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Business Confidence and Cyclical Turning Points: A Markov-Switching Approach

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Abstract

Markov regime-switching analysis is used to consider the relationship between business confidence and the probability of turning points in cyclical GDP. We find, in an application to New Zealand, that confidence is related to both the deepness and duration of the business cycle and is asymmetric regarding the probability of the economy remaining in a given regime. Overall, the New Zealand business confidence series is a useful indicator of cyclical turning points.

Key Words

business confidence

business cycles

Markov-switching

New Zealand

JEL Classification

C22; E32

I. Introduction

Business opinion surveys attract media, forecaster, industry and policymaker interest primarily because they contain a wide range of timely information for decision-makers and indicators for yet-to-be published official statistics. One particular interest is whether or not a turning point has been reached or is likely to occur. In this respect, the business confidence series is often used as an early-warning indicator of cyclical turning points especially if the incidence of 'false calls' is low. This indicator (and others, for example, counting successive periods of negative growth, Granger causality tests and impulse response functions) can also be supplemented by a wide range of statistical techniques to determine turning points. (See Massmann, Mitchell and Weale 2003 for a survey).

In this paper, we use the Markov-switching technique to consider the relationship between business confidence and the probability of turning points in real GDP in New Zealand. This theme, as Taylor and McNabb (2007) remark, has been subject to relatively little empirical scrutiny. We are interested particularly in two questions: how reliable is business confidence as an indicator of cyclical turning points and are there asymmetries in the confidence-cyclical relationship? To assist us in answering these questions, we develop and employ a two-regime Markov switching model with time-varying transition probabilities. Our methodology, which can be applied to similar data series in other countries, builds on Batchelor (2001) who used Markov-switching analysis to consider the relationship between American and British surveys of consumer and business confidence and turning points in economic activity.[1] In what follows, Section II outlines our regime-switching models, Section III covers empirical work while our conclusions are in Section IV.

II. Confidence and Output Switching

Suppose a discrete random variable S_t takes two possible values $S_t = [0,1]$ and serves as an indicator for the state of the economy at time *t*. Let y^c denote cyclical output as the difference between the natural logarithms of observed output and trend output. Similarly, let *conf* denote cyclical confidence as the difference between actual and trend confidence. The

[1] Other applications of Markov switching to business survey data, although not explicitly to business confidence, include Amstad (2000) and Amstad and Etter (2000). For a survey of early-warning systems in a regime-switching context see, for example, Abiad (2003).

expected cyclical component of output, conditional on the value of S_t, is given by equation (1):

$$E(y_t^c \mid S_t) = [(1-S_t)\mu_0 + S_t\mu_1] + (1-S_t)\sum_{i=1}^{k}\beta_{0i}conf_{t-i} + S_t\sum_{i=1}^{l}\beta_{1i}conf_{t-i} + (1-S_t)\sum_{i=1}^{m}\lambda_{0i}y_{t-i}^c + S_t\sum_{i=1}^{n}\lambda_{1i}y_{t-i}^c + \varepsilon_t \quad (1)$$

where $\varepsilon_t \sim i.i.d.N\left(0,\sigma^2(S_t)\right)$ allows the variance to change across regimes. The unobserved indicator variable, S_t, evolves according to the following first-order Markov-switching process described in Hamilton (1989):

$$P\left[S_t = 0 \mid S_{t-1} = 0, conf_{t-1}, conf_{t-2}, \cdots\right] = p_t = \Phi\left(\delta_0 + \sum_{i=1}^{m}\gamma_{0i}conf_{t-i}\right)$$

$$P\left[S_t = 1 \mid S_{t-1} = 1, conf_{t-1}, conf_{t-2}, \cdots\right] = q_t = \Phi\left(\delta_1 + \sum_{i=1}^{n}\gamma_{1i}conf_{t-i}\right) \quad (2)$$

$\Phi(\cdot)$ refers to the cumulative density function of the standard normal distribution. This function ensures that the time-varying transition probabilities p_t and q_t lie in the open interval (0,1). The relationships expressed in (2), then, reflect the *duration* of the output-confidence relationship expressed in (1). Our estimation is based on the following three models.

Model I: Fixed Transition Probabilities

This is the Hamilton Markov-switching specification represented by the restrictions:

$$\beta_{0i} = \beta_{1i} = \gamma_{0i} = \gamma_{1i} = 0, \forall i .$$

Under these restrictions, there is no role for confidence in either the mean equation or the determination of the transition probabilities.

Model II: Time-varying Transition Probabilities

In this specification, confidence enters the transition probabilities only, therefore:

$$\beta_{0i} = \beta_{1i} = 0, \forall i; \gamma_{0i}, \gamma_{1i} \neq 0 .$$

Here, confidence affects the probability of remaining in a given regime and therefore the average duration of remaining in the regime. It is through this channel that confidence determines the turning points between recessionary and expansionary regimes.

Model III: Time-varying Transition Probabilities

This is a generalised specification where confidence enters *both* the mean and the transition probabilities, therefore:

$$\beta_{0i}, \beta_{1i}, \gamma_{0i}, \gamma_{1i} \neq 0 \,.$$

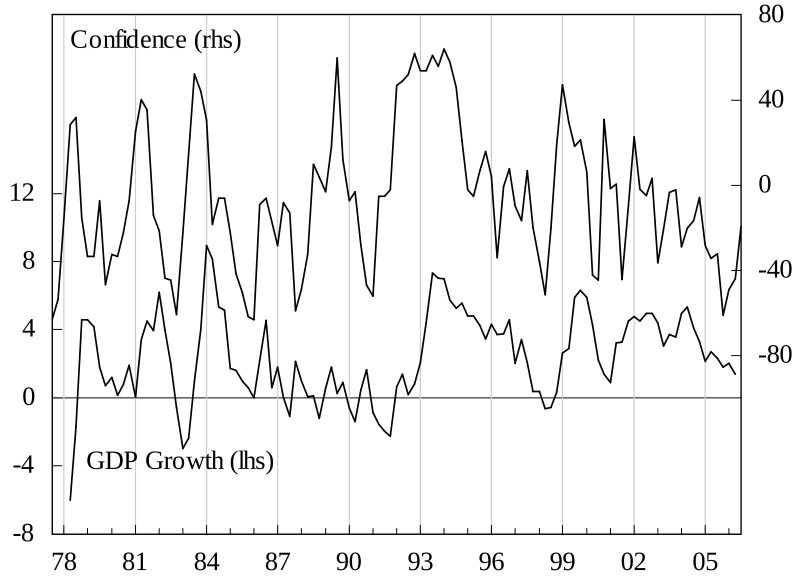
In this model, confidence affects *both* the *deepness* and the *duration* of each cyclical regime. This specification differs from Bachelor (2001) who allows confidence to influence duration only. A second distinction from Batchelor is that we allow the variance of cyclical output to be regime-dependent rather than fixed. This permits us to reflect on the impact of confidence against a background of high and low output volatility.

III. Data and Estimation

This paper is concerned primarily with just three series: business confidence, GDP and, as a basis for comparison, expected own-output. The data on confidence and own-output are taken from a quarterly survey of business opinion conducted by the New Zealand Institute of Economic Research (NZIER) from firms in the manufacturing, building, merchant and service sectors. With one exception, all questions in the survey relate to the microeconomic experiences and outlook of respondents regarding profitability, output, employment, investment intentions, costs, prices and related variables. The remaining question seeks each respondent's overall confidence outlook and asks: 'Do you expect the general business situation during the next six months to improve, stay the same or deteriorate?' The replies (for both confidence and own-output) are published as net balances, that is, the difference between the percentage replying 'improve' and the percentage replying 'deteriorate'. The output series is quarterly, seasonally adjusted real GDP and is taken from official statistics.

Figure 1 plots New Zealand's business confidence net balance and real GDP growth between 1977:2 and 2006:3. The forward-looking nature of the business confidence series in Figure 1 was confirmed by a preliminary finding of positive correlations between lagged confidence and GDP growth. In addition, Granger causality testing indicated the presence of unidirectional causality running from confidence to changes in GDP growth.

Fig. 1. Real GDP Growth and Confidence 1977-2006, Percent



For estimation we use Baxter-King cyclically detrended GDP and the confidence and own-output net balances for New Zealand from 1977:2 to 2006:3. The estimates of the log likelihood values associated with each model are reported in Table 1. Having started with a maximum of six lags, the inclusion of one lagged value of y^c and *conf* in the conditional mean process and lagged *conf* in the state transition probability process was found to be acceptable using various model selection procedures. Compared with the benchmark specification (Model I), the generalised model (Model III) achieves a significant improvement in the likelihood function according to conventional likelihood ratio tests. Moreover, the likelihood ratio statistic of 21.280 is distributed as $\chi^2(4)$ on the null. In comparing Model III against II, the likelihood ratio statistic of 6.422 is distributed as $\chi^2(2)$ on the null. These results lead to the choice of Model III as the preferred model. A similar conclusion is reached using expected own-output.

Table 1. Log likelihood values for each model

	Business Confidence	Expected Own-Output
Model I	-150.453	
Model II	-143.024	-142.590
Model III	-139.813	-138.560

Table 2 reports estimation results. Regarding business confidence, rejection of the null $\mu_0 = \mu_1$ is consistent with the mean cyclical output rate being lower in Regime 1 ($\mu_0 > \mu_1$). This suggests that Regimes 0 and 1 may be described as outcomes where output is above and below trend, respectively. The values of σ_0 and σ_1, together with the rejection of the null $\sigma_0 = \sigma_1$, suggests that Regime 0 is also characterised by relatively lower output volatility. Across the two regimes, the state-dependent confidence coefficient (β_{01}, β_{11}), is positive and significant in both regimes. Acceptance of the null hypothesis, $\beta_{01} = \beta_{11}$, indicates the presence of symmetric behaviour, that is, improved confidence exerts an equal positive impact on GDP irrespective of which phase of the cycle the economy is experiencing.

Regarding the transition probabilities for each state, we find that $\gamma_{01} > 0$ and $\gamma_{11} < 0$. These results indicate that an increase in business confidence is associated with an increase (decrease) in the probability of remaining in the expansionary Regime 0 (recessionary Regime 1). Furthermore, rejection of the null hypothesis $|\gamma_{01}| = |\gamma_{11}|$ indicates a degree of asymmetry whereby a given increase (decrease) in business confidence exerts a stronger effect by prolonging (weakening) an expansionary regime rather than shortening (prolonging) a recessionary regime. There is also general support for these findings using expected own-output data. An increase in expected own-output, however, appears more likely to reduce the probability of remaining in the recessionary regime rather than increasing the probability of remaining in the expansionary regime.

Using the business confidence results from Model III, Figure 2a plots the inferred probabilities of the New Zealand economy being in the expansionary Regime 0 against actual real GDP growth. A strong positive association between these two series is present. In Figure 2b (Figure 2c), positive (negative) turning points are represented by a switch from a low (high) to a high (low) probability of being in Regime 0 (Regime 1). Figure 2b identifies positive turning points - such as 1978:3, 1983:4, 1989:4 and 1999:2 - being preceded by an upward spike in $(1-q)$ which is the probability of switching from Regime 1 to Regime 0. Figure 2c depicts negative turning points from Regime 0 to Regime 1 - such as 1983:1, 1986:1, 1988:1, 1991:1, 1998:3 and 2000:4 - being preceded by an upward spike in $(1-p)$.

Table 2. Estimation of Model III

Coefficient	Business Confidence	Expected Own-Output
Regime 0: Expansionary		
$(1-S_t)\mu_0$	0.178***	0.144**
$(1-S_t)\beta_{01}$	0.006**	0.010*
$(1-S_t)\lambda_{01}$	0.693***	0.714***
σ_0	0.268***	0.259***
Regime 1: Recessionary		
$S_t\mu_1$	-0.340*	-0.212
$S_t\beta_{11}$	0.016***	0.038**
$S_t\lambda_{11}$	0.718***	0.616***
σ_1	1.482***	1.486***
Transition Probabilities		
δ_0	5.092***	1.905***
γ_{01}	0.129***	0.050
δ_1	2.410***	10.080***
γ_{11}	-0.045***	-0.986***
Tests of Restrictions		
$\mu_0 = \mu_1$	6.233**	2.958*
$\beta_{01} = \beta_{11}$	2.162	2.767*
$\lvert\gamma_{01}\rvert = \lvert\gamma_{11}\rvert$	8.596***	30.356***
$\sigma_0 = \sigma_1$	38.907***	43.859***

Estimates are for the regime-switching models described by equations (1) and (2). Chi-square statistics are reported for the hypothesis tests. ***, ** and * denote rejection of a zero null at the 1, 5 and 10 percent significance levels, respectively.

Fig. 2a. Inferred Probability of being in Expansionary Regime

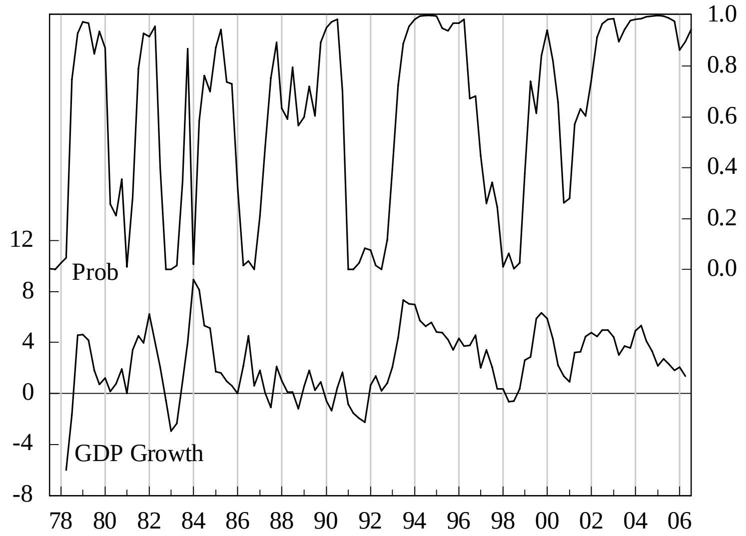


Fig. 2b. Probability of Switching from Recessionary to Expansionary Regime

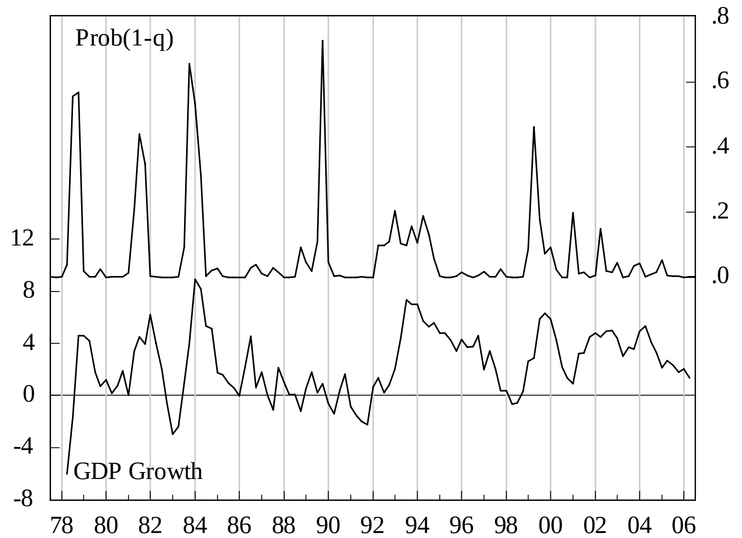
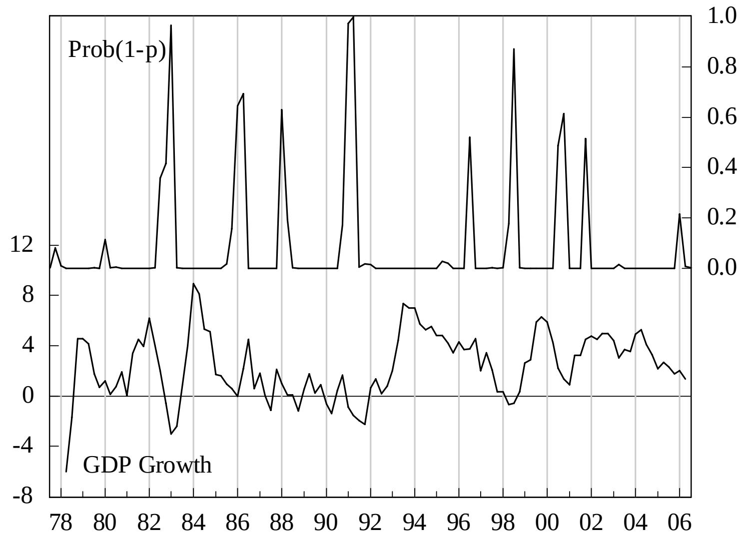


Fig. 2c. Probability of Switching from Expansionary to Recessionary Regime



In contrast to Batchelor's (2001) US-UK Markov study, we find symmetric effects in terms of cycle deepness, asymmetries in terms of cycle duration and relatively few 'false calls'. In contrast to Taylor and McNabb's (2007) European study, which used alternative methodologies, our regime-switching perspective suggests that confidence is also useful at predicting upturns as well as downturns.

IV. Conclusions

This paper has been concerned primarily with just two issues, namely, the reliability of business confidence and own-output to anticipate regime switching and the identification of possible asymmetries. We found that both regimes exhibit equal sensitivity of cyclical output to cyclical confidence in terms of the deepness of the cycle. In addition, asymmetries are present insofar as the duration of the expansionary phase of the cycle is relatively more sensitive to confidence than the recessionary phase. Overall, we find that the New Zealand business confidence series is a useful indicator of cyclical turning points. Further research could follow from our study, such as the relationship between business confidence and growth at a more disaggregated, sector, level.

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