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Technical Appendix to

DOES UNEMPLOYMENT COMPENSATION AFFECT UNEMPLOYMENT DURATION?*

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Appendix: The Business Cycle Indicator

The computation of our business cycle indicator c_t is based on a hazard rate model with the same dependent variable as the model in Section 3 (i.e. exits from unemployment). It builds on the idea the hazard rate is proportional in factors depending on calendar time, spell duration and (time varying) explanatory variables, respectively. The monthly exit probabilities are then parameterised as follows

$$h*(t,d,\mathbf{x}^*_{it}) = 1 - \exp[-\exp(\sigma^*_t + \mathbf{x}^*_{it}\beta^* + \lambda^*_d)]. \tag{3}$$

The vector of explanatory variables, $\mathbf{x}^*_{it}$, includes a total number of 70 covariates capturing age, gender, educational attainment, place of residence, nationality, economic incentives and work-experience (and some interaction terms between these variables). Since this model requires less information and fewer restrictions regarding the definition of new spells than the model in Section 3 of the printed paper, we can also use a much larger dataset. The total number of monthly observations used for the estimation of (3) is 2,188,052, which is essentially the complete register.

The parameters of interest in the present context are σ^*_t, i.e. the variation in transition probabilities related to the passage of calendar time. Note that we have not included unobserved heterogeneity in this particular model. However, attempts to do this on smaller data-sets have revealed that the inclusion of unobserved heterogeneity along the lines described in Section 3 primarily affects the estimates of spell duration effects (the λ^*_d are mixtures of structural duration dependence effects and selection due to unobservables). The estimates of calendar time effects are virtually unaffected. Our Maximum Likelihood estimates of σ^*_t, $\hat{\sigma}^*_t$ are illustrated in Figure 4, together with 95% point-wise confidence intervals, with September 1990 selected as the reference month.

The estimates reveal a substantial element of seasonal variation in exit rates, and the next step in the computation of our business cycle indicator is to remove these high-frequency movements. For this purpose, we rely on the well-established techniques embedded in the X-12-ARIMA filter (see Bureau of the Census (1999) for a detailed description) to establish the trend-cycle component in the point estimates displayed in Figure 4 ($c_t = trend - cycle_{\text{X12ARIMA}}(\hat{\sigma}_t)$). This method includes a trading day adjustment of the raw estimates. A potential disadvantage of this method is that we do not obtain satisfactory measures of uncertainty regarding the various components of the series, i.e. we are not able to report standard errors for the resulting business cycle estimator. However, in our case there is no sampling uncertainty since we use complete register data, hence we consider this problem to be of minor importance. The business cycle indicator (c_t) is displayed in Figure 5,

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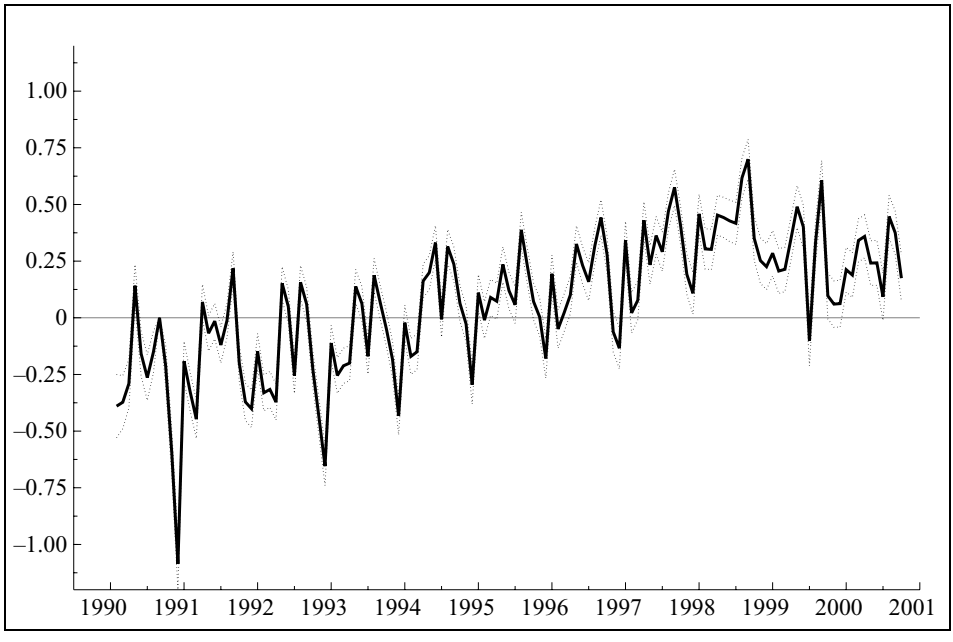

Fig. 4. *Estimated Calendar Time Effects ($\hat{\sigma}_t^*$) with 95% Confidence Intervals*

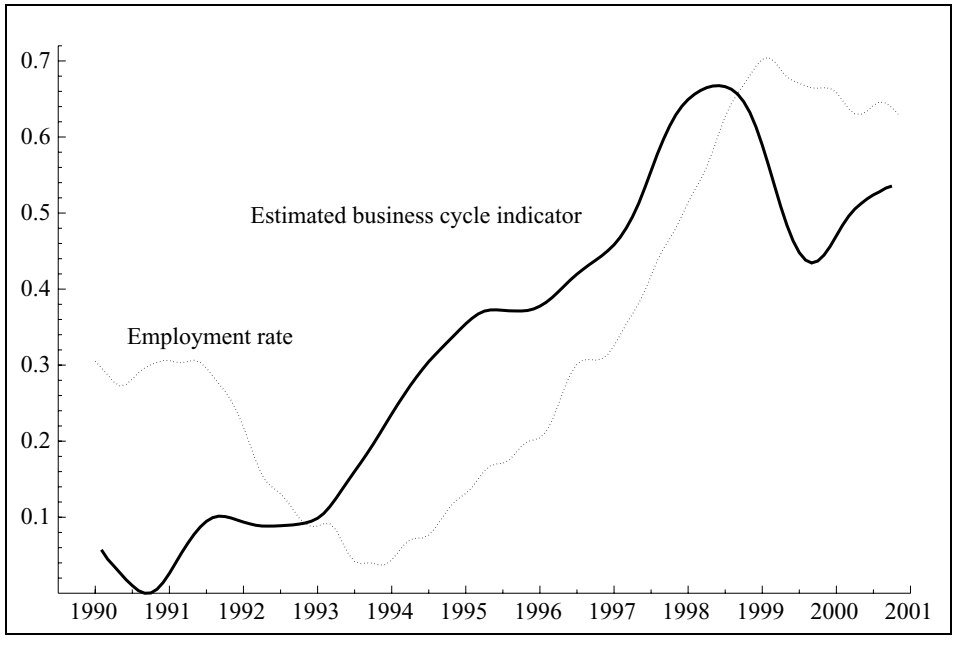

Fig. 5. *The Estimated Business Cycle Indicator (c_t) and the Aggregate Employment Rate* (smoothed with X-12-ARIMA and normalised to mach the mean and the range of the business cycle indicator)

together with the more 'standard' employment rate measure (one minus the rate of unemployment). As can be seen from the figure, the estimated indicator leads the employment rate measure. In Røed (2001), it is shown that the employment rate (as well as the aggregate outflow rate from unemployment) lags behind the 'true' changes in individual employment prospects due to systematic selection effects in the unemployment pool over the business cycle. It is also shown that estimated indicator gives a picture of the business cycle developments in Norway that accords well with recent GDP-based business cycle history evaluations.

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