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Consumer Confidence and the Probability of Recession: A Markov Switching Model

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Working Paper No. 47

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ABSTRACT

This paper uses a recursive Hamilton filter to establish whether and how the Conference Board indexes of consumer confidence can help predict the ends of booms and recessions. Switching points in the overall consumer confidence index consistently lead switching points in the US coincident indicator, though the lead time varies greatly from one cycle to the next. The expectations components of the index are too noisy, particularly in the recent past, to be helpful on their own. And simple versions of the filter produce better ex ante predictions than more complex versions.

City University Business School and Centre for Development Economics, Delhi School of Economics &. We would like to thank James Hamilton for supplying software to parameterize the Markov switching model; and participants at the International Symposium on Forecasting, Toronto, June 1995, and at the Eastern Economic Association meeting, Boston, March 1996, for constructive comments on an earlier draft of the paper.

Introduction

In 1990-91, the US economy experienced a sharp and unanticipated recession, followed by a sluggish recovery. In contrast to earlier recessions, these events were not preceded by any obvious macroeconomic shock, such as an oil price rise or a tightening of monetary policy. After interrogating seven of the usual suspects, Hall (1993) concludes that the most likely cause of the recession was "8. ... a spontaneous decline in consumption". In similar vein, Blanchard (1993) finds that the recession was due to "consumption shocks" driven by "animal spirits".

While spontaneity and animation may be endearing human qualities, they are decidedly unwelcome in a key macroeconomic variable. We would like to find some advance signal of "spontaneous" changes in consumption. The indexes of consumer confidence produced by the Conference Board and the Survey Research Center of the University of Michigan are natural candidates for this role. They are constructed from individual responses to attitudinal questions concerning current and expected economic conditions, and potentially contain subjective information relevant to consumer decisions which might not be revealed in conventional economic indicators.

A number of recent studies have tested this proposition by running a regression, sometimes in a VAR, of some target variable (GNP, consumer spending) on lagged values of one of the consumer confidence indexes, and lagged values of conventional indicators. The results are mixed. Garner (1991) and Leeper (1992) argue that the consumer confidence index anticipated the 1990-1 episode but not earlier recessions; Throop (1992) finds it is consistently significant in predicting durables consumption, but not nondurables or services; Fuhrer (1993) and Carroll, Fuhrer and Wilcox (1994) find it is statistically significant in predicting consumption, but not quantitatively important; Matsusaka and Sbordonne (1995) find it both statistically and operationally important for predicting GNP.

It is disturbing that small differences in the sample size, information set, and structure of the test can make such large differences to its conclusions. In this paper, we apply a more robust methodology, which has the virtue of focusing attention on major events in and consumer perceptions of, the economy.

The best-known example of such a technique is the analysis of business cycle turning points by the National Bureau of Economic Research. Whereas regression analysis gives equal weight to all observations, the NBER technique effectively gives weight only to a few key points - peaks and troughs - in the time series. Interestingly, in a study completed well before the last recession, Moore and Cullity (1989) find that turning points in both the Conference Board and the Michigan SRC consumer confidence series consistently lead peaks and troughs in the coincident indicator.

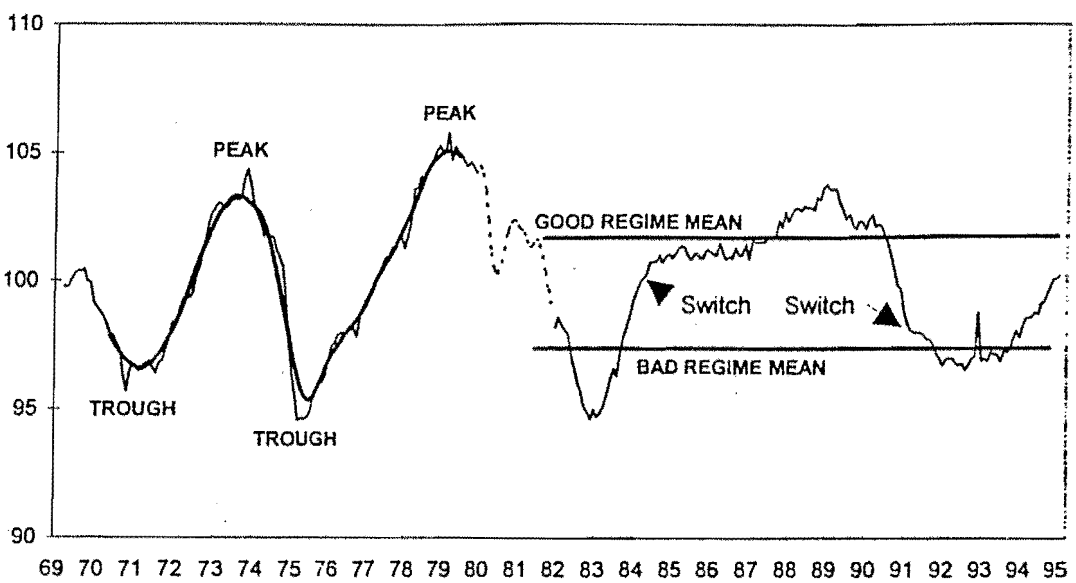
We use a somewhat different approach, which does not assume that the series involved are cyclical but rather that they switch between good (normal) and bad (recession) states, and, use a recently developed statistical technique - the Hamilton (1989) filter - to identify the key points at which these switches occurred. The first section of the paper below compares our switching model and the NBER business cycle analysis, and identifies switching points for the coincident and leading indicator series. The second section introduces our data on consumer confidence and looks at timing relations between switches in these series and switches in the state of the macroeconomy. The third section discusses implications of our results.

We find that switches from good to bad states (and vice versa) in the consumer confidence index lead similar switches in the coincident indicator, not only in 1990-1 but also in earlier recessions. The. overall "consumer confidence" index performs better than the "consumer expectations" sub-index which contains only responses to forward-looking questions. Finally, consistent with the findings of Lahiri and Wang (1994), we find that a simple switching model for the time series gives better ex ante predictions than a model which combines switching with a cyclical, autoregressive, component.

Cycles v Switches in Economic Activity

Figure 1 contrasts two schematic models of the same time series (the Commerce Department's Index of Coincident Indicators), representing the state of the economy. The lefthand panel treats the data as cyclical so that its major features are the peaks (P) and troughs (T) of the identified cycles. Provided a timely method of identifying these turning points can be developed, this kind of analysis can answer questions like "is the worst over?", and "have we passed the peak?". In the United States, an official dating of peaks and troughs is made by the Business Cycle Dating Committee of the National Bureau of

Figure 1. Cycles v Regime Switches: the Coincident Index, 1969-1995



Economic Research. Although some judgment is applied, the dating largely follows the methodology outlined by Bry and Boschan (1971), as applied to the Coincident Index. The index is a weighted sum of statistics on GDP, industrial production, personal income, manufacturing sales and employment. The Bry-Boschan heuristic cleans out the effects of any one-off events, and scans the series for local turning points. The exact date of a major turning point is determined by the behavior of a centered 11 month moving average (shown on the Figure) with the constraint that there be at least 15 months between successive peaks or troughs. This means that there is necessarily a delay of at least 6 months before a turning point can be called.

The right-hand panel of Figure 1 treats the state of the economy in a quite different way, as a switching process with two possible states, GOOD and BAD. From time to time the economy switches between these states. This kind of analysis can answer different but equally interesting questions such as "are the good times over? has the economy plunged into recession?" and "is the recession over?". The maximum likelihood estimators for Markov switching models discussed by Hamilton (1989, 1990) provide techniques for identifying these switching points.

Suppose we represent by y_t the value of the coincident index at time t. A simple two-state Markov switching model assumes that at t, y may be in one of two states S_1 and S_2 with probabilities which depend on its state in the previous period. The probabilities that the previous state will persist are:

$$\text{Prob}\{y_t \,\varepsilon\, S_1 \mid y_{t-1} \,\varepsilon\, S_1\} = p_1 \tag{1}$$

$$\text{Prob}\{y_t \,\varepsilon\, S_2 \mid y_{t-1} \,\varepsilon\, S_2\} = p_2 \tag{2}$$

and hence the probabilities of switching from S_1 to S_2, and from S_2 to S_1, are $1 - p_1$ and $1 - p_2$ respectively.

The states are described by

$$S_1: \qquad y_t = \mu_1 + u_{1t}, \quad u_{1t} \sim N(0, \sigma^2) \tag{3}$$

$$S_2: \qquad y_t = \mu_2 + u_{2t}, \quad u_{2t} \sim N(0, \sigma^2) \tag{4}$$

where μ_1 and μ_2 are the regime means, and with $\mu_1 > \mu_2$ the states S_1 and S_2 correspond to the GOOD and BAD regimes of the schematic model in Figure 1. A transition probability $p_1 = .95$, say, implies that if the economy is currently in the GOOD state, there is a 5 per cent chance it will fall into the BAD state next period.

The system can be generalized in a number of ways. There may be more than two regimes (Engel and Hamilton, 1990; Garcia and Perron, 1993). The transition probabilities p_1 and p_2 may depend on exogenous drivers or on endogenous factors such as the duration of the current regime (Goldfeld and Quandt, 1973; Filardo, 1994; Diebold, Lee and Weinbach, 1995). The expected values of the states also need not be constant but may be trended or depend on exogenous variables (Quandt, 1958). Hamilton (1989) considers the case where y follows an autoregressive process around the state means, an AR(1) version of which is:

$$y_t - \mu_t = \rho(y_{t-1} - \mu_{t-1}) + \varepsilon_t \qquad (5)$$

where μ_1 and μ_2 are the means of the states which actually characterise the system at t and t - 1, and $\varepsilon_t \sim N(0, \tau^2)$. Finally, the variances of the state-dependent shocks u_{1t} and u_{2t}, need not be equal or indeed constant.

Having estimated the parameters of the system (1) - (5), it is possible to compute the probability π_t that the sample observation at time t came from the GOOD regime. Since this can be done in particular for the most recent sample observation T this statistic can be used to give a timely answer to questions about the state of the economy. For example, we might say that if $\pi_T > .90$, the economy is in good shape, but if $\pi_T < .10$, the economy is in recession. A fall of π_T through its upper critical value of .90 might, indicate that the good times were over, a fall through the lower critical value of 0.10 might indicate the definite onset of recession, and a subsequent rise above .10, the end of the recession. Note that the critical values .10 and .90 are subjective, and need to be chosen in the light of the behavior of the π_T series, so as to optimize the ratio of true to false signals.

Suppose we wished to assess the state of the US economy at some point in the past, say the summer of 1990. One possibility is to estimate the parameters of (1) - (5) over our whole data set, starting perhaps in January 1970 and including data from all months up to the current month, and estimate π_T for August 1990 conditional on these parameter values. This "whole-sample smoothed" estimate of the probability that the economy was in the GOOD regime in August 1990 is useful for the purposes of historical analysis. But it does not tell us whether it would have been possible in September 1990, using data only up to August 1990, to reach the same conclusion. Taking away the post- 1990 data may change our estimates of the means and variances of the two regimes, and therefore change our estimate of the probabilities that individual observations belong to each regime.

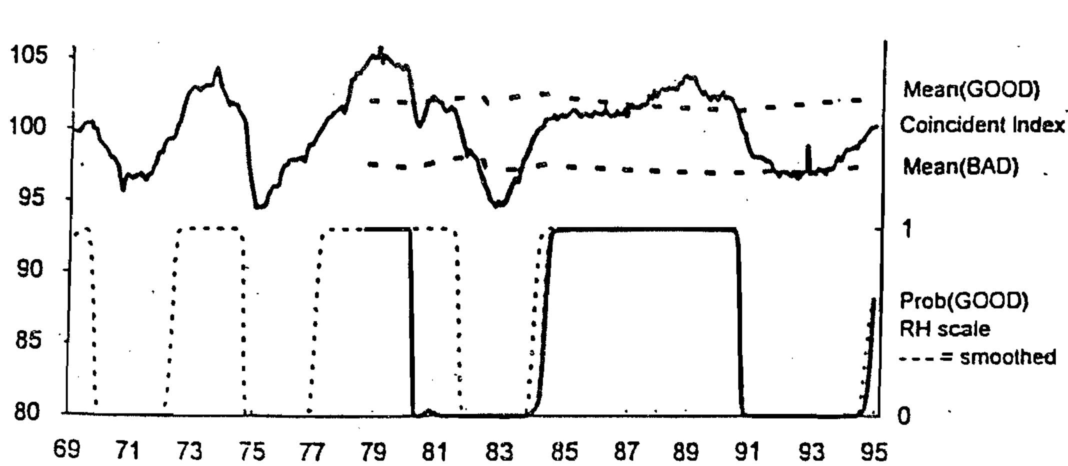
Conversely, as data accumulate after the current month, our estimate of the state of the economy in the current month may be revised.

We therefore compute two estimates of π_T for each observation. One is the full-sample smoothed estimate, the other a "recursive" estimate based on parameter estimates which use observations only up to period T. This involves many hundreds' of recomputations of the model. But it does provide a better insight into whether the model would have been useful in real-time forecasting.

Figure 2 shows the coincident indicator, and our smoothed and recursive probability estimates for the GOOD state, using the simple two-regime switching model (1) - (4) parameterized on monthly data in the period January 1970 - February 1995. The Department of Commerce index is not stationary, but has a trend reflecting the trends in its nonstationary components. In an attempt to infer how the data might have been interpreted at the time, the index shown in Figure 2 has been detrended by expressing each observation as a ratio of the index value to the fitted value from a recursively estimated exponential trend, fitted on data up to that month.

The first column of Table 1 lists parameter estimates derived from the whole sample of data. The mean values of our detrended index in the GOOD and BAD states are estimated to be 102.0 and 97.4 respectively, and the low standard errors show they are clearly different, so the 2-regime interpretation is not rejected. The probability of staying in the GOOD state is .98, and in the BAD state .97, so the GOOD state is slightly more persistent.

Figure 2: Coincident Index, 2-Regime Markov Model



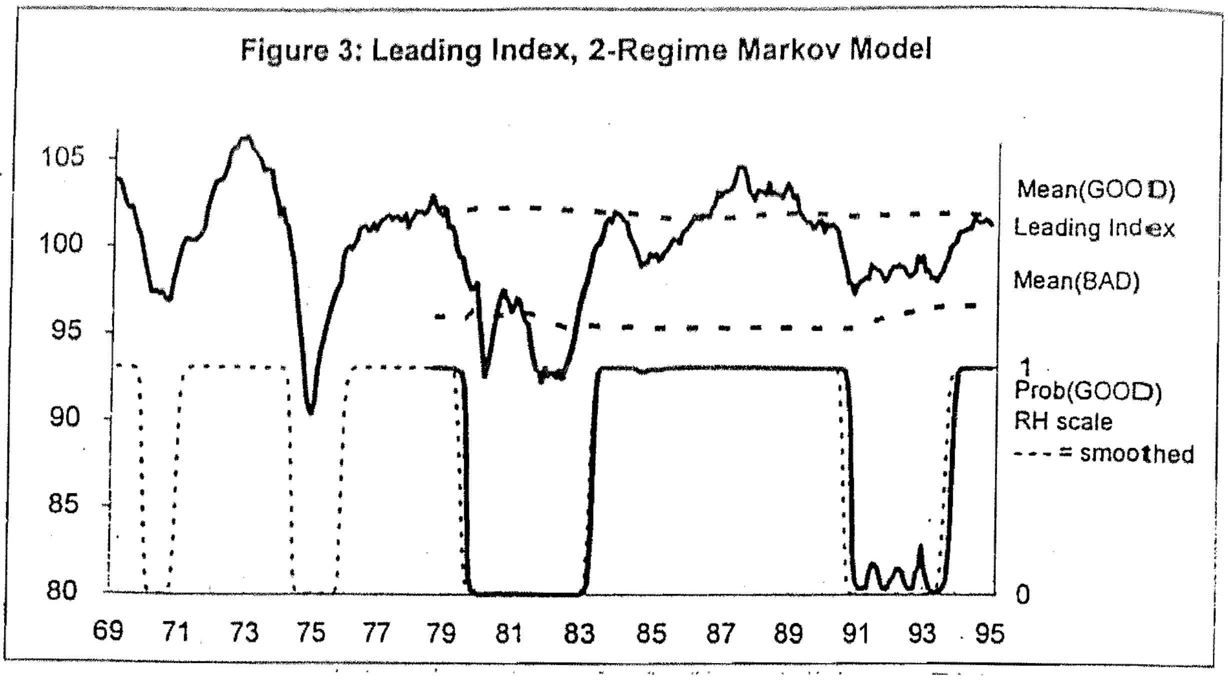
The sequence of estimates of the GOOD and BAD state means μ_1 and μ_2 derived from recursive estimates starting, with the first 100 data points are also shown on Figure 2. Corresponding smoothed and recursive probabilities of being in the GOOD state are shown in the lower part of the Figure.

Both means rise in the years 1980-2, fall sharply in 1982-3, and rise very gently thereafter. This makes a big difference to the interpretation of events in 1980-84. The recursive π_T series interprets the fall in the index in May 1980, relative to a high estimate for μ_1 , as a slide into recession which is not reversed until September 1984. The smoothed π_T series does not fall so much in May 1980 since the whole-sample estimate of μ_T is lower than the estimate based only on earlier data. The dip in the coincident index in May 1980 is therefore not interpreted as a recession, and the move into the BAD state does not occur until December 1981. No such ambiguity is present in the recent recession, where the index leaves the GOOD regime in October 1990 and definitely enters the BAD regime in December.

The exact chronology of these switches, based on the recursive π_T series, and using 0.9 and 0.1 are signals for entering/leaving the GOOD and BAD states, is set out on Table 2, alongside the official business cycle, peaks and troughs. Generally, these turning points lie as expected inside the GOOD and BAD regimes. However, an extra official cycle is identified during the years 1981-2, which are treated as uniformly GOOD by the smoothed filter and BAD by the recursive filter.

Figure 3 shows the time series for the current definition of the Department of Conunerce Composite Index of Leading Indicators, and corresponding estimates of the probability that this index is in the GOOD state in each month. As before, we detrended the official index using a recursively estimated exponential trend. The estimated parameters of the simple Markov switching model are shown in the second column of Table 1.

There is again some conflict between the full-sample smoothed estimates of π_T and the recursive estimates, this time during the 1990-4 period. The backward-looking smoothed estimates suggest the leading index moved into the BAD state in December 1990 and recovered only in December 1994. The at-the-time recursive estimates suggest the index



moved into recession in February 1991, and made two false recoveries in May 1992 and January 1993, before finally rising decisively in December 1993. Both π_T series suggest the leading index moved into the BAD state *after* the coincident indicator had moved into recession, and that the index gave very ambiguous signals about the timing of the recovery.

Table 3 sets out the chronology of switches in the leading index series based on the recursive probability estimates, and lead/ lag times relative to the switches in the coincident indicator shown on Table 2. The figures show that the leading index "worked" in the 1971 recovery, and in the 1974-76 and 1979-83 cycles but not in the most recent cycle, giving some credence to the idea that some unique factors were at work in 1990-1. However, great care must be taken in using the leading index as a benchmark for any forecasting technique, since it has been subject to frequent revision, and is regularly redefined so as to provide good early warnings of previous cycles. Koenig and Emery (1991) show clearly that the real-time performance of the leading index is very much worse than its apparent historical performance.

Consumer Confidence and the Macroeconomy

There are two main sources of information on movements in consumer confidence over time. One is the Index of Consumer Confidence, produced by the Conference Board, the other the

Index of Consumer Sentiment produced by the Survey Research Center of the University of Michigan. Both ask slowly changing panels of consumers five questions about how they feel their own financial position, and the general state of the economy, has changed in the recent past, and whether they expect these to improve or worsen in the future. There are minor differences in the phrasing of the questions - the Conference Board asks explicitly about jobs and incomes, rather than "financial situation" - and in the forecast period - the Conference Board asks about the previous and prospective 6 month period, the SRC about the previous and prospective 12 month period. All studies of these indexes find their statistical properties to be very similar. In this paper, we use the Conference Board index, because it was available on a monthly basis throughout our sample period, whereas the SRC data is only quarterly before 1978. Moore and Cullity (1989) also find the Conference Board index gives slightly earlier signals of business cycles peaks and troughs.

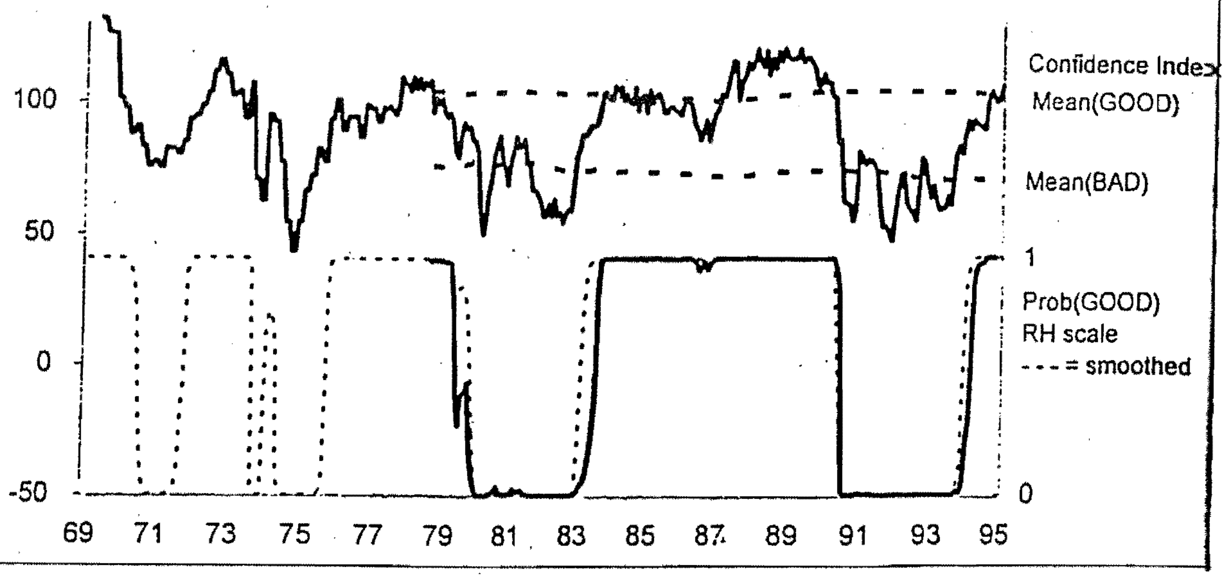
The Consumer Confidence Index is formed by averaging the balances of positive and negative responses to all five questions in the Conference Board survey. The Board also publishes a Consumer Expectations Index, based only on responses to the three forward-looking questions. Since Moore and Cullity (1989) find the expectations index gives better signals than the overall index, and because the SRC expectations index was added to the Commerce Department's index of leading indicators in 1989, we consider the properties of both overall and expectations indexes below.

The consumer confidence index is tracked on Figure 4. The third column of Table 1 sets out estimates of the parameters of a simple 2-regime Markov switching model for this time series. The whole-sample estimates show a statistically significant separation between a GOOD regime (μ_1 = 102.3) and a BAD regime (μ_2 = 69.9), with the GOOD regime more persistent than the BAD (p_1 =.98, p_2 =.96).

The recursive means on Figure 4 vary little over time, so there is little difference between the recursive and smoothed probabilities π_T in the lower part of the Figure. The probabilities generally show the same pattern as the recursive probabilities for the coincident indicator, with sustained BAD regimes though the years 1979-83 and 1990-94. One difference is that the confidence index shows a recovery into the GOOD regime and a subsequent fall into the

BAD during the summer of 1974, but there is no similar cycle in the coincident index which simply falls into the BAD regime in late 1974 and stays in recession until 1977.

Figure 4: Consumer Confidence Index, 2-Regime Markov Model

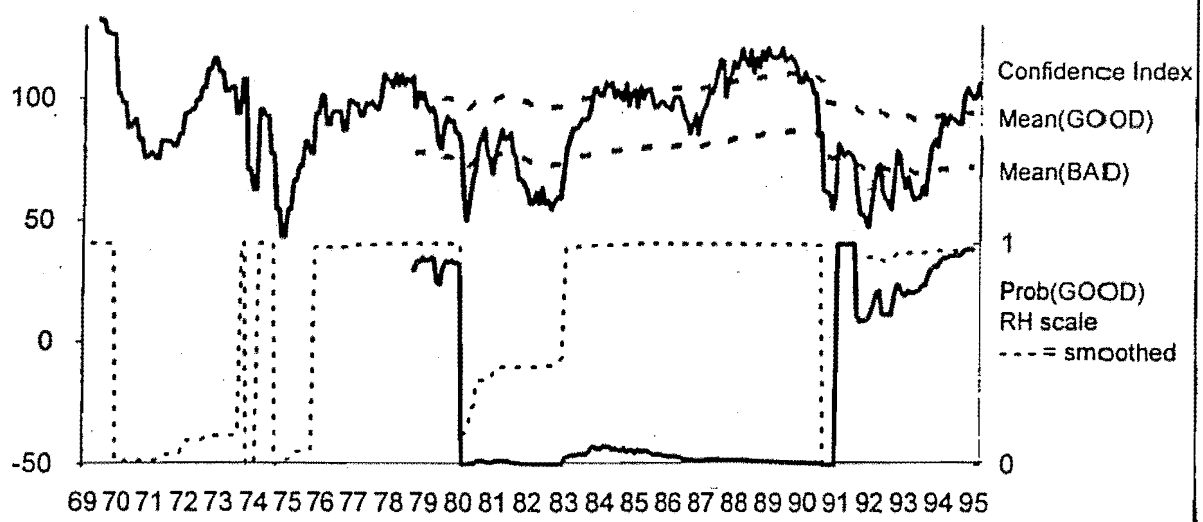


The exact chronology of the switches in the consumer confidence index is set out in Table 4, and leads (-) and lags (+) in months, relative to the coincident index switch points, are also shown. The confidence index was late in signaling the fall into the recession in 1970-1, but so also was the leading index. The consumer confidence index gave a false signal of recovery in 1974. Otherwise it anticipates movements in the coincident index very well, and in particular gave an unambiguous advance warning of the 1990-1 recession - albeit only with 2 months lead - and a clear signal of recovery in 1994. This contrasts favorably with the late and erratic behavior of the index of leading indicators in the 1990s.

We experimented with 3-regime descriptions of the coincident indicator and the consumer confidence index. Although the resulting models were well-defined, they did not add any significant insights into the timing of movements into and out of recession, so the results are not reported here.

In the final column of Table 1 we report estimates for the two-regime Hamilton filter model, with the added assumption of Equation (5) that the index follows a first order autoregressive process (parameter ρ) around the regime means. In statistical terms this model is much superior to the two-regime AR(0) system of equations (1) - (4), with the estimate of ρ significantly non-zero, and the sample likelihood markedly higher.

Figure 5: Consumer Confidence Index, 2-Regime Markov Model, AR(1) process



However, this specification which is statistically superior within-sample leads to decidedly inferior in-sample description and out-of-sample forecast performance. There appear to be two problems with the model. One is that the autoregressive process (5) assumes that a regime shift is only likely if the underlying variable jumps by a large amount from below the GOOD mean to below the BAD mean, for example. Any drift from below the GOOD mean to above the BAD mean will be interpreted as a serially correlated deviation below the GOOD mean, and will not significantly increase the probability that the regime has changed. The second problem is that the recursive means shown in Figure 5 are unstable, falling in the recession years and rising through the recovery years. As a result the recursive and smoothed estimates of π_T in the lower part of Figure 5 are very different from each other, and much less convincing than the estimates from the simple model without an AR(1) process.

In mid-1990, for example, the smoothed π_T falls sharply into the BAD regime but this state does not persist long. The GOOD mean μ_1, also falls sharply, and this is enough to persuade the model that all of the erratic movements in the confidence index from mid-1991 onwards represent a serially correlated series of deviations below the GOOD regime mean. All these observations are attributed to the GOOD regime, even though a visual inspection of Figure 5 shows that throughout 1991-1993 the confidence index was much closer to the BAD regime mean.

Even more counter-intuitive features appear in the recursive estimates of π_T. The smoothed estimates suggest that in 1981 confidence partially recovered from the BAD regime, and by 1982 was back in the GOOD state. However, the recursive estimates suggest that confidence never recovered throughout the 1980s, and only switched back into the GOOD state in 1991. All of the high observations on consumer confidence in the period 1983-1989 are treated as serially correlated deviations above the (rising) mean μ_2 of the BAD regime. A visual inspection shows that throughout this period the confidence index was much closer to, and often above, the GOOD state mean μ_1.

These may well be symptoms of a general weakness of this version of the Hamilton filter. From a similar analysis of the switching behavior of the coincident and leading indicators in the years 1954-93, Lahiri and Wang (1994, p259) conclude:

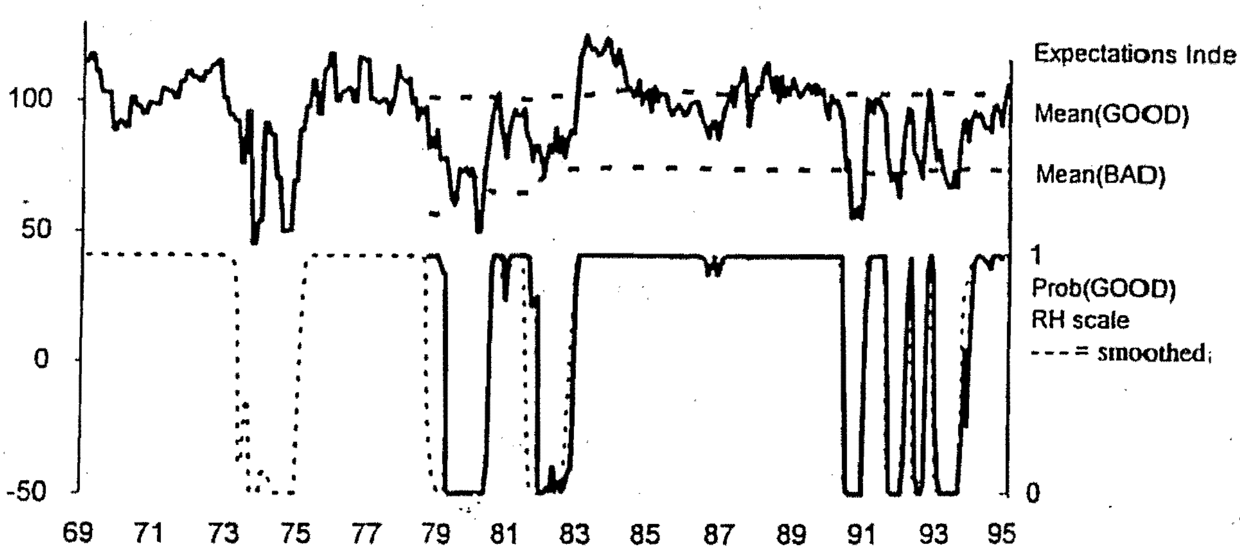
> "..imposing any degree of autoregression in the errors on the simple regime-shift model causes the filter to signal the turning points inappropriately. This is despite the fact that the QPS [quadratic probability score, a measure of fit] values associated with the autoregressive models were often considerably less than those associated with simple versions of the model."

They note that the quadratic probability score, like our likelihood function, gives equal weight to fit at all data points, rather than focusing on the key switching points, and suggest that an error metric other than maximum likelihood might be more appropriate. Our results add weight to their argument. Incidentally, our own attempts to estimate a two-regime AR(1) model for the coincident indicator on post-1970 data resulted it collapsing to one regime ($\mu_1 = \mu_2$) with an autoregressive scheme close to a unit root process ($\rho = 1$).

In a final attempt to refine our results, we analyzed the consumer expectations index. Since this embodies responses to the forward-looking questions in the Conference Board survey, it might be expected to provide better signals than the overall consumer confidence index. Figure 6 shows the expectations index and recursive means from the simple two-regime model. After some instability in 1979-80, the means settle down at stable values through the 1980s and early 1990s.

Looking at the π_t estimates for the expectations index in the lower part of the Figure, two differences from the corresponding figures for the overall confidence index in Figure 4 are apparent. First, the expectations index does show a "double-dip" recession in 1980-3, a

Figure 6: Consumer Expectations Index, 2-Regime Markov Model



feature of the official business cycle chronology but not of our filtered coincident indicator. This may explain the relative attractiveness of the expectations index to commentators interested in predicting "peaks" and "troughs". Second, the index is very noisy in the years 1990-94. It successfully signals the onset of the 1990-1 recession, but thereafter produces three false recovery signals before finally moving decisively into the GOOD regime early in 1994.

On balance, the expectations index does not outperform the overall consumer confidence index. Its poor performance in the early 1990s mirrors the erratic performance of the filtered index of leading indicators described in Table 3, and suggests that this may be in part due to the inclusion of the Michigan SRC expectations index as a leading indicator series.

Conclusions

Our conclusions can be simply summarized. The simple two-regime switching model provides a visually dramatic transformation of time series which draws attention to important features-movements into and out of recession - which are of great concern to researchers, policy makers and the general public. While the simple version of this model may be dominated in statistical terms by more complex versions, with multiple regimes and complex dynamics, the complex versions are -- not necessarily more insightful. On the contrary, conventional statistical criteria for model specification may not adequately reflect the loss functions of the users of such models.

Application of the simple two-regime switching model shows that there is information in the Conference Board consumer confidence index which is helpful in predicting switching points in the Commerce Department coincident index of economic activity. The lead between consumer confidence and the indicator varies, but on only one occasion, in 1974, did the confidence index give a (weak) false signal.

Comparison of the consumer confidence index with the current index of leading indicators is problematical, since the leading index is regularly redefind to optimize its past performance, whereas the consumer confidence index is never revised. However, it is clear that the consumer confidence index performed much better in tracking the recession and recovery of 1990-4. Comparison of the overall confidence index with the narrower expectations index suggests that the overall index is less noisy, and consequently less prone to give false signals. It is therefore not obvious that a consumer expectations index is the most natural candidate for inclusion in the index of leading indicators.

Table 1. Two-Regime Markov Switching Models

	Coincident Index	Leading Index	Consumer Confidence	
	AR(0)	*AR(0)*	*AR(0)*	*AR(1)*
μ_1	102.0 (0.12)	101.9 (0.15)	102.3 (0.93)	93.5 (1.29)
μ_2	97.38 (0.14)	96.62 (0.20)	69.90 (1.34)	71.53 (6.92)
σ_2	1.92 (0.16)	3.78 (0.31)	130.62 (11.15)	25.31 (2.19)
p_1	0.98 (0.01)	0.98 (0.01)	0.98 (0.01)	0.98 (0.01)
p_2	0.97 (0.02)	0.96 (0.02)	0.96 (0.02)	0.94 (0.03)
ρ				0.95 (0.02)
log-likelihood	-282.3	-387.5	-944.3	-695.5

Note: Estimated on monthly data, Jan 1970 - Feb 1995.

Figures in parentheses are standard errors.

Table 2. Switching Regime Chronology: Coincident Index

Recession			Normal/ Boom		
Enter BAD	*NBER Trough*	Leave BAD	Enter GOOD	*NBER Peak*	Leave GOOD
			7/69	*12/69*	1/70
3/70	*11/70*	8/72	10/72	*11/73*	12/74
12/74	*3/75*	5/77	7/77	*1/80*	5/80
6/80	*7/80*				
	11/82	6/84	9/84	*7/90*	10/90
12/90	*3/91*	12/94			

Table 3. Switching Regime Chronology: Leading Index

Enter BAD		Leave BAD		Enter GOOD		Leave GOOD	
						3/70	*(+2)*
5/70	*(+2)*	3/71	*(-17)*	5/71	*(-17)*	8/74	*(-4)*
9/74	*(-3)*	2/76	*(-10)*	6/76	*(-13)*	11/79	*(-6)*
12/79	*(-6)*	6/83	*(-12)*	8/83	*(-13)*	12/90	*(+2)*
2/91	*(+2)*	8/91					
11/91		5/92					
8/92		1/93					
4/93		12/93	*(-12)*	3/94			

Note: Figures in parentheses after switch dates show lead (-) or lag (+) in indicator relative to corresponding switch dates for the coincident indicator in Table 2.

Table 4. Switching Regime Chronology: Consumer Confidence Index

Enter BAD		Leave BAD		Enter GOOD		Leave GOOD	
						11/70	*(+10)*
1/71	*(+10)*	2/72	*(-6)*	4/72	*(-6)*	12/73	*(-12)*
1/74	*(-11)*	4/74		6/74		8/74	
10/74	*(-2)*	12/75	*(-17)*	2/76	*(-17)*	7/79	*(-10)*
2/80	*(-4)*	8/83	*(-10)*	12/83	*(-9)*	9/90	*(-1)*
10/90	*(-2)*	4/94	*(-8)*	7/94			

Note: Figures in parentheses after switch dates show lead (-) or lag (+) in indicator relative to corresponding switch dates for the coincident indicator in Table 2.

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