

AN EMPIRICAL EXAMPLE: US UNEMPLOYMENT

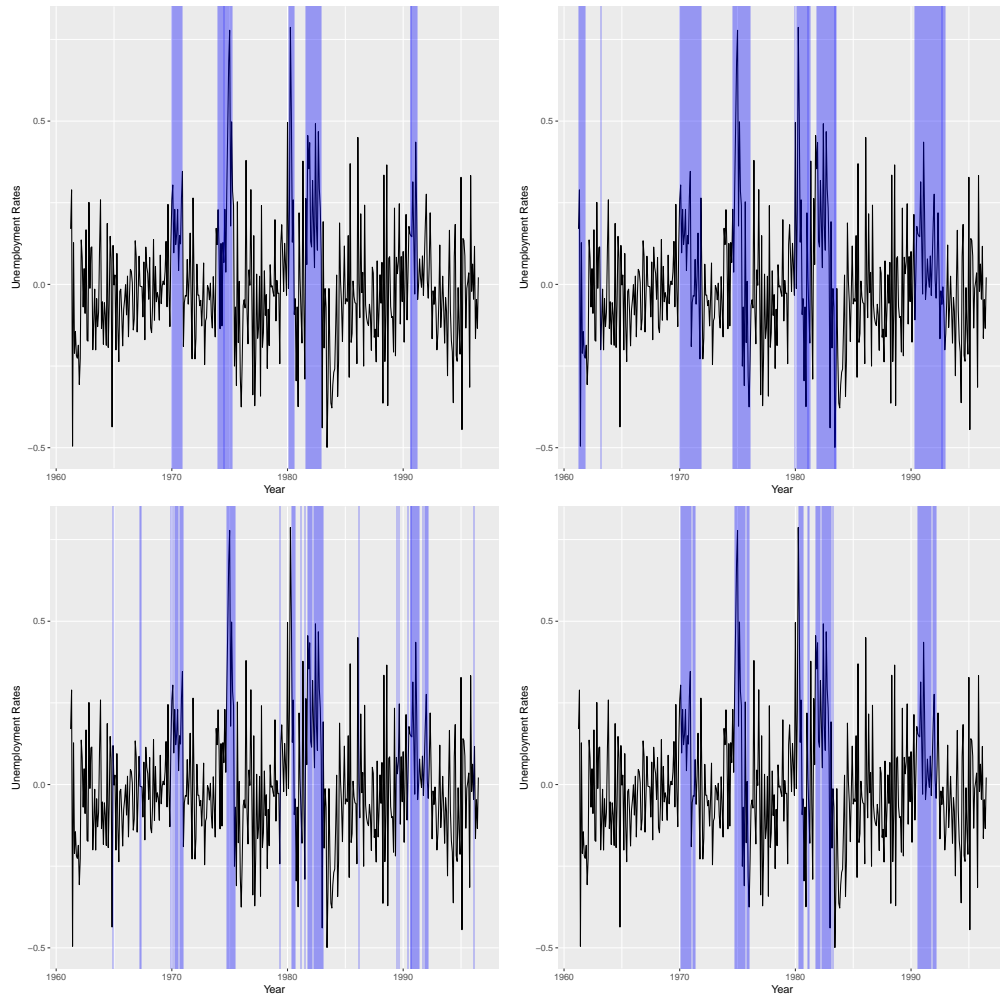
In this section, we revisit the empirical application in Hansen (1997), who used threshold autoregressive models for the US unemployment rate. Hansen (1997) measured unemployment among males age 20 and over and estimated his threshold model with the first-differenced series, say Δy_t , to avoid nonstationarity. The lag length in the autoregressive model was $p = 12$ and his preferred threshold variable was $q_{t-1} = y_{t-1} - y_{t-12}$. In this section, we investigate the usefulness of a macro factor obtained from a large macro dataset. In particular, we use the first factor, say F_t , of Ludvigson and Ng (2009) among eight common factors in their paper. The first factor not only explains the largest fraction of the total variation in their panel data set but also loads heavily on employment, production, and so on. They call it a real factor and thus it is a great candidate for explaining the unemployment rate. We consider three different specifications for f_t : (1) $f_{1t} = (q_{t-1}, -1)$, (2) $f_{2t} = (F_{t-1}, -1)$, and (3) $f_{3t} = (q_{t-1}, F_{t-1}, -1)$. That is, the first specification of f_t corresponds to Hansen (1997), the second one uses the first factor only, and the third case includes both. We combined the updated estimates of the first factor, which are available on Ludvigson's web page, with Hansen's data, yielding a monthly sample from March 1960 to July 1996 for our estimation purpose.

Table 1 reports the parameter estimates of regression coefficients and their heteroskedasticity consistent standard errors for each of three specifications. It also shows the goodness of fit by reporting the average of squared residuals and the results of regime classification by showing the proportion between the NBER recession indicators and regime indicators using three different specifications. Figure 1 gives the graphical representation of regime classification.

TABLE 1. Estimation Results

Specification	(1)		(2)		(3)	
	$f_{1t} = (q_{t-1}, -1)$		$f_{2t} = (F_{t-1}, -1)$		$f_{3t} = (q_{t-1}, F_{t-1}, -1)$	
	Estimate	Std. Err.	Estimate	Std. Err.	Estimate	Std. Err.
Regime 1	$q_{t-1} \leq 0.302$		$F_{t-1} \leq -0.28$		$q_{t-1} + 3.55F_{t-1} \leq -1.60$	
Intercept	-0.0214	0.0126	-0.0255	0.0101	-0.0294	0.0101
Δy_{t-1}	-0.1696	0.0640	-0.1182	0.0629	-0.1628	0.0601
Δy_{t-2}	0.0382	0.0650	0.0774	0.0558	0.0264	0.0600
Δy_{t-3}	0.1896	0.0587	0.2097	0.0645	0.1933	0.0520
Δy_{t-4}	0.1399	0.0630	0.1039	0.0523	0.1445	0.0552
Δy_{t-5}	0.0858	0.0749	0.0622	0.0600	0.0699	0.0656
Δy_{t-6}	0.0214	0.0653	0.0193	0.0558	0.0177	0.0613
Δy_{t-7}	0.0318	0.0678	-0.0268	0.0596	0.0174	0.0613
Δy_{t-8}	0.0402	0.0599	-0.0006	0.0617	0.0103	0.0626
Δy_{t-9}	-0.0667	0.0663	-0.0766	0.0660	-0.0637	0.0656
Δy_{t-10}	-0.0540	0.0640	-0.0120	0.0559	-0.0467	0.0575
Δy_{t-11}	0.0782	0.0568	0.0162	0.0529	0.0196	0.0528
Δy_{t-12}	-0.0899	0.0641	-0.1216	0.0576	-0.1224	0.0572
Regime 2	$q_{t-1} > 0.302$		$F_{t-1} > -0.28$		$q_{t-1} + 3.55F_{t-1} > -1.60$	
Intercept	0.0876	0.0375	0.0509	0.0560	0.1893	0.0576
Δy_{t-1}	0.2406	0.1179	0.3671	0.2011	0.2937	0.1665
Δy_{t-2}	0.2455	0.0932	0.2198	0.1634	0.1420	0.1279
Δy_{t-3}	0.1283	0.1038	0.0936	0.1563	0.1042	0.1549
Δy_{t-4}	-0.0222	0.1033	-0.0053	0.1883	-0.1035	0.1690
Δy_{t-5}	-0.0272	0.1104	-0.1804	0.2188	-0.0723	0.1868
Δy_{t-6}	-0.0851	0.1083	-0.0500	0.2125	-0.0821	0.1400
Δy_{t-7}	-0.1562	0.1057	-0.0297	0.2027	-0.1853	0.1443
Δy_{t-8}	-0.0372	0.1357	0.0021	0.2923	-0.1214	0.2038
Δy_{t-9}	0.0991	0.1358	0.0754	0.1754	-0.0861	0.1475
Δy_{t-10}	0.1149	0.1125	0.0445	0.1574	0.0392	0.1426
Δy_{t-11}	-0.1012	0.1256	0.1872	0.1995	-0.0307	0.1840
Δy_{t-12}	-0.4440	0.1144	-0.2269	0.1668	-0.3807	0.1542
Avg. of squared residuals						
$(T^{-1} \sum_{i=1}^T \widehat{\varepsilon}_t^2)$	0.0264		0.0272		0.0252	
Proportion of matches between NBER recession dates and threshold estimates						
	0.807		0.894		0.896	

FIGURE 1. Regime Classification



Note. The top left panel shows NBER recession dates in the shaded area, the top right panel displays regime 1 with specification (1), and the bottom left and right panels show regime 1 with specifications (2) and (3), respectively.