CONSUMERS' SUNSPOTS, ANIMAL SPIRITS AND ECONOMIC FLUCTUATIONS*

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November 1998

Abstract

Multiple-equilibria macroeconomic models suggest that consumers' and investors' perceptions about the state of the economy may be an important independent factor for business cycles. In this paper, we verify empirically the interrelations between waves of optimism and pessimism and subsequent economic fluctuations. We focus on the nonlinear behavior of non-fundamental movements in consumer sentiment, as a proxy for consumer's sunspots, and in business formation, representing animal spirits, around economic turning points. We find that bearish consumers and entrepreneurs are present before the onset of some U.S. economic downturns, even when the fundamentals are all very strong. In particular, our analysis suggests that waves of pessimism may have played a nontrivial role for the 1969-70 recession and slowdown, the 1981-82 recession and the 1984-87 slowdown. The results are robust to a range of alternative linear and nonlinear specifications. Our evidence provides empirical support for the role of sunspots in multiple-equilibria macroeconomic models.

KEY WORDS: Multiple Equilibria, Animal Spirits, Economic Fluctuations, Sunspots, Markov Switching.

JEL Classification Code: C32 , E32

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* We thank Jess Benhabib, Dean Corbae, Russell Cooper, Randall Wright, and other participants in the 1998 NBER Summer Institute for helpful comments. The authors bear full responsibility for any errors.

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1. INTRODUCTION

Recently, there has been growing interest in dynamic general equilibrium models that exhibit indeterminacy and a continuum of stationary rational expectations equilibria.[1] In contrast to standard frameworks with a unique equilibrium, these models provide a theoretical justification of how shocks to agents' self-fulfilling beliefs can be an independent source of business cycle fluctuations.[2] However, most of the research in this area is theoretical or quantitative in nature, hence leaves empirical relevance of sunspots largely unexplored. This paper attempts to fill this gap by studying empirically the nonlinear characteristics of animal spirits for the post-Korean War period in the U.S. economy. Specifically, we examine the interrelations between waves of optimism and pessimism and subsequent economic fluctuations around turning points.

The basic intuition for indeterminacy and sunspot equilibria to occur in this class of models can be understood as a coordination problem. Consider starting with a specific equilibrium trajectory of consumption or investment, and inquire whether a faster rate of accumulation can also be justified as an equilibrium. Suppose that a subset of agents becomes optimistic about the rate of return of an asset and decide to increase their investment in it. If there exist strategic complementarities in the economy, then it is in the other agents' best interest to invest more in that asset as well (see Cooper and John, 1988).[3] As a result, agents' expectations of a higher rate of return are validated, which in turn causes an investment spurt without any change in economic fundamentals. We can repeat this argument to construct infinitely many equilibrium paths and, therefore, the original equilibrium is said to be indeterminate. Moreover, it is well known that there are many other mechanisms that can generate multiple equilibria in dynamic general equilibrium models, such as strong income effects, incomplete market participation, external increasing returns and monopolistic competition, among others.

In this paper, we take an agnostic view on the exact channel through which agents' beliefs may affect economic activity. Instead, our focus is on the fact that expectations are self-fulfilling

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[1] Notable examples within the overlapping generations paradigm include Azariadis (1981), Cass and Shell (1983) and Farmer and Woodford (1997), among many others. For the real business cycle model with multiple equilibria, see Benhabib and Farmer (1994), Farmer and Guo (1994) or a recent survey by Benhabib and Farmer (1998).

[2] In this paper, we will use the terms "animal spirits", "sunspots", "self-fulfilling beliefs" and "waves of optimism and pessimism" interchangeably. All of them refer to disturbances to expectations that are not related to uncertainties about economic fundamentals such as technology, preferences and endowments.

[3] The term "strategic complementarity" means that one agent's optimal action is positively correlated with the actions of others.

in these 'sunspot' models.[4] We begin our analysis by dividing agents' expectations into two components, one for consumers and another for investors. To measure consumer expectations, we use the University of Michigan Index of Consumer Sentiment, which is constructed based on consumers' responses to survey questions regarding current and expected economic conditions. Figure 1 plots this index against NBER-dated recessions and slowdowns between 1954:2 and 1994:4.[5] Notice that all recessions and many slowdowns are preceded by a decrease in consumer sentiment. On the other hand, we use the index of net business formation to measure investor expectations. Figure 2 illustrates that falling business formation precedes declines in gross fixed investment in almost every economic downturn over the sample period.[6] These two figures thus suggest that changes in consumer and investor confidence may serve as good predictors of subsequent business and growth cycle turning points.

The objective of this paper is to examine whether movements in non-fundamentals are present around turning points of NBER-dated recessions and slowdowns. Thus, we need to extract non-fundamental idiosyncratic variations in consumer and investor expectations. One way to formalize this is to estimate an unrestricted vector autoregression (VAR) including variables that reflect comprehensive information on fundamentals. Some candidates are, for example, GDP, stock returns, interest rates, indices of consumer sentiment and business formation, and leading economic indicators such as manufacturers' new orders, housing permits, among others. Without imposing any particular theoretical restriction on these variables, the VAR will capture the dynamic correlations underlying the data. This yields a model that explains much of the movements in the system variables with no discernible serial correlation remaining in the estimated residuals. Hence, innovations to the VAR equations of consumer sentiment and business formation provide good approximations to consumers' sunspots and investors' animal spirits, respectively.

There have been several studies that also investigate the empirical contribution of waves of optimism and pessimism to the business cycle (see Leeper, 1992; Fuhrer, 1993; Matsusaka and

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[4] Imrohoroglu (1993), Dagsvik and Jovanovic (1994), Farmer and Guo (1995) and Farmer and Ohanian (1998) take a different approach. Each paper presents parameter estimates based on a particular theoretical model and investigates the empirical plausibility of multiple equilibria.

[5] The dotted bars and shaded areas in this and all remaining figures correspond to a dummy variable that takes the value of zero for expansions and high growth phases, as dated by the NBER.

[6] It is straightforward to show that Granger causality exists from business formation to gross fixed investment.

Sbordone, 1995). As in this paper, these authors use VAR to obtain the observable counterpart to the non-fundamental disturbances that impact on the economy.[7] However, our analysis differs from theirs in two important respects. First, these studies analyze solely the effects of consumer sentiment whereas this paper looks further into investor expectations. Second, previous literature has concentrated on whether consumer sentiment innovation is a good *linear* forecaster of output fluctuations. Our focus instead is on exploring the nonlinear relationship between movements in non-fundamentals and economic activity around turning points. That is, we are not interested in checking the predictive performance of consumers' and investors' confidence in linear forecasting the level of output, but instead whether they give early signals of business and growth cycle turning points.

In our framework, if the VAR residuals do not exhibit distinct patterns over different stages of the business cycle, then this indicates that agents' self-fulfilling beliefs do not matter in predicting economic activity around turning points. However, it turns out that both innovations on consumer sentiment and business formation display higher volatility during NBER-dated recessions and slowdowns. This reflects times of great uncertainty inherent to economic downturns. In fact, we find that times of high volatility are associated with falls in consumer confidence, fewer new businesses formed and more existing ones dissolved, even after controlling for economic fundamentals.

In order to explore this feature more formally, we fit Hamilton's (1989) Markov switching model individually on the consumer sentiment and business formation innovations. The conditional variance of each innovation is modeled as a first-order two-state Markov variable that represents consumers' or investors' perceptions about the state of the economy, either pessimistic or optimistic. We find that the two Markov states for both innovations are statistically significant. In particular, the 'bad' state shows high volatility and a shorter average duration, reflecting the large uncertainty and agents' pessimism associated with recessions and economic slowdowns. By contrast, the 'good' state is characterized by low volatility and a longer average duration. This corresponds to periods of relative calmness and agents' optimism during economic expansions. More importantly, the estimated probabilities of the Markov states can be used to analyze cyclical

[7] Oh and Waldman (1990) use revisions of the Conference Board's index of leading indicators to measure expectational shocks. They find that these revisions have incremental linear predictive power of the fluctuations in industrial production.

variations in the consumer sentiment and business formation innovations around NBER-dated recession and slowdown turning points.

Our analysis shows that the peak probabilities of the bad state from the consumer sentiment innovation precede the 1973-74 and 1981-82 recessions, and the 1984-87 slowdown. We also find that the peak probabilities of pessimism from the business formation innovation are distinct from those of consumers. Specifically, these probabilities precede the 1969-70 recession and slowdown and the 1984-87 slowdown. A careful examination of the behavior of several economic fundamentals before these economic fluctuations suggests that shocks to investors' and consumers' expectations may have played an important independent role in the 1969-70 recession and slowdown, the 1981-82 recession, and the 1984-87 slowdown.

To check the robustness of this evidence, we estimate a number of vector autoregressions with alternative linear and nonlinear specifications and using various additional variables capturing fundamental information. We find that even after incorporating many good predictors of output into the VAR, innovations to consumer sentiment and business formation continue to show the same cyclical patterns that are observed from the baseline model. In particular, the turning points analysis of recessions and slowdowns is not affected by inclusion of different economic fundamentals or by estimating a nonlinear specification. Thus, these results provide some empirical support for the class of macroeconomic models with multiple equilibria whereby consumers' sunspots and investors' animal spirits have important independent influence on aggregate fluctuations.

The remainder of this paper is organized as follows. Section 2 describes the econometric model and estimation procedure. Section 3 presents the empirical results and robustness analysis is conducted in section 4. Section 5 concludes.

2. EMPIRICAL PROCEDURE

Our approach starts with a set of economic variables that might reflect fundamentals and information about the state of the economy, such as output (GDP), interest rates (3-month T-Bill rate), business formation, and consumer sentiment, using quarterly data from 1954:2 to 1994:4. Consumers and investors' confidence about present and future economic conditions are measured using, respectively, the Index of Consumer Sentiment from the Survey Research Center at the

University of Michigan (C), and the index of net business formation (B).[8] These variables are modeled as a system of unrestricted autoregressive equations:

$$(1) \qquad \begin{vmatrix} Y_t \\ r_t \\ B_t \\ C_t \end{vmatrix} = \begin{vmatrix} c_{yt} \\ c_{rt} \\ c_{bt} \\ c_{ct} \end{vmatrix} \begin{vmatrix} a_{yy}(L) & a_{yr}(L) & a_{yb}(L) & a_{yc}(L) \\ a_{ry}(L) & a_{rr}(L) & a_{rb}(L) & a_{rc}(L) \\ a_{by}(L) & a_{br}(L) & a_{bb}(L) & a_{bc}(L) \\ a_{cy}(L) & a_{cr}(L) & a_{cb}(L) & a_{cc}(L) \end{vmatrix} \begin{vmatrix} Y_t \\ r_t \\ B_t \\ C_t \end{vmatrix} + \begin{vmatrix} e_{yt} \\ e_{rt} \\ e_{bt} \\ e_{ct} \end{vmatrix}$$

where Y_t is GDP, r_t is the 3-month T-Bill rate, B_t, is the index of business formation, C_t is the index of Consumer Sentiment, c_{it} are constant terms and $a_{ij}(L)$ are lag polynomials for the i^{th} variable and j^{th} equation. If the model is well specified, ε_{yt}, ε_{rt}, ε_{bt}, and ε_{ct} are serially uncorrelated error terms. We find that four lags for the parameters yield the best fit and the errors are an adequate approximation for idiosyncratic movements in the system variables.

In order to investigate whether non-fundamental movements anticipate and possibly cause economic downturns, we examine the idiosyncratic variations in the consumer sentiment and business formation indexes, ε_{bt}, and ε_{ct}. Previous literature has studied the performance of consumer sentiment in linear forecasts of output or the possible direction of causation of their innovations, using linear VARs. Our focus instead is on the relationship between innovations and the economic activity around turning points. That is, we are not interested in checking whether consumers and investors' confidence are good linear forecast of output, but instead whether they give early or coincident signals of business and growth cycle turning points. This analysis might shed light in the role of sunspots as a source of cyclical downturns.[9]

Figures 3 and 4 plot, respectively, sentiment innovations and business formation innovations against NBER-dated recessions and slowdowns. The economic fluctuations pattern underlying these innovations is remarkable. Sentiment innovations generally fall right before or at the beginning of economic slowdowns and recessions, although during the latter the decreases are more abrupt. A more careful look into the data reveals that during economic recessions and slowdowns, idiosyncratic variation in consumer sentiment is highly volatile. This same feature is also found in the business formation innovation, with periods of high volatility during recessions

[8] The data was obtained from the 1995 release of the DRI Basic Economic Database. The variables are transformed to appear stationary. A Dickey-Fuller test (1979) was not able to reject the null hypothesis of unit roots against the alternative of stationarity at the 1% level for consumer sentiment, and at the 10% level for GDP, business formation and interest rates. Thus, we use the first differences of these variables.

and slowdowns and steep falls during recessions.

The period of high volatility in the innovations reflects times of great uncertainty inherent to economic downturns. As seen in Figure 1, consumer confidence itself experiences decreases during slowdowns and recessions. In fact, periods of high volatility in the innovations are associated with periods of falls in consumer confidence (pessimism), while periods of lower volatility are associated with increases in consumer confidence (optimism) during expansions. Figure 2 shows that net business formation falls also correspond to economic downturns, reflecting entrepreneurs' pessimism about the state of the economy. That is, when there is a great deal of uncertainty, fewer new businesses are formed and existent ones are dissolved. We focus our analysis in the relationship between waves of optimism and pessimism not based on the fundamentals, as measured by the innovations, around turning points of the economic activity.[10]

In order to explore this pattern more formally, univariate Markov switching models are individually fitted on the consumer sentiment and business formation' innovations. Their conditional variances are modeled as functions of a first-order two-state Markov variable S_t, which represents consumers and investors' perceptions about the state of economic conditions, either pessimistic or optimistic:

Model 1:

$$\varepsilon_{ct} = \alpha_c + h_{cS_t} \qquad h_{cS_t} \sim \text{i.i.d. } N(0, s^2_{hcS_t}), \qquad S_t = 0,1 \tag{2}$$

Model 2:

$$\varepsilon_{bt} = \alpha_b + h_{bS_t} \qquad h_{bS_t} \sim \text{i.i.d. } N(0, s^2_{hbS_t}), \qquad S_t = 0,1 \tag{3}$$

where $s^2_{hcS_t}$ and $s^2_{hbS_t}$ are the state dependent conditional volatility of the consumer sentiment innovations (consumers' sunspots), and the business formation innovations (animal spirits), respectively, and α_c and α_b are their constant terms.[11] The volatility of these sunspots indicators may switch between states, according to the transition probabilities of the Markov process, p_{ij} =

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[9] Note that a good predictive performance of sentiment or business formation in linear forecasting the level of output does not necessarily have any implication for the nonlinear prediction of turning points.

[10] We check if this cyclical economic patterns in the innovations are robust across different model specifications (linear and nonlinear) and using several additional variables. As will be discussed in Section 4, we find that the innovation terms across different specifications are very correlated with each other and present the same economic features.

[11] In the empirical part, we find that the constant terms are not significantly different from zero, which is expected given that the VAR innovations are constructed as zero mean series. Omitting the constant term does not change the other estimated parameters and the difference in the log likelihood functions is negligible.

Prob[S_t=j|S_{t-1}=i], $\sum_{j=0}^{1} p_{ij} = 1,\ i = 0,1$. That is, consumers and investors can either be pessimistic (S_t=0) or optimistic (S_t=1) about the state of the economy.[12]

The model is a nonlinear combination of discrete and continuous dynamics. For model 1, for example, the parameters are: (α_c, s^2_{hc0}, s^2_{hc1}, p_{00}, p_{11}). A positive characteristic of the model is that no prior information is imposed with respect to the cyclical patterns (dates) of the two volatilities. Hamilton's (1989) nonlinear filter allows estimation of the conditional probabilities associated with the latent Markov state. The conditional likelihood of the variable ε_{ct} is evaluated as a by-product of the algorithm at each t, which can be maximized with respect to the model parameters using a nonlinear optimization algorithm. Inferences about the filtered probabilities are then obtained from the maximum likelihood estimated parameters. The estimation procedure and derivation of the likelihood function is described in Hamilton (1989).

3. EMPIRICAL RESULTS

The empirical analysis is divided in three parts. First, we estimate vector autoregressive equations using the consumer sentiment index, the business formation index, GDP, and other variables that reflect economic fundamentals. In the second part, we explore potential cyclical economic patterns in the VAR innovations by allowing their variance to switch regimes following a two-state Markov process. We use the estimated filtered probabilities to study cyclical variations in the innovations, with particular focus on the onset of economic recessions and slowdowns. In the third part we check whether the results are robust across different VAR specifications and to the inclusion of additional variables.

The maximum log likelihood estimates of the Markov switching models are shown in Table 1. For both the consumer sentiment and business formation innovations, the two Markov states are statistically significant: state 0 exhibits high volatility and a shorter average duration,

[12] We also estimate a model in which the volatility of both innovations switch synchronously as a function of one Markov state process. We find that the resulting probabilities strongly resemble the probabilities obtained from the univariate Markov switching on the consumer sentiment innovations. The univariate analysis, which allows the possibility of non-synchronous switches for the volatility of the innovations, provides more insight in the analysis of the idiosyncratic factors that may lead to waves of pessimism among consumers and entrepreneurs.

and state 1 has low volatility and a longer average duration.[13] These results confirm our earlier speculation that the high volatility state reflects the great uncertainty and pessimism associated with periods of slowdowns and recessions, while the low volatility one corresponds to the optimism and relative calmness of economic expansions.

The analysis will be focused on the probabilities of pessimistic state around economic turning points. We are interested in studying not only recessions and expansions as dated by the NBER, but also periods of low and high growth in output. The interrelation between trends and economic cyclical fluctuations may shed light on the analysis of the role of sunspots and fundamentals in business and growth cycles. As for the business cycle reference chronology, the NBER also dates growth cycles using the same procedures and variables. While business cycle dates are decided based on a consensus about turning points of some coincident economic variables in levels, growth cycle dates are obtained from the concurrence of cyclical variations in the deviations from long-term trend of these same coincident series.[14]

In our sample data, there are 9 slowdowns and 7 recessions. The analysis of both economic slowdowns and contractions should encompass all phases in which the economy exhibits "weak" fundamentals. Empirical observation indicates that slowdowns are generally more frequent and precede contractions. Sometimes the economy enters in a low-growth phase, but no recession follows, as in 1951-52, 1962-64, 1966-67, and 1984-86. However, with the exception of the 1981-82 recession, each of the other six recessions was preceded by a phase of low-growth. As discussed below, it turns out that we find interesting correlations between waves of pessimism from consumers and entrepreneurs and the unusual 1981 recession.

[13] We also estimate a model in which the constant term also switches regimes, but we find that the two-state constant terms were not statistically significant. In fact, this is not only true for the innovations but also for the consumer sentiment and business formation series.

[14] The NBER Business Cycle Committee dates recessions based on coincident variables as manufacturer's and trade sales, personal income, industrial production, and employment, among others. Chauvet (1998), using a switching dynamic factor obtain dates for the U.S. business cycle, which are highly correlated with the ex-post NBER dating. Thus, even though the dating decisions by the NBER are made with long delays, information about peaks and troughs can be captured in the data in a more timely basis, as in Chauvet.

The estimated probabilities from the Markov switching model can be used as filtering rules to analyze the role of the innovations, which may be interpreted as consumers' sunspots and animal spirits around economic turning points.[15] In particular, we can argue that:

a. If the peak of the probabilities of pessimism lags or coincides with the onset of a recession or slowdown, it is possible that waves of pessimism may intensify or extend the economic downturn. However, they can not be an original cause since they do not anticipate it.

b. If the peak of the probabilities of pessimism precedes the recession or slowdown, there is a possibility that waves of pessimism are a source of the economic downturn as long as the fundamentals are strong. On the other hand, if pessimism is associated with weak fundamentals such as decreasing incomes, higher unemployment and reduced borrowing power, then pessimism may be a natural consequence and not an independent cause. A particular case is when the probabilities of pessimism increase during a slowdown that turns into a recession. In this case, pessimism may have triggered the subsequent recession.

Consumer Sentiment

Figure 5 plots the filtered probabilities of the pessimistic state for consumers against NBER-dated recessions and slowdowns. In the first half of the sample, the probabilities of pessimism increase only mildly during periods when slowdowns turned into economic recessions.[16] It seems that a general optimism prevailed in the 50s and 60s, and recessions did not cause so much uncertainty or pessimism among consumers. During the oil crisis in 1973 and thereafter, however, consumer sentiment was much more reactive to uncertainty about the future of the economy. In particular, some slowdowns and all recessions subsequently were associated with increased probabilities of the pessimistic state. Also, waves of pessimism prevailed for a while even after the end of the economic downturns.

[15] The frequency distribution of the estimated probabilities can be used to define turning points: a peak occurs if the probabilities are greater than their mean plus their standard deviation. This criterion is flexible across different probabilities since it is based on values above the average values intrinsic to their specific distribution. Also, since the estimated probabilities switch regimes abruptly with changes close to 0/1, turning point calls are not ambiguous.

[16] The consumer sentiment index has some few missing monthly observations in the 50s and in the 60s. However, for the quarterly data this does not change the dynamics of the series.

Tables 2 and 3 summarize the relationship between filtered probabilities of waves of consumers' pessimism with recession and slowdown turning points (peaks and highs). The probabilities of pessimism precede the 1973-74 and the 1981-82 recessions, are coincident with the 1990 recession and lag the 1980 recession (Table 2). With respect to low-growth phases, these probabilities lag the 1989-92 and 1978-80 slowdowns, are coincident with the 1973-75 slowdown, and precede the 1984-87 low-growth phase (Table 3). The interesting economic downturns seem to be the 1973-75 and the 1981 recessions, and the 1984-87 slowdown, which were preceded by an increase in the probabilities of pessimism three, four, and two months before their turning points, respectively. Since the 1984 slowdown was led by increases in both consumers' and entrepreneurs' pessimism, it will be discussed in the next section.

The 1973 Recession - This recession started in the last quarter of 1973, three quarters after the beginning of a low-growth phase associated with the increase in oil prices. The probabilities of pessimism increase in the beginning of the 1973 slowdown, and remain high during and after the subsequent recession in 1973-75. This may indicate that the unprecedent pessimism and uncertainty that consumers were facing during this low-growth period could have intensified and even caused the recession. As shown in Figure 6, consumption growth decreased significantly following the probabilities of pessimism. At the same time, personal income and employment growth were increasing and in fact were rebounding before the recession (Figure 7). The decrease in consumption growth cannot be attributed to falling income and high unemployment, but interest rates were at its highest level in the last 20 years (Figure 7). Thus, although waves of pessimism were presented before the 1973-75 recession, they do not seem to be an independent cause of it.

The 1981 Recession - This recession is the only one that occurred outside an economic slowdown, as discussed above. The previous three years were marked by a slowdown and a short subsequent recession. In fact, the 1978-80 slowdown culminate in a recession, which the NBER declared to have ended in the third quarter of 1980. The economy was then in a recovery pace, with a steep growth in personal income and employment. Interest rates, after reaching its highest level in the whole sample at the trough of the 1980 recession, were steadily and rapidly decreasing during 1981 (Figure 7). Even though the fundamentals were giving positive signals, consumers were still very uncertain about the economic recovery. Consumers confidence did not increase

during the economic recovery (Figure 1). Also, the probabilities of waves of pessimism based on non-fundamentals remain at high levels after the end of the 1980 recession (Figure 5). In this period, consumption growth followed closely the probabilities of pessimism - that is, an increase in the probabilities is associated with a subsequent decrease in consumption growth a couple of months later (Figure 6). The 1981 recession started just one year after the end of the 1980 recession.

The 1990 Recession - It is a popular belief, which was particularly spread by the press, that a fall in consumer confidence was the main cause of the 1990 recession. Fuhrer (1993), on the other hand, does not find any strong evidence supporting this argument. Our results confirms Fuhrer's. Consumer confidence fell during the slowdown, as observed in all the previous low-growth phases and recessions (Figure 1). However, we find that the probabilities of pessimism based on non-fundamentals increased only in July 1990, coinciding with the onset of this recession (Figure 5). The same is observed for personal income, manufacturer's trade and sales, and employment growth, while consumption and industrial production growth only decreased one quarter after the beginning of the recession. Even though interest rates were kept at low levels, investment growth was very low during the slowdown, and could have been a possible cause of the 1990 recession (Figure 8). Thus, consumers' pessimism does not seem to hold as a source of this recession, contrarily to popular beliefs, although they could have been a factor in intensifying and extending it. Officially, the recession ended in the first quarter of 1991, and the low-growth phase in the first quarter of 1992, but the probabilities of pessimism remain high until mid 1994 (Figure 5).

Business Formation

Figure 9 shows the filtered probabilities of pessimistic state for business formation innovation against NBER-dated recessions and slowdowns. The probabilities of pessimism for entrepreneurs, which can be interpreted as animal spirits, are very different from the ones for consumers. As seen in Figure 2, the business formation index is highly correlated with leads of fixed investment. However, its innovations, which correspond to entrepreneurs' perceptions of the environment to form new businesses based on non-fundamentals, generally lag economic slowdowns and recessions, as depicted by the probabilities of pessimistic state.

As shown in Tables 2 and 3, the probabilities of pessimism for entrepreneurs precede the 1969-70 slowdown and recession, and the 1984-87 slowdown, while they lag all the other economic downturns.

The 1969 Slowdown and Recession - According to the NBER dating, the economy entered in a low-growth phase in the first quarter of 1969, which turned into a recession in the fourth quarter of that year. The probabilities of entrepreneurs' pessimism started increasing in 1968 and peaked two quarters before the onset of this economic slowdown, and therefore, five quarters before the 1969 recession peak (Figure 9). Here again, sunspots in the form of animal spirits may have been one of the causes of the 1969 slowdown. In 1968, the economy was functioning in a normal pace, with sales, personal income and industrial production growing above average. Also, interest rates were considerably low, and investment growth was high — its peak coincides with the beginning of this low-growth phase (Figure 8). However, as shown by the probabilities of pessimism in Figure 9, entrepreneurs were uncertain about the state of the economy, and were not prone to open new businesses in spite of positive signals from fundamentals.

The 1984 Slowdown - The 1984 slowdown was preceded by a period of great uncertainty and pessimism from both consumers and entrepreneurs not accounted for by fundamentals. After a sequence of periods of weak economic performance, comprising the 1979-80 slowdown, the 1980-81 recession and again another recession in 1981-82, agents were skeptical about the ensuing recovery. In fact, the probabilities of waves of pessimism from consumers remained very high after the 1982 recession (Figure 5), even though personal income growth was high and interest rates low. Figure 9 shows that the probabilities of pessimism among entrepreneurs peak during the 1981-82 recession and remain high during the 1983 recovery. A close examination of the data shows that increases in the pessimism probabilities are associated with a subsequent decrease in investment, industrial production, sales, and employment growth a couple of months later. This may indicate a potential contributing role for sunspots and animal spirits in the 1984 economic slowdown.

4. ROBUSTNESS

It is possible that we have overlooked an economic fundamental that could be driving the economic patterns in the consumer sentiment and business formation innovations. In this section, we consider a number of different variables in the VAR system, as well as different model specifications in search of this potential fundamental.

First, we estimate the base VAR – a four-lag four-variable system with the series GDP, consumer sentiment, business formation, and including different fourth additional variables. That is, we substitute interest rates for other variables such as excess stock returns (return on the valued-weighted portfolio in excess of the T-Bill 3 months), inflation (CPI growth), money supply, government spending, and some of the components of the Composite Leading Indicator constructed by the Conference Board – manufacturer's new orders, housing permits, manufacturer's unfilled orders, vendor performance, unemployment insurance initial claims, and sensitivity material prices.[17] Second, we estimate linear VAR specifications with four lags and five variables, combining the above mentioned series (55 combinations). Since the inclusion of a large number of series in a VAR uses a lot of degrees of freedom, we next choose to include six variables and three lags (165 combinations). We obtain sentiment and business formation innovations from these different VARs and we find that they all yield very similar residuals, with correlations ranging from 0.754 to 0.945 with the consumer sentiment innovations from the base model, and from 0.866 to 0.932 compared to business formation innovations from the base model. In particular, we find that the cyclical economic pattern underlying the VAR innovations are robust across different model specifications. Figure 10 shows some of these residuals plotted against the NBER dated business cycles and growth cycles.

There remains the question whether the linear VAR is not capturing a nonlinear fundamental process underlying the data in form of switches at expansions and recessions. To verify this possibility, we perform two exercises. First, we assume that the constant term of each equation of the base VAR switches regimes according to a Markov process and obtain the residuals from the consumer sentiment and business formation equations. The same procedure is repeated using the above mentioned alternative fundamental variables. Again, we find that the

[17] This series were also obtained from Citibase 1995 release. For a full description of the Composite Leading indicator and its components see, for example, M. Rogers (1994).

consumer sentiment and business formation residuals still present the same economic fluctuation patterns as the ones obtained from the linear VAR. The correlations range from 0.710 to 0.919 with for the consumer sentiment innovations and from 0.829 to 0.944 compared to business formation innovations from the base model. Figure 11 plots some of these residuals, the NBER-dated business cycles and growth cycles.

Finally, we check if the inclusion of real time expectations about future economic activity in the VAR modifies the results. For that, we estimate recursively a univariate Markov switching model for the unrevised version of the Conference Board index of leading indicator.[18] That is, we use the first released versions of the leading indicator, which reflect the beliefs about future state of the economy in real time. The basic model uses quarterly data from 1954:2 to 1968:1. From 1968:2 up to 1994:4, the model is recursively estimated. For example, in 1968:2, we use the preliminary data for leading indicator series from the 1968:3 issue of the Business Condition Digest or Survey of Current Business to estimate the filtered probabilities of recession for the 1968:2. Each additional quarter uses only the data released at that quarter, and the output is a time series of real-time filtered probabilities of recessions. We then run the base linear VAR including the real time filtered probabilities from the unrevised leading indicator as one of the variables. Once more, the resulting innovations for consumer sentiment and business formation are very similar to the one from the base model (Figure 12).

Even after including a number of good predictors of GNP, consumer sentiment and business innovations continue to show the same economic fluctuation pattern we obtained from the base model. In particular, we find that the turning point analysis for recessions and slowdowns is not affected by the inclusion of different fundamentals or by using nonlinear specifications.

5. CONCLUSIONS

We examine the behavior of non-fundamental movements in consumer sentiment and business formation around economic turning points. We find that bearish consumers and entrepreneurs are present before the onset of some economic downturns, even when the

[18] The data for the unrevised CLI up to 1988 was obtained from Frank Diebold and Glenn Rudebusch. Updates were obtained generously supplied by James Hamilton and also from our own data collection out of several issues of the *Survey of Current Business*.

fundamentals are all very strong. In particular, our analysis suggests that shocks to expectations may have played an important role in the 1969-70 recession and slowdown, the 1981-82 recession and the 1984-87 slowdown.

Our evidence does not prove that waves of pessimism cause output fluctuations. There remains the possibility that a missing fundamental variable may be causing the behavior of the innovations. However, we find that the results are robust across a range of alternative linear and nonlinear specifications which includes many different additional variables as proxies for fundamentals. This suggests that some of the U.S. recessions and slowdowns could have been a response not to shifts in fundamentals, but to switches in waves of pessimism and optimism. Hence, our results provide empirical support for the class of macroeconomic models with multiple equilibria, such as coordination failures or self-fulfilling prophecies, whereby consumers' sunspots and investors' animal spirits have important independent influence on economic fluctuations.

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Table 1 - Maximum Likelihood Estimates
Quarterly Data: 1954.2-1994.4

	Parameters				
Model 1 **Sentiment Innovation**	$\sigma^2_{\eta 0}$	$\sigma^2_{\eta 1}$	p_{00}	p_{11}	**LogL(θ_c)**
	10.818	71.224	0.920	0.966	-338.397
	(1.691)	(17.29)	(0.052)	(0.021)	
Model 2 **Business Innovation**	$\sigma^2_{\eta 0}$	$\sigma^2_{\eta 1}$	p_{00}	p_{11}	**LogL(θ_h)**
	2.526	12.322	0.947	0.649	-184.301
	(0.399)	(6.376)	(0.043)	(0.203)	

Asymptotic standard errors in parentheses correspond to the diagonal elements of the inverse hessian obtained through numerical calculation.

Model 1:

$\varepsilon_{ct} = \alpha_0 + \alpha_1 S_t + h_{S_t}$ $\quad S_t=0, 1$

Model 2:

$\varepsilon_{bt} = a_0^* + a_1^* S_t^* + h_t^* \quad S_t^* = 0,1$

Table 2 - Peak Turning Point Signals of Business Cycles (NBER)

Peaks NBER	Consumer Sentiment Model 1	Business Formation Model 2
1957:III	-	-
1960:II	-	+2
1969:IV	-	**-5**
1973:IV	**-3**	+4
1980:I	+2	+1
1981:III	**-4**	+5
1990:III	0	-

Source: First column - Survey of Current Business, Dec .1994.
The (+) and (-) signs refer to lags and leads, respectively.

Table 3 - High Turning Point Signals of Growth Cycles (NBER)

High NBER	Consumer Sentiment Model 1	Business Formation Model 2
1957:I	-	-
1960:I	-	+3
1962:II	-	-
1966:II	-	-
1969:I	-	**-2**
1973:I	0	+7
1978:IV	+7	+6
1984:III	**-2**	**- 7**
1989:I	+6	-

Source: First column - NBER.

Figure 1 - Consumer Sentiment (—), NBER Recessions (Shaded Area) and Slowdowns (- - -)

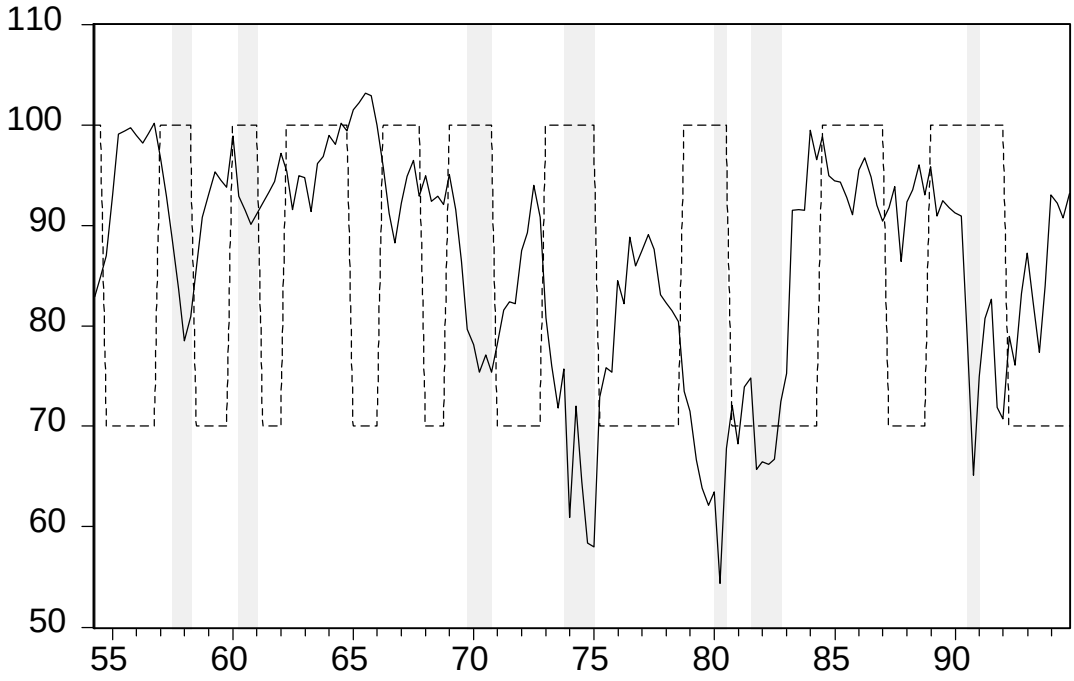

Figure 2 - Business Formation Index (—), Fixed Investment (- - -), NBER Recessions (Shaded Area) and Slowdowns (– – –)

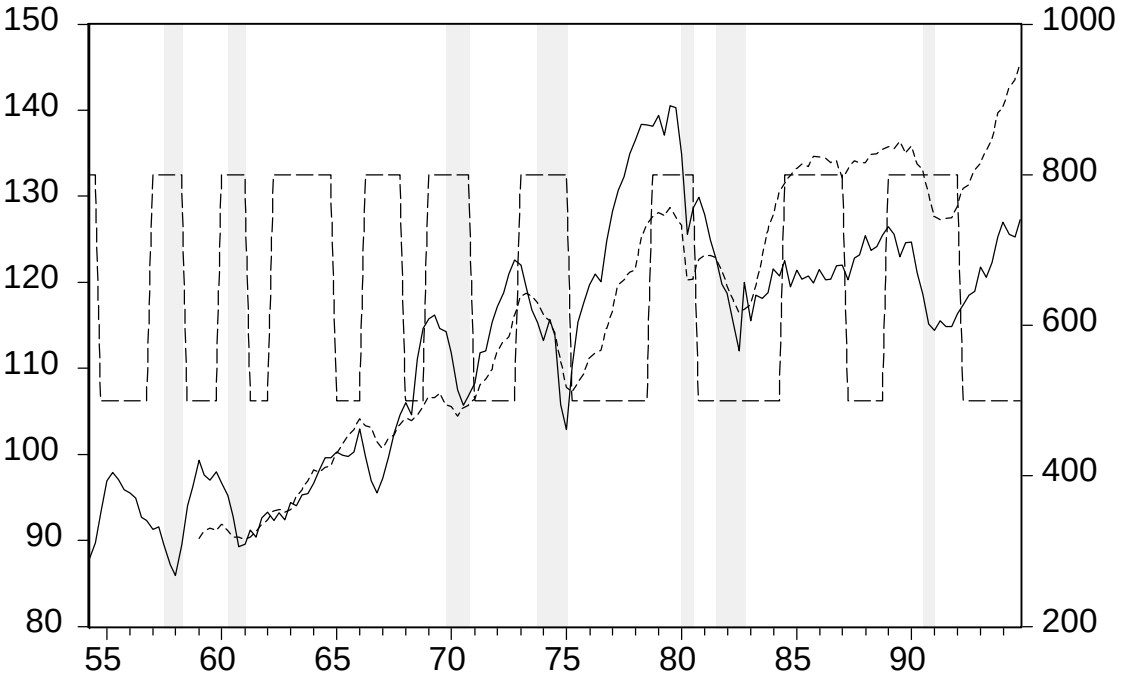

Figure 3 - Consumer Sentiment Innovation from VAR(4) (—), NBER Recessions (Shaded Area) and Slowdowns (- - -)

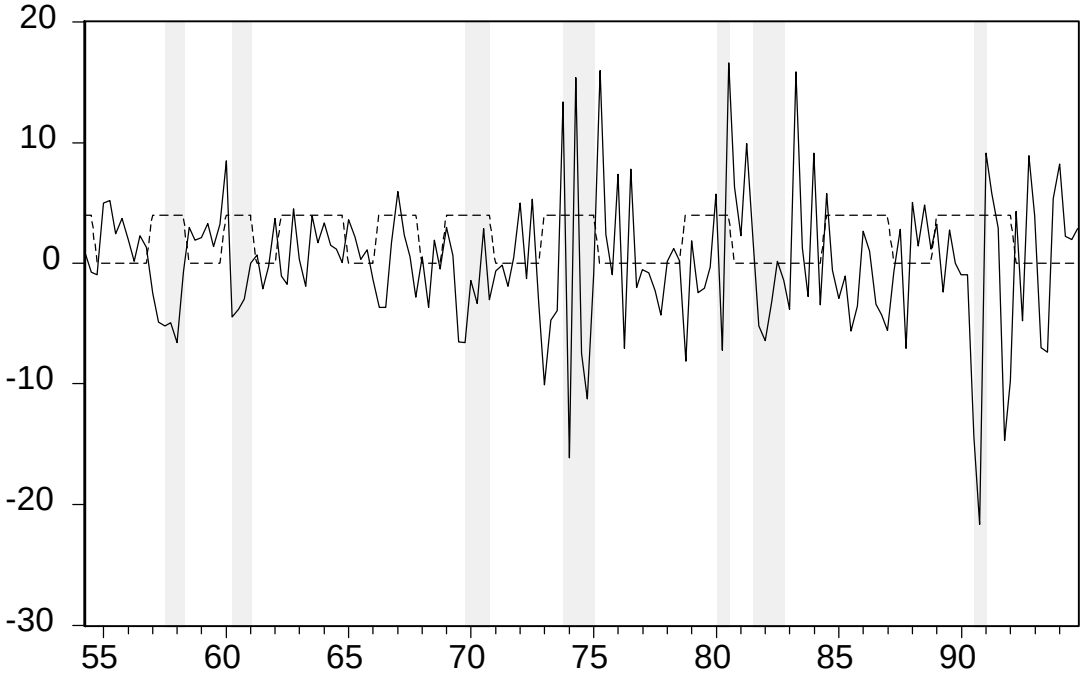

Figure 4 - Business Formation Innovation from VAR(4) (—), NBER Recessions (Shaded Area) and Slowdowns (- - -)

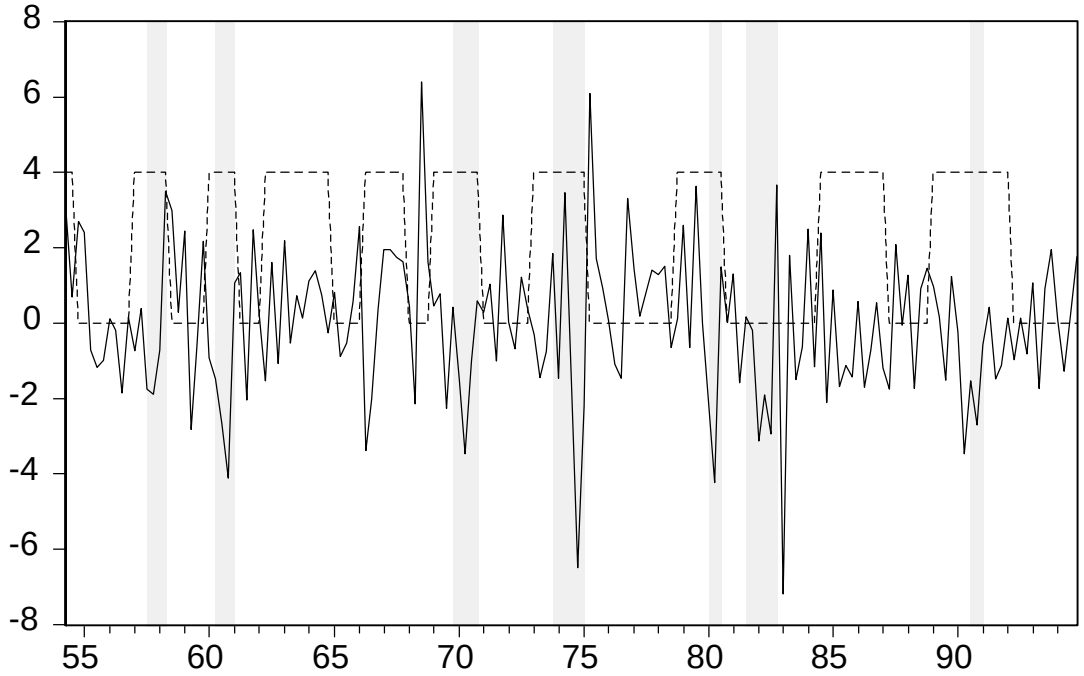

Figure 5 - Filtered Probabilities of Pessimistic State (—): MS on Consumer Sentiment Innovation from VAR(4), NBER Recessions (Shaded Area) and Slowdowns (- - -):

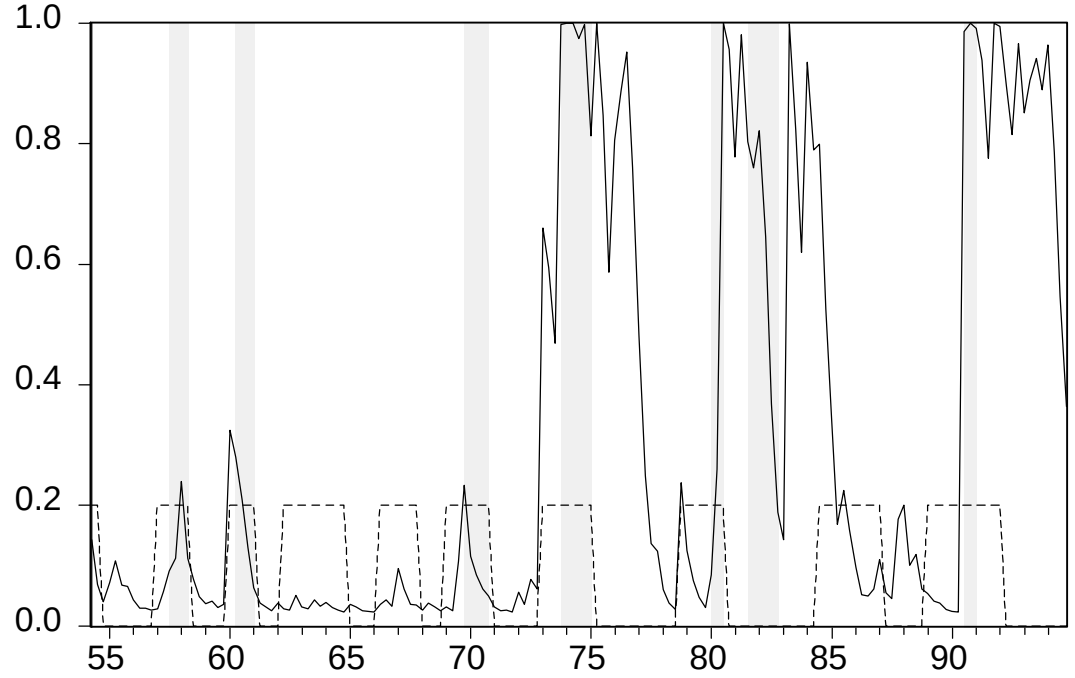

Figure 6 - Consumption Growth (—), NBER Recessions (Shaded Area) and Slowdowns (- - -):

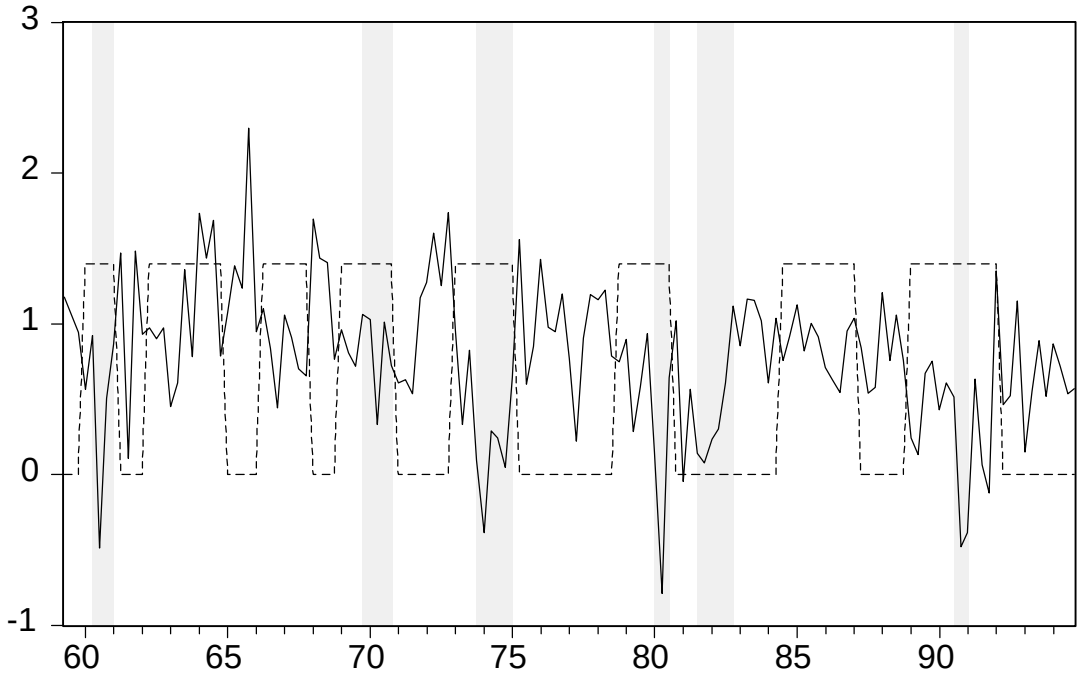

Figure 7 - Changes in log of employment (—), Manufacturer's and Trade Sales (- - -), Industrial Production (– – –), NBER Recessions(Shaded Area) and Slowdowns (– —)

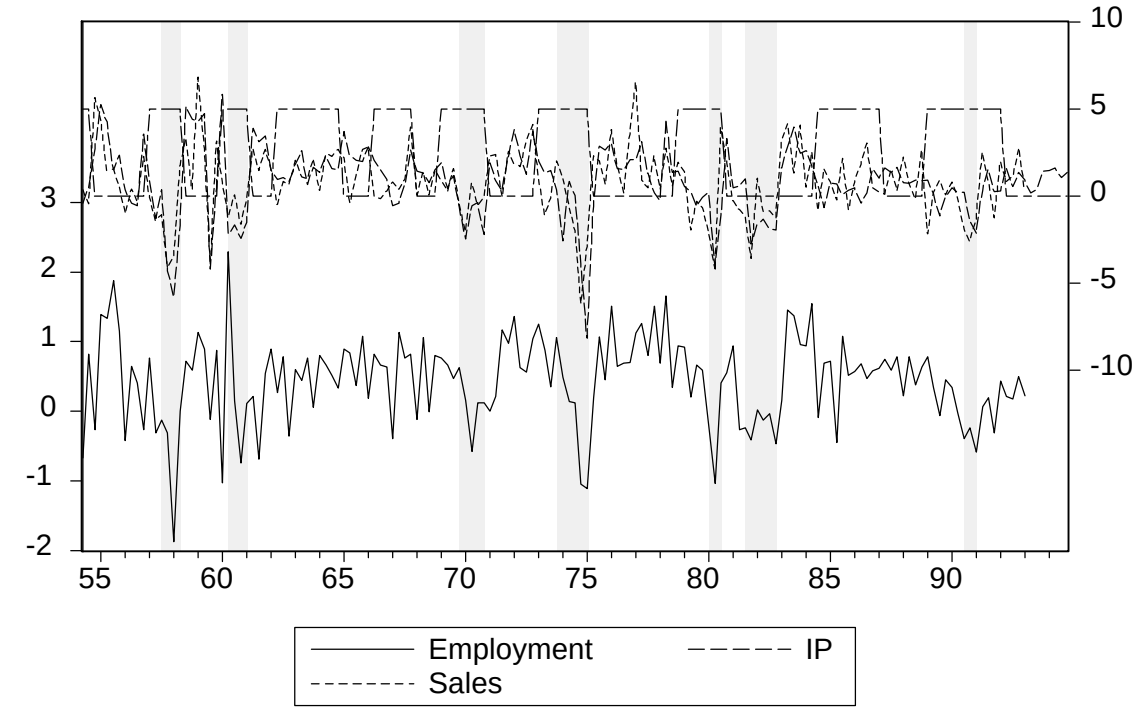

Figure 8 - Investment Growth (—), Interest Rates (- - -), NBER Recessions (Shaded Area) and Slowdowns (– —):

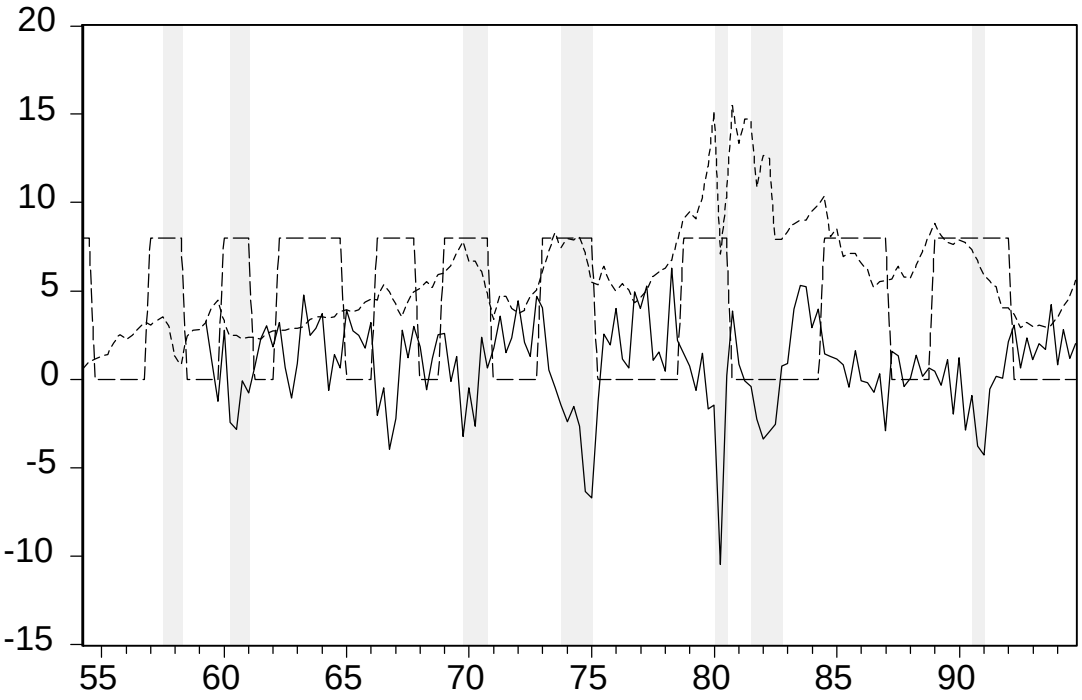

Figure 9 - Filtered Probabilities of Pessimistic State (—): MS on Business Formation Innovation from VAR(4), NBER Recessions (Shaded Area) and Slowdowns (- - -):

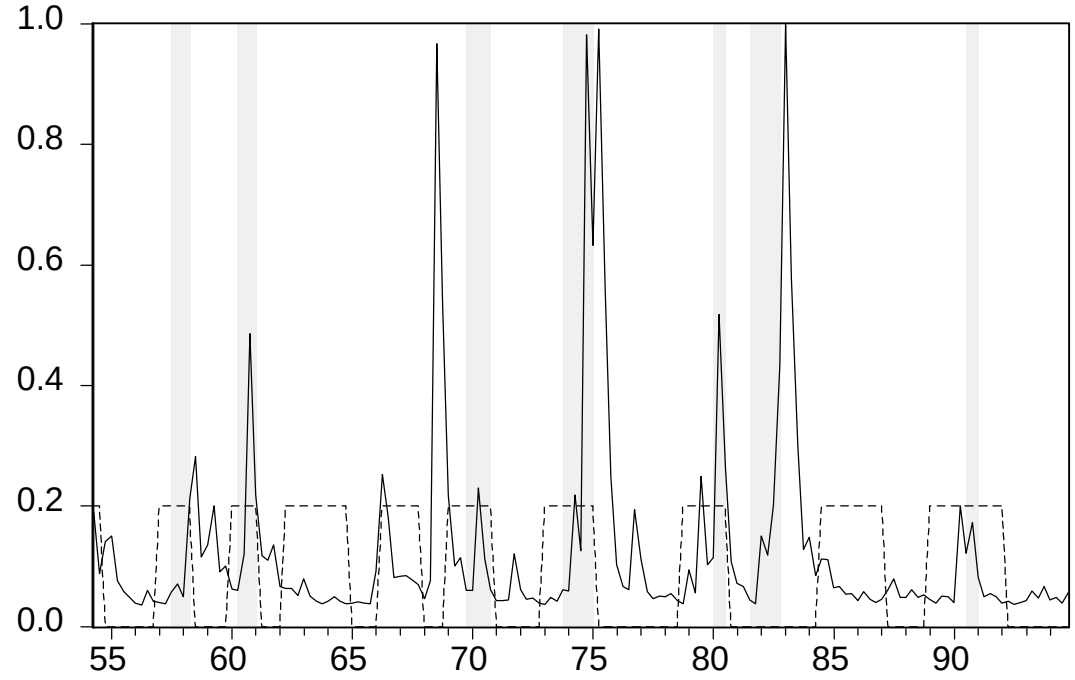

Figure 10 - Consumer Sentiment and Business Formation Innovations from Alternative VAR(4), and NBER Recessions (Shaded Area)

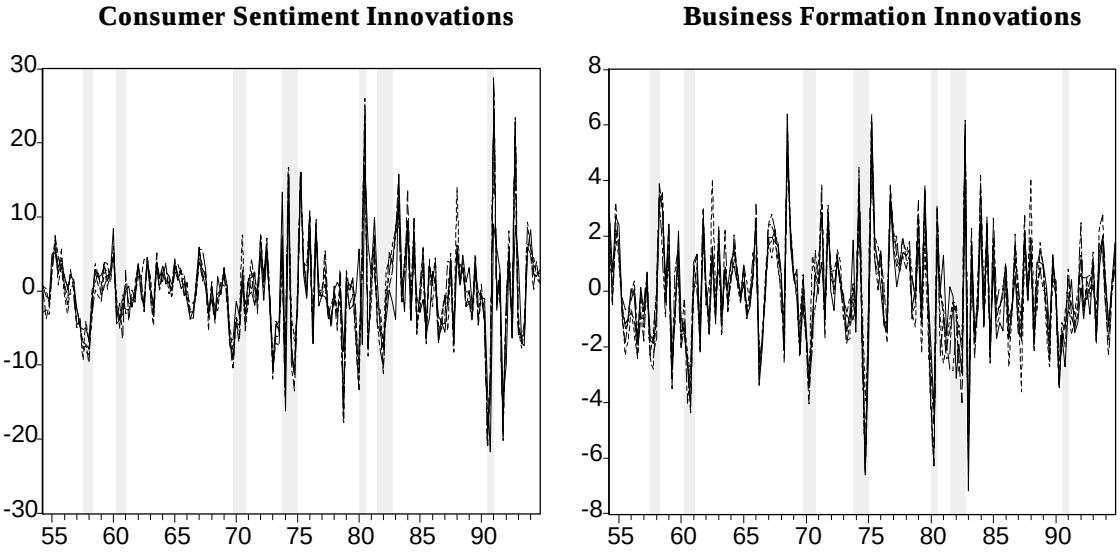

Figure 11 - Consumer Sentiment and Business Formation Residuals from Markov Switching Specifications, NBER Recessions (Shaded Area)

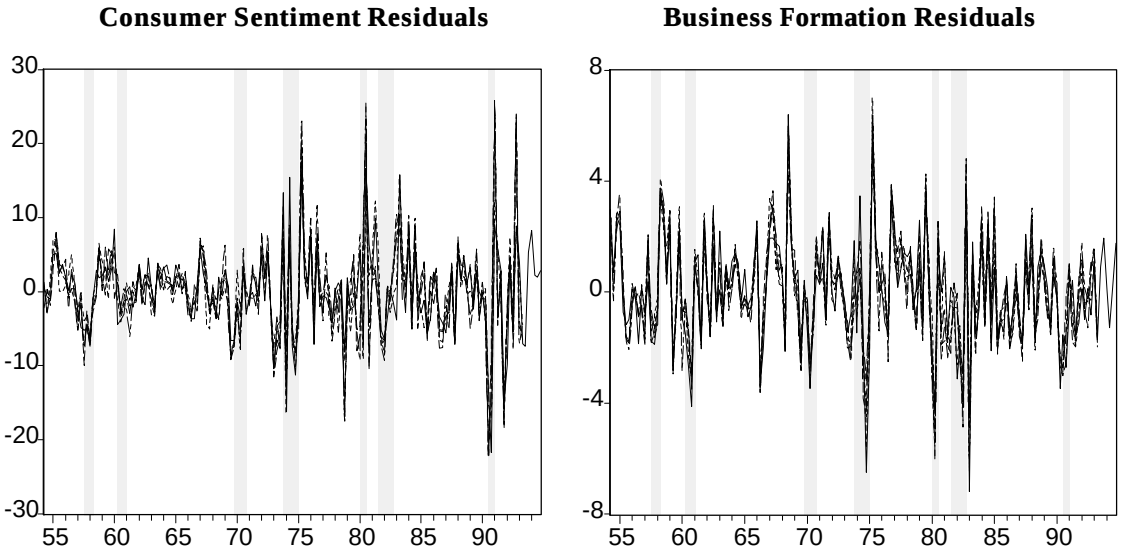

Figure 12 - Consumer Sentiment and Business Formation Innovations from Alternative VAR(4), Including Real Time Filtered probabilities of the Leading Indicator, and NBER Recessions (Shaded Area)