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THE NORWEGIAN CONSUMPTION FUNCTION: A COMMENT

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INTRODUCTION AND SUMMARY

This comment discusses some aspects of the error correction model for the Norwegian consumption function proposed in Brodin and Nymoen (1991). The main focus is on the pursued simplification process since the simplified model contains an error correcting variable that includes a contemporaneous variable, and it further includes combinations of variables which may be hard to interpret. Additionally, it can be observed from the initial general model that adjustment to equilibrium is rather quick, and that the parameters in the cointegration relation are about equal to those for the unlagged variables. As will be demonstrated, this implies that the model may lack the dynamics that correspond to an error correction mechanism, an occurrence which can be tested with a joint F test. These comments provide a challenge to specify an alternative error correction model. The result of this exercise is that an appropriate model for the Norwegian consumption turns out to be an extended cointegrating regression.

I. THE NORWEGIAN CONSUMPTION FUNCTION BY BRODIN AND NYMOEN

A central issue of the general error-correction model for consumption in Norway for the period 1966(1)–1989(4) developed in Brodin and Nymoen (1991) is a cointegration relationship between log expenditures c_t, log income y_t and a broad measure of households' wealth w_t. To test for the presence of cointegration, as well as to estimate the parameters in the cointegrating vector, the authors apply the Johansen and Juselius (1990) procedure. In their general, possibly overparameterized, model, Brodin and Nymoen rely on the results obtained by Bårdsen (1989) and estimate the error correcting variable and its adjustment parameter in an unrestricted error correction model. Apart from dummy variables for the quarters and for the introduction

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of the VAT, and also apart from two price variables and lagged Δc_t, Δy_t and Δw_t, where Δ denotes the first order differencing filter, the initial model looks like

$$\underset{}{\Delta c_t} = \underset{(0.205)}{-0.925 c_{t-1}} + \underset{(0.113)}{0.514 y_{t-1}} + \underset{(0.061)}{0.253 w_{t-1}} + \underset{(0.107)}{0.432 \Delta y_t} + \underset{(0.099)}{0.291 \Delta w_t}, \tag{1}$$

where the numbers in parentheses are the standard errors. The implied long-run relation is estimated to be

$$c_t = \text{constant} + \underset{(0.031)}{0.556 y_t} + \underset{(0.018)}{0.274 w_t}, \tag{2}$$

where the standard errors are obtained using the Bårdsen (1989) method. The model in (1) (or table 5.1 in Brodin and Nymoen's paper) appears to be overparameterized since some parameters seem to be insignificantly different from zero, while others obtain coefficients that are approximately equal. Hence, the authors proceed with a simplification strategy by imposing various parameter restrictions. Their final model (5.2) contains an error correcting variable,

$$c_{t-1} - 0.56 y_{t-1} - 0.27 w_t, \tag{3}$$

where w_t is included since Δw_t and w_{t-1} have about the same coefficient in (1). Further, the model includes the ΔVAT dummy and three seasonal dummies, a linear combination of two price variables denoted as $\Delta \text{STOP}_t - \Delta_4 \Delta pc_t$ (see the appendix in Brodin and Nymoen's paper for variable definitions), and the variables

$$\Delta y_t + \Delta_4 \Delta y_t + 2\Delta c_{t-4} \quad \text{and} \quad \Delta c_{t-2} + \Delta(c-y)_{t-3} + \Delta(c-y)_{t-5}, \tag{4}$$

which capture the dynamics of the model, where Δ_4 denotes the fourth order differencing filter. The value of the estimated adjustment parameter falls from -0.925 in (1) to -0.708 in the final model.

Several comments on this empirical model can now be made. The first concerns the test for the presence of cointegration. Although the Johansen and Juselius method can be informative on aspects as exogeneity, there is a simpler method to test for cointegration in a single equation framework. The approach in Boswijk (1991), which amounts to testing the significance of the adjustment parameter, can straightforwardly be applied to the error correction model in (1), or preferably to a less parameterized version.

The second comment deals with the final simplified model. Although the precise simplification steps are not given, it somehow seems unsatisfactory that the authors end up with an error correction variable like (3), and, to a lesser extent, with variables like (4), which may be hard to interpret.

The third comment considers the value of the adjustment parameter. This value in (1) comes close to -1, which implies that the adjustment to the equilibrium is rather quick. Moreover, the parameters for both Δy_t and Δw_t

in (1) are also close to those in the cointegration relation in (2). Together this suggests that there may be no error correction dynamics at all. To clarify this, consider the simple bivariate error correction model

$$\Delta z_t = a\Delta x_t + \gamma(z_{t-1} - \beta x_{t-1}) + \varepsilon_t, \tag{5}$$

which can be written as

$$z_t = ax_t + (1+\gamma)\, z_{t-1} + (-a - \beta\gamma)\, x_{t-1} + \varepsilon_t. \tag{6}$$

In case a equals β and γ equals -1, it is easy to see that (5) reduces to

$$z_t = ax_t + \varepsilon_t, \tag{7}$$

or that the parameters for z_{t-1} and x_{t-1} in (6) are zero. A simple test is now given by estimating model (6) and checking the significance of these parameters with a joint F test. When the z_t and x_t are nonstationary, the distribution of this test statistic may not be standard, and hence it can only be used as a rough measure.

II. AN ALTERNATIVE NORWEGIAN CONSUMPTION FUNCTION

These comments on the Brodin and Nymoen consumption function indicate that an alternative model for the Norwegian data may be more appropriate. I have decided to re-estimate their general model with the same set of data, while deleting the apparently not important lagged Δw_t variables and one price variable. I do not expect that the forthcoming results will change when these variables are included. The data were kindly provided by Ragnar Nymoen. My initial model contains a constant, three seasonal dummies, the ΔVAT dummy, the untransformed variables c_{t-1}, y_{t-1} and w_{t-1}, the variables Δy_t and Δw_t, and the first order differenced income and consumption variables up till the fifth lag. Preliminary analysis has indicated that the parameter for a linear trend was not constant over the sample, and therefore it is not included in the model. So far, there are almost no differences with respect to the Brodin and Nymoen model. The usual set of misspecification checks do not cause alarm, and, given that there are some possibilities for imposing parameter restrictions, I proceed with a simplification search. In this search, I do not touch upon the variables in levels since these are necessary for testing for cointegration, and I merely focus on the lagged Δc_t and Δy_t variables. My final error correction model turns out to be

$$\begin{aligned}\Delta c_t = &-\underset{(0.108)}{1.013}c_{t-1} + \underset{(0.063)}{0.564}y_{t-1} + \underset{(0.033)}{0.277}w_{t-1} + \underset{(0.086)}{0.473}\Delta y_t + \underset{(0.070)}{0.305}\Delta w_t \\ &+ \underset{(0.042)}{0.228}(1 + B + B^2 + 2B^3 + B^4)\,\Delta(c-y)_{t-1}\end{aligned} \tag{8}$$

The model further includes the significantly contributing seasonal dummies Q_{1t}, Q_{2t} and Q_{3t}, the ΔVAT dummy and the variable $\Delta STOP_t - \Delta_4\Delta pc_t$.

The Boswijk (1991) Wald test for cointegration considers the empirical relevance of the three variables c_{t-1}, y_{t-1} and w_{t-1}. It obtains a value of 29.600, and the null hypothesis of no cointegration can be rejected. Note again that in this stage no parameter restrictions with respect to, e.g., Δw_t and w_{t-1} are imposed. From (8) one can see that the adjustment parameter approaches -1, and that the parameters in the cointegration relation are close to the parameters for Δy_t and Δw_t. A formal check of the occurrence of no error correction dynamics is provided by estimating model (8) in a form similar to (6), and testing the significance of the one period lagged variables. The corresponding F test statistic yields a value of 0.366, of which it can safely be assumed that it is not significant. Altogether this results in a simple alternative model for the Norwegian consumption, which is given by

$$\underset{}{c_t} = \underset{(0.120)}{1.353} - \underset{(0.005)}{0.108}Q_{1t} - \underset{(0.006)}{0.048}Q_{2t} - \underset{(0.005)}{0.091}Q_{3t} + \underset{(0.010)}{0.054}\Delta\text{VAT}_t + \underset{(0.023)}{0.555}y_t$$
$$+ \underset{(0.012)}{0.276}w_t + \underset{(0.064)}{0.234}(\Delta\text{STOP}_t - \Delta_4\Delta pc_t)$$
$$+ \underset{(0.034)}{0.230}(1 + B + B^2 + 2B^3 + B^4)\Delta(c-y)_{t-1} \tag{9}$$

1968(3)–1989(4) $T=86$ $k=9$ $R^2=0.995$ $\hat{\sigma}=1.39\%$

$F_{\text{AR1-1}}(1,76)=0.003$ $F_{\text{AR1-6}}(6,71)=0.560$ $\chi^2_N(2)=0.188$

$F_{\text{ARCH1-4}}(4,69)=0.150$ $F_{\text{HET-}x_ix_j}(13,63)=0.742$ $F_{\text{RESET}}(1,76)=0.034$

$F_{\text{CHOW}}(20,57)=0.82$ Predictive failure $\chi^2(20)/20=1.49$

Moreover, sequences of break-point Chow statistics and checks for parameter constancy using recursive estimation do not change the impression that this model passes a battery of diagnostic checks. Encompassing checks of model (8) versus Brodin and Nymoen's model indicates that neither of the models encompasses the other.

The economic implications of (9) are that, apart from deterministics, consumption is effected by current income and wealth, and that the dynamics are established by an average of past changes in consumption/income ratios. Statistically speaking, it emerges that an appropriate dynamic model for Norwegian consumption is an extended cointegrating regression.

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