655	.23	2.01
	(0.65)	(0.21)			
1948I–1964IV	1.35	0.21	.0232	.30	2.04
	(0.30)	(0.13)			
1965I–1973III	4.08	0.22	−.0191	.09	2.27
	(1.44)	(0.37)			

NOTE: $\bar{R}^2$ = coefficient of multiple determination adjusted for degrees of freedom; DW = Durbin-Watson statistics; SE = standard error. Actual inflation is defined as $100[CPI(t+4) - CPI]/CPI$, where CPI is the average value in the quarter. For further explanation, see text.

PRICE EXPECTATIONS AND CONSUMPTION BEHAVIOR[7]

The simplistic view that consumer behavior is neutral with respect to price change has been followed in most econometric studies of consumption. Exceptions include the Branson-Klevorick (BK) study of the money illusion phenomenon and the Juster-Wachtel (1972b) savings rate forecasts. I use the BK framework to analyze the effect of price movements on consumption and to present some evidence based on recent experience. I reached two conclusions: first, in the last eight years, consumers have learned to perceive price changes; and second, consumers react to inflationary expectations by holding back on their expenditures.[8]

There are three ways in which movements in the price level and price expectations can directly effect consumption behavior—money illusion or incorrect price perceptions, intertemporal substitution in consumption patterns, and uncertainty caused by expectations of inflation. Tests for the presence of each of these effects can be specified because the survey data on inflationary expectations are a source of information that is not solely dependent on past prices. For this reason, consumption effects based on price perceptions of past price movements can be distinguished from purely expectational effects. As will be shown, uncertainty resulting from inflationary expectations will cause a permanent decline in consumption; money illusion implies a permanent increase; and intertemporal substitutions imply a temporary increase.

Money illusion in the consumption function arises because the consumer may not perceive, in exactly the same way, changes in real income or wealth stemming from changes in nominal income or emanating from changes in prices. Money illusion can be defined as a tendency to overlook price change. If prices rise and the consumer does not perceive the increase, then he will think that real income is higher than it actually is and consume more than he otherwise would. The implication of this argument is:

$$\left.\frac{d\frac{C}{\rho}}{d\rho}\right|_{\frac{Y}{\rho},\frac{W}{\rho}} > 0$$

where ρ is the price level, and C, Y, and W are respectively nominal consumption, income, and wealth. One point that should be noted is that the money illusion response is not based on price expectations but on perceptions of the existing price level. It requires some consumer ignorance of changes in the price level. We are led to ask, therefore, whether it is reasonable to expect consumers to be ignorant. The answer is affirmative because information about the price level is costly to obtain and difficult to interpret. Information on nominal income and wealth, however, is readily available. It is easy to imagine a situation of moderate price change where the disutility of incorrect price perceptions is relatively small, and it might not pay at all to attempt to gather improved information. However, in time of rapid or large price change the disutility of an incorrectly perceived price level is much larger. In that case, consumers would spend more time and resources in collecting price information. This may or may not enable them to forecast future prices, but it will provide them with better current price information. As a consequence, we would expect less money illusion in inflationary times.

Intertemporal substitution in the pattern of consumption is often suggested as the major consequence of inflation. Simply put, when price increases are expected, purchase plans are advanced. The potential for such intertemporal substitution is limited because for each inflation rate there is an optimal level of inventories of consumption goods. Thus, unless inflation accelerates, consumers will not increase their stocks of goods. There have been very few instances of this type of buying activity in this country.

The third and final possible reaction to price change is the uncertainty effect.[9] We will argue that inflation is a major cause of real-income uncertainty and therefore leads to more saving. Sandmo (1970) demonstrates formally that uncertainty about future income leads to more saving by risk-averse consumers. A higher rate of inflation leads to more real-income uncertainty if the dispersion (variance) of inflationary expectations increases with the rate of inflation. Alternatively, in a society that has difficulty in making adjustments to inflation, an increase in the rate of inflation represents a shift in the state of the world. At a higher rate of inflation there is an overall increase in uncertainty and anxiety. In the face of these attitudes—which should be reflected in an individual's subjective probability distribution of expectations, but not necessarily in the distribution across individuals[10]—the logical response is to build up precautionary balances and to avoid expenditure commitments.

The above hypotheses are tested by estimating the BK version of the life-cycle consumption model with an inflation rate variable:

$$C = \alpha_0 Y^{\beta_1} W^{\beta_2} \rho^{\beta_3} \pi^{\beta_4}$$

Almon lags are used on Y and ρ but not W or π. The price level coefficient can, depending on the shape of the lag distribution, indicate the presence of either money illusion or intertemporal substitutions. π, the expected rate of inflation, which is not found in the BK study, is used to test for the presence of the uncertainty effect; the empirical series used is π^N. The price level (ρ) is the CPI. The real income, wealth, and consumption data are per capita values from the FRB-MIT econometric model data bank.

In Table 5 results are presented for two estimation periods. The Almon lag specifications are the same as those used by BK. The results in the first column correspond rather closely to the preferred BK result. The distributed lag coefficients on the price level are positive (except for a small negative coefficient in the last lag), suggesting a significant degree of money illusion. As the results in the second column indicate, there is little evidence of any uncertainty effect in this period. The coefficient on π^N is negative but not significantly different from zero. These results are not at all surprising. The earlier period was one of unusually stable prices. Consequently, there was little incentive to use resources to obtain price information; in times of stable prices ignorance costs little.

The second set of equations presents the same specification for 1965–1973. The distributed lag on the price level is, in this case,

TABLE 5 Consumption Function Estimates (figures in parentheses are t statistics)

	1957I–1965IV		1965IV–1973III	
	(1)	(2)	(3)	(4)
Constant	−1.7888	−1.7752	−0.6941	−0.4787
	(9.8)	(9.2)	(4.3)	(2.8)
W	0.1377	0.1477	0.1546	0.1410
	(3.0)	(2.3)	(6.3)	(6.1)
$\Sigma w_i Y_i$	0.5818	0.5756	0.6960	0.7623
	(10.3)	(9.1)	(9.7)	(10.7)
$\Sigma w_i \rho_i$	0.3730	0.3660	0.1020	0.0512
	(6.7)	(5.7)	(2.3)	(1.1)
π^N		−0.0008		−0.0066
		(0.2)		(2.4)
R^2	0.9983	0.9983	0.9987	0.9989
SE	0.00282	0.00287	0.00292	0.00266
DW	2.07	2.05	1.69	1.81

more suggestive of intertemporal substitution than of money illusion. The first three lag coefficients are positive and sum to 0.5009, the succeeding three are negative and sum to −0.6712, and the last is positive. Thus, the initial response to a price increase is a rise in real consumption which is followed by a decline of about the same magnitude later on. The sum of the lag coefficients is positive and more than twice its standard error, suggesting that some money illusion remains after the intertemporal substitutions. However, the amount of money illusion in the later period is only 27 percent of the amount in the earlier one.

When π^N is added to the equation, the sum of the lag coefficients on the price variable is not significantly different from zero. There is no evidence of money illusion, but the lag distribution does suggest that there are intertemporal substitutions. In addition there is strong evidence of an uncertainty effect, that is, consumption declines significantly when the expected rate of inflation increases.

The magnitude of the uncertainty effect is rather small. If the expected rate of inflation increases from 4 to 5 percent (by 25 percent), then real per capita consumption decreases by 0.17 percent. The estimates of money illusion in the early period are, on the other hand, fairly large; a 1 percent price increase leads to an increase of 0.37 percent in consumption.

The combined effect on consumption of money illusion, intertemporal substitution, and uncertainty effects leaves unsettled the question of how prices and price expectations have affected consumption behavior in the past decade. We can examine this question by showing a breakdown of the relative size of the two price effects. We take the log of the BK function above and obtain first differences, with the following result (showing the effects of the variables with distributed lags schematically)

$$\Delta \ln C = \beta_1 \Delta \ln Y + \beta_2 \Delta \ln W + \beta_3 \Delta \ln p + \beta_4 \Delta \ln \pi^N$$

The dependent variable is approximately the percent change in predicted real per capita consumption, and the terms on the right-hand side represent the contributions of Y, W, p, and π to the prediction. Table 6 shows the percent change in real per capita consumption and the predicted changes due to the effects of price level and inflationary expectations as calculated from the estimates in the last column of Table 5.

The price level effects are positive in most of the quarters since 1966, indicating the presence of some money illusion. As inflation moderates, the lagged negative weights balance out the early positive ones. Large price increases in early 1973, along with those of

1967–1968, led to positive price level effects. When inflation moderated in 1970–1972, the intertemporal substitutions led to negative price level effects.

The expected inflation or uncertainty effects are somewhat erratic because the series itself has many seemingly random

TABLE 6 Contribution of Prices and Inflationary Expectations to Changes in Consumption, Quarterly, 1966–1973 (percent)

	Predicted Change in Real per Capita Consumption	Predicted π Effect	Predicted Price Level Effect
1966II	0.50	−.33	.20
III	0.39	.15	.19
IV	0.47	−.25	.19
1967I	0.75	.31	−.11
II	0.71	−.13	−.23
III	0.73	−.08	.01
IV	0.70	.04	.18
1968I	1.13	−.15	.29
II	1.33	.07	.24
III	0.66	.08	.09
IV	0.61	−.09	.13
1969I	0.71	.27	.13
II	0.47	−.19	.17
III	0.50	−.25	.19
IV	0.40	.17	.16
1970I	0.59	.17	.12
II	0.69	−.10	.07
III	0.71	−.08	−.05
IV	0.48	.19	.05
1971I	0.56	−.10	−.14
II	0.58	−.04	−.13
III	0.22	.05	−.04
IV	0.45	.49	−.04
1972I	1.24	−.03	−.08
II	1.48	−.14	.01
III	0.91	.18	−.01
IV	1.54	−.17	.16
1973I	0.99	−.05	.26
II	0.68	−.39	.43
III	1.01	.31	.59

changes. The effects are negative in only seventeen of thirty quarters because the expected rate of inflation has not increased monotonically. These effects are fairly small—rarely more than 0.2 percent while predicted consumption increases by almost 1 percent per quarter. Finally, it is not uncommon (sixteen out of thirty quarters) for the two price effects to be operating in opposite directions. These results suggest that the relationship between price behavior and consumption is fairly complex and deserving of more study.

EXPECTATIONS AND PRICE CHANGE

Inflationary expectations are likely to affect the actual rate of inflation because they will affect the behavior of price setters throughout the economy. Most prices are less than perfectly and continuously flexible, as they are either set by contract or imply real costs when changes take place (e.g., new catalogues and price labels). Thus, expectations of future inflation will affect current price-setting behavior. The higher the expected rate of inflation, the larger will be the price adjustments made and consequently the higher will be the actual rate of inflation, that is, price changes will reflect anticipated costs and overall expectations of future inflation, as well as current supply and demand conditions. When decision makers throughout the economy expect future inflation, their expectation will be reflected in a higher observed rate of inflation. A similar argument can be made in terms of the variability of the expected rate of inflation. When there is a great deal of uncertainty about future prices, decision makers may move their price increases forward because pricing errors may entail large costs.

Most previous discussions of the effect of inflationary expectations on inflation (e.g., Solow 1969 and Eckstein and Brinner 1972) have been in the overall context of the Phillips-curve trade-off and Friedman's expectations hypothesis. In my discussion here, I have relied implicitly on a similar argument to explain why inflationary expectations will be passed through to the actual rate of inflation. The hypothesis is tested in the context of a price inflation equation that draws upon the current state of the art. The framework is taken, with some modifications, from de Menil (1974), who specifies a single-equation model without any price expectations influence. The above discussion suggests that the inflation rate should, in addition, vary with inflationary expectations. This is the case, as my expectations measures do add to the explanatory power of the model.

The price equation is given by:

$$\Delta \ln P = \alpha_0 + \alpha_1 T + \alpha_2 UC + \alpha_3 \ln Q + \alpha_4 (\ln P_{t-1} - \ln W) + \alpha_5 \pi_{t-1} + u$$

where

P = implicit price deflator for private nonfarm business sector
$\Delta \ln P$ = rate of change in P
T = time trend
UC = trend-adjusted ratio of unfilled orders to capacity (series by Gordon 1971, p. 155; later dates were supplied by Gordon)
Q = output per man-hour for private nonfarm sector
W = compensation per man-hour for private nonfarm sector
π = expected rate of inflation

The expected signs of the coefficients are: $\alpha_1, \alpha_3, \alpha_4 < 0$; $\alpha_2, \alpha_5 > 0$. The rationale for the model will be presented very briefly, as our main interest is in the role of the price expectations variable. The time trend is included to represent the influence of the trend in productivity on price changes. The ratio of unfilled orders to capacity is a short-run demand pressure variable. Current labor productivity enters the de Menil model because it is a determinant of marginal costs in his vintage production model. The major determinant of marginal costs is, of course, the wage rate, which enters with a positive coefficient. To reduce collinearity, the coefficient of W is constrained to be of the same absolute value as that of the lagged price level. The latter is included because lagged adjustments to the optimal price level are expected.

Estimates of the price equation are shown in Table 7. The estimation period, 1955I–1973II, extends four and a half years beyond the estimation period used by de Menil. Nevertheless, the coefficient estimates are remarkably similar to his except for α_3, which is sensitive to the presence of his variable for average age of machinery, which I omit from my specification because data are not available. Thus, equation 1 essentially reproduces the de Menil results. Lagged price expectations are added to the model in equation 2. π^0 is lagged one period to avoid any simultaneity bias. The expectations coefficient is significantly positive, and the other coefficients of the model are essentially unchanged.

In Solow's 1969 lectures at the University of Manchester, he also discusses the effects of price expectations on price change. He uses the familiar adaptive expectations hypothesis to generate price expectations and estimates his price equation for the period 1948–1966. I have not used his specification because the estimates de-

TABLE 7 Price Equations
(figures in parentheses are t statistics)

	1955I–1973II				1955I–1964IV	1965I–1973II
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	.3951	.3656	.3194	.4395	.2348	.8182
	(5.9)	(5.5)	(3.8)	(4.5)	(1.0)	(4.5)
T	−.0004	−.00072	−.00052	−.00066	−.0011	−.0012
	(2.2)	(3.1)	(2.6)	(2.8)	(2.4)	(2.2)
UC	.0176	.0124	.0163	.0152	.0125	.0042
	(6.3)	(3.5)	(5.6)	(3.4)	(2.0)	(0.5)
$\ln Q$	−.0791	−.0682	−.0620	−.0853	−.0348	−.1561
	(5.2)	(4.4)	(3.3)	(3.8)	(0.7)	(4.6)
$\ln P_{t-1} - \ln W$	−.1404	−.1661	−.1349	−.1751	−.1951	−.2912
	(5.5)	(6.1)	(5.3)	(2.3)	(1.9)	(3.5)
π^o_{t-1}		.3302		.3320	.3678	.3421
		(2.3)		(2.3)	(1.0)	(1.8)
$(\bar{\sigma}^o)^2$			.0920			
			(1.5)			
π^X				−.1618		
				(1.0)		
$\bar{R}^2$	0.6924	0.7097	0.6981	0.7101	0.6462	0.6735
SE	0.00222	0.00216	0.00220	0.00216	0.00193	0.00810
DW	2.11	2.19	2.21	2.03	2.33	2.20
Average absolute residuals						
1966II–1971II	.00158	.00155				
1971III–1973II	.00238	.00203				

NOTE: $(\bar{\sigma}^o)^2 = (1/2)[(\sigma^o_{t-1})^2 + (\sigma^o_{t-2})^2]$; $\pi^X = 0.4\,\Delta \ln P_{t-1} + 0.3\,\Delta \ln P_{t-2} + 0.2\Delta \ln P_{t-3} + 0.1\Delta \ln P_{t-4}$. Other variables are defined in text.

teriorate when the period of fit is extended. However, his preferred equation has a coefficient on the expectations variable of 0.4029, fairly close to my estimate of 0.3302.

The de Menil model[11] is specified as a partial adjustment in $\ln P$: $\ln P = \lambda \ln P^* + (1 - \lambda) \ln P_{t-1}$, where the target price level, P^*, is given by $P^* = e^{\alpha X} P^{e\beta}$, and P^e is the expected price level and X is a vector of the other variables in the model. If P^e is defined as $P_{t-1}(1 + \pi_{t-1})$ and $\ln(1 + \pi) \approx \pi$, the reduced form can be written as the estimated form:

$$\Delta \ln P = \lambda\alpha X + \beta\lambda\pi_{t-1} - \lambda(1 - \beta) \ln P_{t-1}$$

The adjustment coefficient, λ, and the expected price effect, β, can be identified from the estimated equation: $\beta = -\alpha_5/(\alpha_4 - \alpha_5)$, and $\lambda = \alpha_5 - \alpha_4$. Using the estimates in equation 2 of Table 7, the long-run price effect, β, is found to be 0.6653, and the adjustment of prices to the expected level is fairly rapid, although it is incomplete, even in the long run.

A comparison of the survey measure of expected inflation with a more traditional measure based on past inflation is shown in equation 4. An extrapolative measure of inflationary expectations, π^X, is added to the specification. It is defined as a simple weighted average of the actual rate of inflation in the four prior quarters, with linearly declining weights. When both π^O and π^X are included, the π^X coefficient is negative. Price expectations based on a common extrapolative hypothesis do not add to the explanation of de Menil's thoroughly specified price model. The extrapolative proxy for expectations contains no information about price determination that is not already included in the partial adjustment of prices to their target level. The survey measure of inflationary expectations does, however, add some significant new information to the model. In addition, the π^O coefficient is remarkably stable when the period of fit is divided into a ten-year span characterized by stable prices and an eight-year inflationary span (equations 5 and 6). Similar results are obtained with the other survey measures derived from the SRC data, but the Livingston series did not enter the price equation significantly, perhaps because every other data point of π^L is an interpolation in the regression estimates.

The effect of the dispersion of expectations on price change is shown in equation 3. The variable $(\bar{\sigma}^O)^2$ is the average of the variances in the expected rate of inflation in periods $t - 1$ and $t - 2$. The coefficient is positive but not quite twice its standard error. π^O and $(\bar{\sigma}^O)^2$ are collinear and therefore are not both included in the equation. At its peak in 1970IV, $(\bar{\sigma}^O)^2$ is 10.21, some six points higher than the values observed in the early 1960s. Thus, the increase in dispersion accounts for an increase of only 0.55 percent in the rate of inflation.

A final test of the additional information provided by the inflationary expectations variables is shown at the bottom of Table 7. Although the standard error of equation 2, with expected inflation, π^0, included, is only slightly smaller than that of equation 1, without π^0, the residuals are much smaller in the later periods. Particularly in the postfreeze period (1971III–1973II) the average absolute residual is reduced by 17 percent.

WAGE EQUATIONS

The area in which the role of price expectations has received the most attention is the determination of wages. The theoretical controversy—whether the Phillips-curve relationship between labor market conditions and wage changes shifts with price expectations—is by now familiar. It was thrust into prominence by Friedman's presidential speech (1968) and has been the subject of numerous empirical studies as well (see, for example, Perry 1970 and Gordon 1972). Wage determination has also been the testing ground for the Livingston price expectations data (Turnovsky and Wachter 1972) and for the SRC series (de Menil and Bhalla 1975).

The Turnovsky-Wachter article uses the Livingston data on wage and price expectations in several variations of the Phillips relationship augmented by the "expectations hypothesis." Their period of fit is 1949–1969. They find that there is a significant expectations effect on wage inflation and also an error adjustment or catch-up effect. The de Menil paper provides a more rigorous test of the survey data. De Menil takes three wage equations from the literature, each of which has a more elaborate specification than the Phillips curve and a distributed lag specification for the formation of price expectations, and adds the SRC-based survey data as an alternative expectations variable. He finds that the initial specification can be improved upon with the survey data, especially when it is used in the form of a catch-up variable.

In this section similar results are presented with the period of fit extended to include the freeze and postfreeze period through 1973II. It is difficult to determine wage movements over this period and indeed the standard specifications (see Perry 1970 and Gordon

1971) used by de Menil do not hold up. I was unable to find an entirely satisfactory specification based on the standard determinants for wages. Nevertheless, some results using two standard specifications are shown.

First, a standard Phillips-type relationship is shown:

$$\Delta \ln W = \alpha_0 + \alpha_1 U^{-1} + \alpha_2 U_{t-1}^{-1} + \alpha_3 DG + \alpha_4 \Delta \ln SS + \alpha_5 \pi_{t-1} + u$$

where variables not defined in the previous section are

U = standard unemployment rate
DG = dummy variable for the wage-price guideposts: 1962I = 0.25, 1962II = 0.50, 1962III = 0.75; 1962IV–1966IV = 1.0; 1967I = 0.75, 1967II = 0.50, 1967III = 0.25
$SS = 1/[1 - 0.5\,(SIN/WY)]$
SIN = contributions for social insurance
WY = wage and salary income

The alternative specification is based primarily on productivity[12] rather than labor market demand (unemployment):

$$\Delta \ln W = \beta_0 + \beta_1 \ln QT + \beta_2 DG + \beta_3 \Delta \ln SS + \beta_4 \pi_{t-1} + u$$

where QT = ratio of output per manhour (Q) to its trend (estimated by $\hat{Q} = 67.15 + 0.5812T$). Both specifications include a dummy variable to reflect the effect of the wage-price guideposts of the Kennedy-Johnson years. Most of the coefficients are significant, indicating that the guideposts reduced wage inflation by perhaps as much as 1.5 percent. Also included is a variable used by Gordon that is designed to reflect the incidence of changes in social security taxes. The coefficients are consistently close to unity, indicating the complete passthrough of payroll taxes to the wage earner.

Estimates of the unemployment rate model are shown in Table 8 and of the productivity model in Table 9. For the whole period of fit both the survey variable (π^O) and the extrapolative formulation (π^X) enter with significant coefficients below 1.0. In the productivity model π^O provides the better fit, and in the unemployment model π^X provides the better fit. However, it is interesting to note that π^O and π^X seem to embody distinctly independent pieces of information, both of which are relevant to wage inflation. This is indicated by the results shown in the third column of each table, which includes both π^O and π^X; both variables enter significantly. In addition, the sum of the two coefficients is very close to 1.0. This suggests that in a long-run static equilibrium situation (where $\pi^O = \pi^X$ because prices have been changing at a constant rate which is perceived) the expectations hypothesis may in fact be justified.

TABLE 8 Wage Equations: Unemployment Rate Model (figures in parentheses are t statistics)

	1955I–1973II				1955I–1964IV	1965I–1973II
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0042	.0047	0.0047	0.0024	.0069	0.1249
	(1.9)	(2.1)	(2.1)	(0.9)	(1.4)	(3.1)
U^{-1}	0.0920	.1206	0.1183	0.1111	.1010	0.0380
	(2.6)	(3.3)	(3.3)	(2.9)	(2.2)	(0.5)
U^{-1}_{t-1}	−0.0688	−.1067	−0.1090	−0.0861	−.0958	−0.0431
	(1.9)	(2.7)	(2.9)	(2.2)	(1.8)	(0.6)
DG	−0.0031	−.0002	−0.0012	−0.0023	.0013	−0.0054
	(2.8)	(0.2)	(0.9)	(1.8)	(0.8)	(2.8)
$\Delta \ln SS$	1.0586	.9892	1.0297	1.0966	.6134	1.1489
	(3.8)	(3.6)	(2.7)	(4.0)	(1.1)	(4.0)
π^{o}_{t-1}	0.6108		0.3979	0.4413	−.1410	0.7860
	(3.9)		(2.7)	(2.2)	(0.4)	(2.3)
π^{x}		.8191	0.5796		.6820	−0.2700
		(4.2)	(2.7)		(1.7)	(0.7)
$(\bar{\sigma}^{o})^2$				0.1648		
				(1.3)		
$\bar{R}^2$	0.4141	0.4272	0.4633	0.4207	0.1835	0.4594
SE	0.00390	0.00385	0.00373	0.00387	0.00371	0.00343
DW	1.66	1.88	1.91	1.75	1.91	2.30
Average absolute residuals						
1966II–1971II	.00264	.00282	.00253			
1971III–1973II	.00330	.00334	.00341			

NOTE: Variables are defined in text and in note to Table 7.

TABLE 9 Wage Equations: Productivity Model (figures in parentheses are t statistics)

	1955I–1973II			1955I–1964IV	1965I–1973II
	(1)	(2)	(3)	(4)	(5)
Constant	0.0086	.0082	0.0072	.0062	0.0123
	(8.5)	(7.1)	(6.4)	(2.8)	(3.4)
$\ln QT$	0.1073	.0972	0.1043	.1243	0.0662
	(4.5)	(4.0)	(4.6)	(2.2)	(0.1)
DG	−0.0036	−.0007	−0.0021	−.0010	−0.0056
	(3.5)	(0.6)	(1.8)	(0.5)	(2.8)
$\Delta \ln SS$	1.0004	.9751	1.0074	.9266	1.1521
	(3.9)	(3.7)	(4.1)	(1.7)	(3.9)
π^{0}_{t-1}	0.7317		0.5056	.6200	0.7637
	(5.7)		(3.2)	(1.1)	(2.5)
π^{x}		.7635	0.4137	.5136	−0.3649
		(5.1)	(2.3)	(2.0)	(0.8)
$\bar{R}^2$	.4923	.4588	.5231	.2035	.4693
SE	.00363	.00374	.00351	.00367	.00340
DW	1.80	1.90	1.99	1.81	2.39
Average absolute residuals					
1966I–1971II	.00270	.00294	.00269		
1971III–1973II	.00250	.00284	.00286		

NOTE: Variables are defined in text and in note to Table 7.

When the period of fit is divided into an early one of fairly stable prices and a later one of inflation, the coefficients of the price expectations variables change. In the early period π^X dominates and in the later one, π^O. The additional information contained in the survey measures of expected inflation is particularly important in the recent past. This can be seen by comparing the average absolute residuals of the different specifications for the Vietnam War and postfreeze periods shown in each table.

The above estimates all utilize π^O. The other survey measures of inflationary expectations series yield similar results. Virtually identical results are obtained with the Livingston series, π^L, in both specifications of the wage equation (π^L did not enter the price equation significantly). The wage equations do not provide a very good explanation of wage behavior in the period for which the SRC data provide direct point estimates. The direct series, π^S, does about as well as π^O in equations for the post-1966 period and both are clearly preferred to π^X.

Although the models of the wage formation process shown here may not be entirely satisfactory, the results for the inflationary expectations variables are very revealing. In both specifications of the wage equation, the extrapolative measure of expectations and the survey measure appear to provide virtually independent information about price expectations which is relevant to wage behavior. However, in the period of relative price stability, the extrapolative measure is an adequate proxy for actual expectations. In the later period it adds no information not included in the survey measure.

INTEREST RATES

The relationship between price expectations and the interest rate (R) has been widely studied, usually in the context of the Fisher equation: $R = \alpha + \beta \pi$. This approach has been justifiably criticized because no attempt is made to explain changes in the real interest rate due to either structural changes in the economy, which alter the real rate of return, or shifts in the supply and demand of particular financial assets. Nevertheless, I will use the Fisher equation to estimate the effect of expectations on short-term interest rates. Several investigators have extensively explored distributed lag proxies for expectations in the Fisher equation (e.g., Yohe and Karnosky 1969) and the Livingston survey measure of expected inflation (Gibson 1972 and Pyle 1972). Another look at the relationship between price expectations and interest rates is warranted because the possibility that the relationship might be more complex than indicated by the Fisher equation was not explored in the previous studies.

Comparisons of the various survey measures of expected inflation and an extrapolative measure[13] are shown in Table 10. Since financial markets respond quickly to changed conditions, expectations based on the current-quarter survey are used to explain current interest rates. To keep the discussion brief the only interest rate examined here is the commercial paper rate.

For the whole period the survey measure explains more of the variance of interest rates than does the extrapolative forecast.[14] However, it is interesting to note that the standard error (SE) is substantially reduced when both are included. The evidence here strongly suggests that there are two independent types of expectational information, one based on recent experience and one that reflects the forecasts and perceptions of the public. However, the equations that divide the sample period indicate that this is only the case in the post-1965 period. In the earlier period the survey measure dominates π^X completely.

The Livingston series is superior to the SRC series in interest rate determination but inferior in the price and wage equations. This is not surprising, as the expectations of professional forecasts may very well be more important in financial markets, while expectations of the public at large are relevant to overall price and wage determination. The SRC measure based on the respondents' direct estimates is here superior as well, although the difference in the standard errors is not large.

Earlier on in my discussion I suggested that the variance of expectations in survey responses may be a measure of the uncertainty with which expectations are held. This hypothesis is tested in the equation for interest rates, with interest rates taken as reflecting a premium for uncertainty. Another hypothesis is that the effect of inflationary expectations on the interest rate depends on the dispersion of expectations, that is: $\beta = \beta_1 + \beta_2 \bar{\sigma}^2$. Both these hypotheses were tested. For the entire period both can be accepted, although the coefficient on the variance (0.20) is very large. The interaction term suggested by the second hypothesis yields reasonable coefficients, but the effects are difficult to interpret. In the early period, the effect of expectations on interest rates declines with the variance of expectations while in the later period it increases. I will not attempt to justify this difference, but I conclude that the dis-

TABLE 10 Interest Rate Equations (figures in parentheses are t statistics)

Constant	π^O	π^X	$(\bar{\sigma}^O)^2$	$\pi^O(\bar{\sigma}^O)^2$	$\bar{R}^2$	SE	DW
			1955I–1973II				
1.69	1.02				.6110	1.02	.94
(5.9)	(10.8)						
2.76		0.71			.5275	1.12	.27
(11.9)		(9.1)					
1.56	0.71	0.40			.7228	0.86	.86
(6.4)	(7.2)	(5.5)					
1.15	0.80		0.20		.6601	0.95	.97
(7.3)	(7.3)		(3.4)				
2.12	0.43			0.07	.7031	0.89	.80
(8.0)	(2.9)			(4.8)			
2.46	0.86[a]				.7169	0.87	.40
(13.7)	(13.6)						
			1955I–1964IV				
1.87	0.76				.5602	0.47	.58
(8.5)	(7.1)						
1.86	0.76	0.01			.5484	0.48	.58
(7.9)	(7.0)	(0.1)					
2.01	0.97			−0.06	.5986	0.45	.68
(9.2)	(6.9)			(2.2)			
2.18	1.07[a]				.3423	0.57	.65
(8.2)	(4.6)						
			1965I–1973II				
3.84	0.54				.1596	1.22	.63
(4.9)	(2.7)						
2.60	0.39	0.49			.4213	1.02	.70
(3.6)	(2.3)	(3.9)					
4.41	−0.19			0.08	.4754	0.97	.53
(7.0)	(0.8)			(4.5)			
3.22	0.68[a]				.2967	1.12	.34
(4.5)	(3.9)						
			1966II–1973II				
4.45	0.42				.0849	1.25	.57
(5.0)	(1.9)						
1.97	1.29[b]				.1662	1.19	.69
(1.2)	(2.6)						

NOTE: Variables are defined in text and in note to Table 7.
[a] Variable is π^L.
[b] Variable is π^S.

tribution of expectations does affect interest rates. This relationship clearly merits further study.

CONCLUSION

Several conclusions are suggested by the wide-ranging and somewhat casual examination of survey measures of expected inflation presented here:

1. The recent inflationary experience has clearly established the necessity for better measurement of inflationary expectations. The measures available provide information about expectations that cannot be generated by the expectational hypotheses used in many econometric studies.
2. Survey measures of expectations are not necessarily a substitute for measures based on past experience, but do provide important supplementary information.
3. The dispersion of expectations varies greatly and is probably an important determinant of aggregate behavior.
4. Future work will have to include an examination of the determinants of the apparent variation in adjustments to inflationary experience.

NOTES

1. This has been forcefully stated by Gordon (1972). He points out that after World War II, expectations were based on the previous postwar deflationary experience (1919–1920), rather than the most recent experience.
2. None of the authors presented the data and there are, in fact, alternative versions. A full examination of the data is currently under way by John Carlson of Purdue University, whose comments have helped me avoid some serious errors in this section.
3. The data have been collected from a representative national sample that has included up to 3,500 respondents and has recently included about 1,500.
4. Carlson and Ryder (1973) are critical of this procedure for two important reasons: (a) sampling variation in the survey responses can have a relatively large effect on the estimated expected rate of inflation and (b) the assumption of constant bounds for the remain-the-same category can lead to some peculiar implications. For example, if more than half the responses are that prices will go up, a shift in responses from remain-the-same to prices-will-go-down will *increase* the mean of the distribution because the variance of the distribution must increase to allow for the smaller percentage in the remain-the-same category, which has fixed boundaries. The increased dispersion shifts the mean *upward in this case*.

5. As noted earlier, the scaling of π^N is determined by the choice of the bounds of the remain-the-same category. The value chosen (1.25) makes the average value of π^N for all the surveys, 1946–1973, somewhat smaller than the average value of actual inflation in Table 3. They would be equal if the bounds were 1.70 (1.50 if the sample ends in 1972).
6. As noted earlier, the scaling of both π^L and π^0 is somewhat arbitrary. The scaling chosen does, of course, determine the size of the slope coefficients and whether the rationality hypothesis is accepted.
7. This section draws heavily on a New York University dissertation in process by Meir Sokoler of the University of Connecticut, who estimated the equations.
8. For a discussion of these issues see Wachtel (1974).
9. Unlike the other two, it is not often discussed in consumer theory although it can easily fit into a theoretical framework. Katona (1960) suggested uncertainty effects based on consumer psychology and Juster and Wachtel offer some crude empirical support. Sandmo (1970) provides a theoretical model of the effect of uncertainty on consumption.
10. The variance of the distribution of expectations across individuals may decrease with the rate of inflation. Individuals will increase their information-gathering activities, and this may mean that they become aware of, and adopt as their own, some consensus forecast.
11. I am grateful to the discussant, George de Menil, for pointing out an error in this discussion as it appeared in the conference paper.
12. In all these single-equation models, the simultaneity inherent in the relationships is overlooked.
13. The extrapolative measure of expectations used in this section is based on the consumer price index (CPI); it is defined as: $\pi^X = 0.4\ RCPI(t-1) + 0.3\ RCPI(t-2) + 0.2\ RCPI(t-3) + 0.1\ RCPI(t-4)$, where $RCPI = [CPI - CPI(t-4)]/CPI(t-4)$.
14. An Almon lag on the price change can be chosen that will increase R^2. The simple extrapolative forecast is used throughout for simplicity.

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COMMENTS

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In this paper, Paul Wachtel presents some evidence regarding the usefulness of survey measures of inflationary expectations. It has long been the accepted view in the economics profession that such measures are largely useless because respondents do not reveal their true attitudes on the questionnaires. This is an empirical question. The validity of any particular measure should be judged on its significance as an explanatory variable in an equation or equations explaining actual behavior. The verdict should *not* be based on anecdotal evidence. Interviewers all have their own stories to tell about the crazy answers people give them, but these are no substitute for good statistical analysis. Wachtel's paper contributes to a small but growing body of evidence suggesting that survey measures of inflationary expectations are a unique and valuable data source.

Wachtel's paper falls into two parts. The first two sections contain a presentation of several existing survey measures of inflationary expectations and a discussion of their characteristics. The remainder of the paper consists of four separate studies of the influence of expectations on consumption, prices, wages, and interest rates.

Two things happen when data is obtained on a variable for which previously there had been no data. First, it is learned that the variable does not behave quite the way it was thought to. Second, the new data open up new directions for research and so make it possible to raise and answer new questions. The four studies in the second part of Wachtel's paper are a good indication of the kind of questions to which survey data on inflationary expectations may provide some answers.

PRESENTATION OF SURVEY MEASURES AND THEIR CHARACTERISTICS

The Data

Wachtel presents five different measures derived from three different data bases. However, he does not do anything with one of the data bases (the ASA-NBER sample of business forecasters) because he judges that it has been available for too short a time period, and therefore I will not talk about it either. This leaves us with the Livingston series and three different series constructed from the Michigan SRC questionnaire. I have nothing to add to his description of the two data sources and will therefore move directly to a discussion of methodological problems associated with their use.

A general caveat is in order for anyone looking at distributions of point-estimate forecasts by individuals. It is that there is a tendency for the responses to cluster around integer values, and this may completely distort the distribution. Wachtel's failure to allow for this phenomenon accounts for the randomness of the skewness and kurtosis measures which he estimates for the Livingston data in Table 1. In a recent paper,[1] John Carlson performs very careful tests of the shape of the distribution of responses to Livingston's questionnaire in which he allows for this tendency to cluster. He finds no evidence of skewness and only mild evidence of kurtosis. He shows that the adjusted distribution fits the normal curve reasonably well, and a t distribution with a small number of degrees of freedom has an even better fit.

The subject of the shape of the distribution of responses brings us to the question of the proper method for interpreting the SRC questionnaire. An economist trying to use the answers to the two SRC questions reported in Wachtel's paper (in the section "Survey Research Center Data") is not automatically provided with a measure of the average expected rate of inflation, or any other moment of the distribution for that matter. He must infer that statistic more or less indirectly from the responses before him. The best way to do that is a matter of some importance. Wachtel, rightly I believe, appears in his paper to look with disfavor upon a procedure which both he and I have at one time used. The rejected method involves assigning values to the interval and end points in the second question asked and computing directly an average for the period from 1966II to the present and then linking that figure in some way to an index of the difference between the percentage of respondents who expect an upturn and the percentage who expect a downturn from the earlier period. There are several good reasons to reject this method. One is that this index does not fully use all the information available for the earlier period. It takes almost no account of variations in the percentage who expect no change. Another reason is the difficulty of appropriately linking two such different series. A third reason to reject the method is that, in my opinion, individuals do not adequately understand the second question. It is a complicated one. There is some evidence of inconsistency in individual answers to this question and two others in the 1970 SRC survey.[2]

The general approach, which Wachtel does appear to favor (and I agree with him), is to discard answers from the second question and to infer the mean and variance of the distribution of expected rates of inflation solely from answers to the first question.

The procedure is well explained in the paper in the section on the SRC data. Suffice it to say that an assumption is made about the shape of the underlying distribution and that this assumption makes it possible to infer the desired moments from the responses in percentages.

The choice of the proper assumption regarding the shape of the underlying distribution is an important one, and unfortunately we have little information to guide us in doing so. For lack of anything better, several people who have worked with these data have assumed normality. Carlson, as mentioned above, offers some support for this procedure and raises serious questions about Wachtel's preference for a log-normal distribution with the floor arbitrarily set at −100 percent. One would like to see more evidence to support Wachtel's claim that the two measures are in fact very similar. The results reported in the second part of the paper are based on the log-normal measure.

It is important for users of measures of this kind to be aware of an associated statistical problem, which is present under either the normality or the log-normal assumption. The problem is very thoroughly discussed in an unpublished paper by Carlson and Ryder.[3] The problem is one of measurement error. Briefly, the transformation from percentage responses to the mean of the distribution is nonlinear, and it tends to magnify very significantly the measurement error in the raw percentages whenever, as is often the case in periods of rapid inflation, the sum of the percentage who expect no change and the percentage who expect a downturn falls below roughly 10 percent. The problem is an awkward one because the variance of the resulting measurement error is not constant. A maximum likelihood technique for estimating relations in which a measure such as π^O or π^N is an explanatory variable has been developed by Yohn.[4] In principle, the equation estimates presented in the second part of Wachtel's paper suffer from neglect of this measurement error problem. In my judgment, however, on the basis of some experimentation by Yohn, this is not likely to change Wachtel's results qualitatively.

Comparison of Different Measures

Wachtel does not provide much systematic comparison of the different series, but the material he presents does throw light on two interesting questions.

The first concerns differences between the Livingston series and the two principal SRC series. (Because Wachtel asserts that the normal and log-normal SRC series do not differ much, I shall not distinguish between them and shall use the term "SRC series" to refer to either one.) It is clear from looking at Wachtel's figures 1 and 3 that the two series are quite different. All kinds of interesting conjectures are suggested by close examination of the two graphs, but Wachtel does not pursue them systematically.

The second question concerns the bias of forecasts or rationality in Muth's sense. This is an important question because of its implications for the Phillips trade-off and because of other implications—as evidenced by a recent spate of theoretical papers on the subject.[5] In Table 4 Wachtel presents results of the Theil test of unbiasness for different series and different time periods. He finds that with the exception of one or two regressions running from the mid-1950s through the early 1970s the series are not rational. However, I feel that his results are marred by a mechanical and unfortunate choice of sample periods. He starts his sample period in several cases in 1948I. For technical reasons which have to do with dramatic changes in the percentage of nonresponses at the end of the Korean War, I have grave misgivings about applying the same construction procedure to the SRC data before and after the Korean War. Moreover, his sample frequently extends through phases I, II, and III. It is true that perfect rationality would in principle include rationality in forecasting the effect of the controls. But I think it is mechanistic and unrealistic to stretch the hypothesis that far, and would have favored stopping the sample period in 1971II. For the period from the end of the Korean War through the Vietnam War, Wachtel does find (as I have also[6]) that the SRC series is very close to unbiased.

INDIVIDUAL STUDIES OF THE EFFECTS OF INFLATIONARY EXPECTATIONS

The more interesting part of Wachtel's paper is the second, which contains the four ministudies of the effect of inflationary expectations on consumption, prices, wages, and interest rates.

Interest Rates

Wachtel extends the results of Gibson and Pyle on the Fisher equation in an original and interesting way, finding among other things that *both* directly measured inflationary expectations *and* a distributed lag of changes in past price together contribute to explaining the commercial paper rate.

Wages

The subject of the effect of inflationary expectations on wage changes has been a controversial one in the Phillips-curve literature ever since Phillips wrote his original paper.

Wachtel constructs two simple but robust wage equations. One is of the Phillips variety; the other he terms a productivity equation. He then examines the effect of inflationary expectations in each one.

He finds again that *both* the SRC series *and* an Almon-type distributed lag contribute significantly to explaining wage changes in both models. When the two measures are introduced together, the sum of their coefficients appears to be insignificantly different from 1.0. Unfortunately, this result is probably sensitive again to what I consider an unfortunate extension of the sample period right through the control period. The very different significance of the distributed lag and the survey measure when the sample is split in 1965I is not adequately explained.

Prices

In an original manner, Wachtel introduces the expected rate of general price change into a markup model of prices given wages. The notion simply is that the target price is a function of unit cost (somehow defined) *and* the expected future general price level. The idea is interesting, and the results are statistically significant, but I find the parameter estimates puzzling. The speed of adjustment doubles, and the estimated trend rate of productivity growth drops from 2.8 percent a year to 0.7 percent. More work on this promising idea is called for.

Consumption

Of the four questions studied by Wachtel, the effect of expected inflation on consumption is the one that has been studied the longest in the literature, and in the light of recent research, I believe it is the most perplexing. Wachtel reports on the work of Meir Sokoler, a thesis student at NYU. Sokoler departs from the earlier work of Juster and Wachtel on the related issue of savings functions and instead takes the Branson and Klevorick money-illusion consumption function as a point of departure. There follows a very convenient and useful separation of the effects of the price level on real consumption into a level or money illusion effect, a substitution effect, and an uncertainty effect—a division long championed by George Katona and his associates.

Where I part company is that π, which in the other studies is used as what it is, a measure of the expected rate of inflation, here is used as a proxy for uncertainty regarding future real income. I think we have to be consistent across equations for the same agents (households in this case). π cannot be a mean forecast in the wage equation and a measure of uncertainty in the consumption function.

CONCLUSION

In summary the four studies support the view that much is to be learned by using direct measures of inflationary expectations—in fact, employing different survey measures for different agents—in explaining actual behavior.

I would like to end with the old story of the drunk and the lamp post. The drunk has been alternately praised and maligned for looking for his lost key solely under the lamp post. I would like to propose another strategy—to turn on more light. And the new source of light I would like to see is additional direct survey measures of economic expectations.

NOTES

1. J. A. Carlson, "Are Price Expectations Normally Distributed?" *Journal of the American Statistical Association,* December 1975.
2. Cf. the appendix of G. de Menil, "The Rationality of Popular Price Expectations," mimeographed (Paris: INSEE, March 1975).
3. J. Carlson and H. Ryder, "Quantitative Expectations from Qualitative Surveys: A Maximum-Likelihood Approach," mimeographed, Purdue University, October 1973.
4. F. Yohn, "A Maximum-Likelihood Technique for Estimation in the Face of

Measurement Error with Nonconstant Variance," mimeographed, Princeton University, May 1975.

5. See the review of this literature in R. J. Shiller, "Rational Expectations and the Dynamic Structure of Macroeconomic Models, A Critical Review" (paper presented to the Conference on the Monetary Mechanism in Open Economics, Helsinki, Finland, August 4–9, 1975).
6. de Menil, "Popular Price Expectations."