Online Appendix for Oil Price Volatility, Endogenous Regime Switching and Macroeconomic Factors [*]

Yoosoon Chang [†]
Indiana University

Ana María Herrera [‡]
University of Kentucky

Elena Pesavento [§]
Emory University

February 13, 2023

[†]Indiana University, Email: yoosoon@indiana.edu.
[‡]University of Kentucky, Email: amherrera@uky.edu.
[§]Emory University, Email: epesave@emory.edu.

A Estimation with Brent Prices

This section contains the results from the estimation of the endogenous regime switching model with one and two (asynchronous) Latent factors for returns computed with Brent Oil prices. The data are monthly data from May 1987 to January 2021. Volatility is computed as the sum of daily squared returns. The estimated models are described in Section 2 of the main paper. 68% confidence intervals are computed using Stationary Block Bootstrap.

Table A.1: Descriptive Statistics

Monthly (demeaned) Brent return	
mean	0.003
std	0.100
max	0.469
75 quantile	0.062
median	0.009
25 quantile	-0.050
min	-0.555

Table A.2: One Factor Volatility Switching Model

Parameters	Estimates	68% CI
τ	3.617	[1.896, 4.739]
ρ	-0.794	[-1.000, -0.423]
α	0.902	[0.760, 0.945]
σ_0	0.075	[0.068, 0.080]
σ_1	0.281	[0.173, 0.350]
log-likelihood	415.484	[400.181, 469.012]

Table A.3: Two factors model: Unsynchronized Switching Model

Parameters	Estimates	68% CI
τ_1	-1.090	[-1.346, -1.090]
τ_2	7.727	[6.324, 8.067]
ρ_{u,v_1}	0.426	[0.245, 0.426]
ρ_{u,v_2}	-0.791	[-0.927, -0.723]
ρ_{v_1,v_2}	-0.891	[-0.891, -0.542]
α_{11}	0.307	[0.307, 0.546]
α_{21}	-1.544	[-1.632, -1.412]
α_{12}	0.008	[0.008, 0.014]
α_{22}	0.840	[0.777, 0.840]
μ_0	-0.099	[-0.103, -0.099]
μ_1	0.020	[0.016, 0.022]
γ_1	0.069	[0.069, 0.194]
σ_0	0.064	[0.060, 0.064]
σ_1	0.255	[0.174, 0.267]
log-likelihood	430.205	[392.652, 458.160]
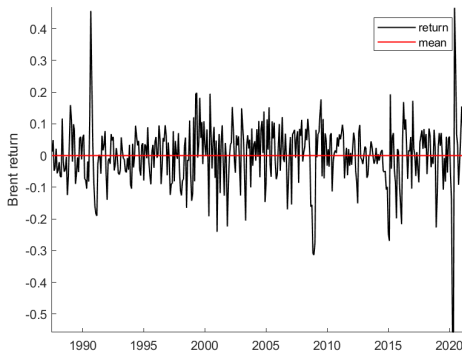
(a) Returns
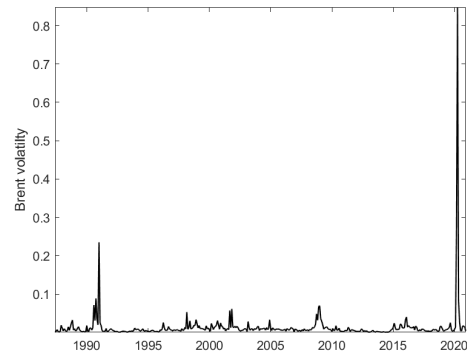
(b) Volatility

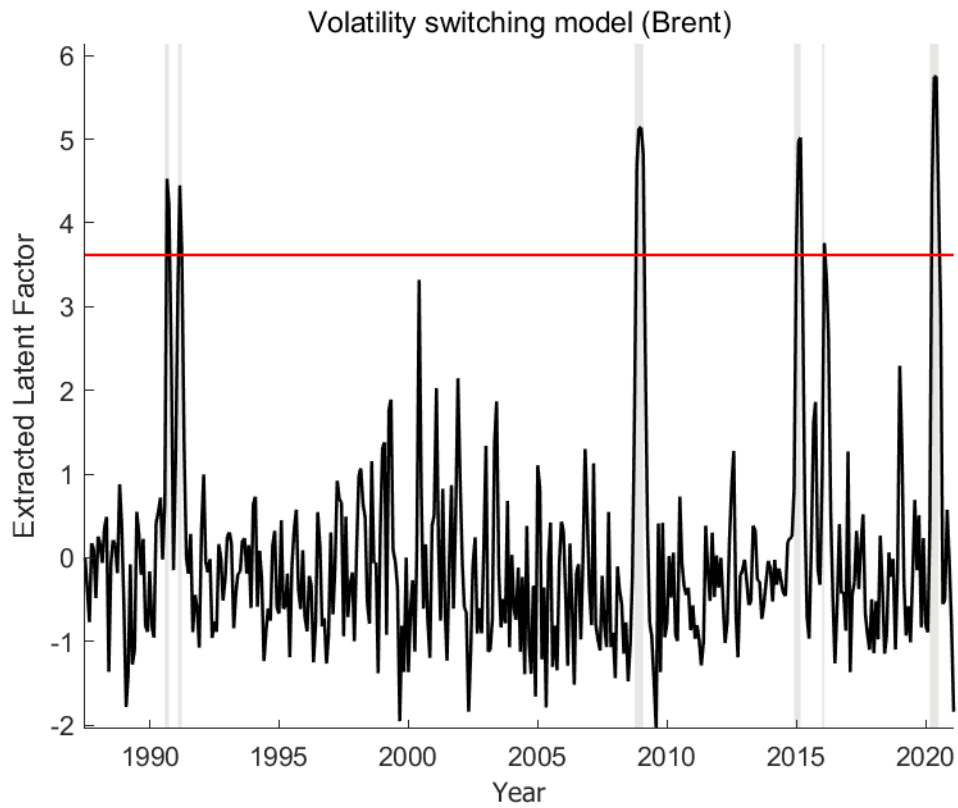Figure A.1: Evolution of Monthly Brent Prices Returns and Volatility
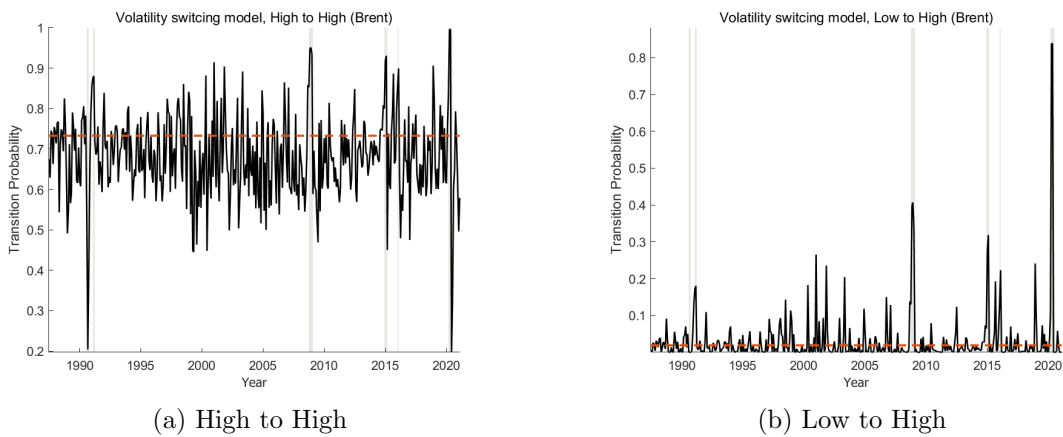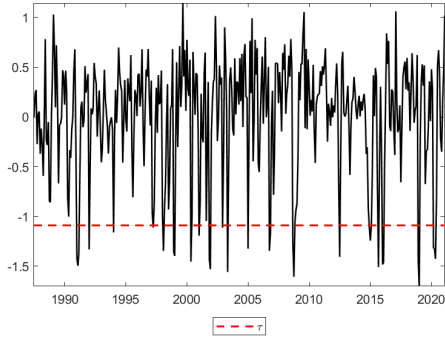
Figure A.2: Extracted Latent Factor: Volatility Switching Model
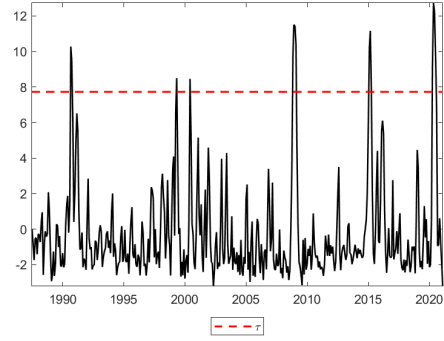

(a) High to High

(b) Low to High

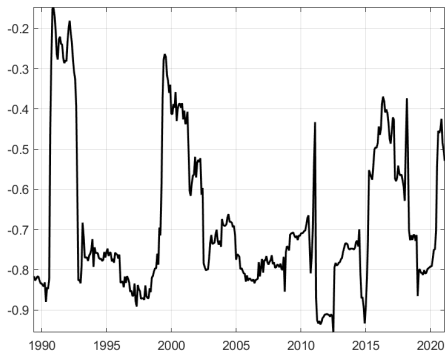Figure A.3: Transition Probabilities for One Factor Model - Brent
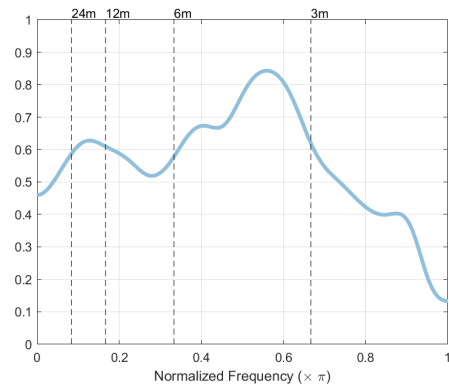
(a) Mean Factor

(b) Volatility Factor

Figure A.4: Extracted Factors - Unsynchronized Mean and Volatility for Brent
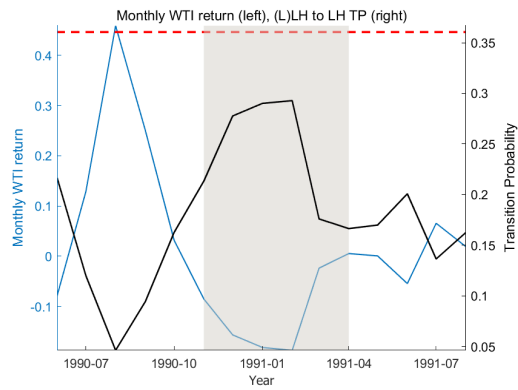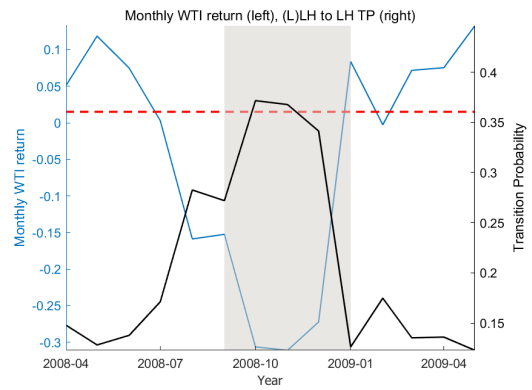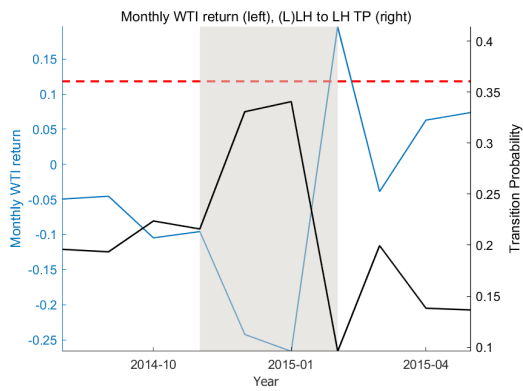

(a) Correlation

(b) Coherence

Figure A.5: Correlation and Coherence between Extracted Latent Factors
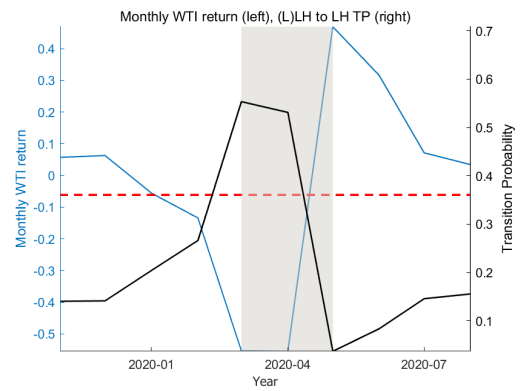
4

(a) Persian Gulf War

(b) Great Recession

(c) Oil Price Collapse

(d) Covid-19 Pandemic

Figure A.6: High-to-High Transition Probabilities and Brent Returns