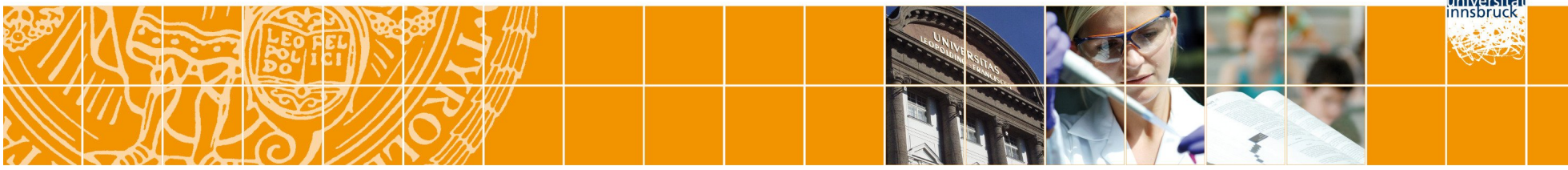

UNIVERSITAS

Universität Innsbruck



Structural Breaks in Inflation Dynamics within the European Monetary Union

Thomas Windberger, Achim Zeileis

`http://R-Forge.R-project.org/projects/glogis/`

Overview

- Introduction
- Data
  - HICP
- Methods
  - Model
    - Test
  - Distribution reasoning
- Results

Introduction

- Did EMU change inflation dynamics ?
- Economic Reasons

Data

- 21 Monthly HICP series, unadjusted
- Source: OECD Statistics

HICP

First step: local sub–index of a specific price collected item R_{iy}^t:

$$R_{iy}^t = \frac{(\prod_{j=1}^n p_{iyj}^t)^{1/n}}{(\prod_{j=1}^n p_{iyj}^0)^{1/n}} \quad (1)$$

Second step: sub–index for whole country R_i^t:

$$R_i^t = \sum_{y=1}^m R_{iy}^t G_y \quad (2)$$

$$R_h^{t,T} = R_h^{12,T-1}[\frac{\sum_{i=1}^q w_i^T R_i^t / R_i^{12,T-1}}{\sum_{i=1}^q w_i^T}] \quad (3)$$

Third step: weighted average of all included individual subindices HICP:

$$HICP_t = \sum_{i=1}^n \gamma_i R_h^{t,T} \quad (4)$$

Model

$$H_0 : \theta_i = \theta_0 \ (i = 1, ..., n) \tag{5}$$

First order conditions $\psi(y_i, x_i, \theta_i) = \delta\psi(y_i, x_i, \theta_i)/\delta\theta$:

$$\underset{\theta \in \Theta}{argmin} \sum_{i=1}^{n} \psi(y_i, x_i, \theta) = \hat{\theta}, \tag{6}$$

$$\sum_{i=1}^{n} \psi(y_i, x_i, \hat{\theta}) = 0 \tag{7}$$

Under some assumptions, a central limit theorem holds:

$$\sqrt{n}(\hat{\theta}) \xrightarrow{d} (0, A_0^{-1} B_0 A_0^{-1}), \tag{8}$$

$$A_0 = plim\ n^{-1} \sum_{i=1}^{n} E[-\psi'(y_i, x_i, \theta_0)], \tag{9}$$

$$B_0 = plim\ n^{-1} \sum_{i=1}^{n} VAR[-\psi(y_i, x_i, \theta_0)] \tag{10}$$

Model

The empirical fluctuation process efp(.), defined as the decorrelated partial sum process of the empirical estimating functions, converges to a k-dimensional Brownian bridge $W^0(.)$ on the interval [0,1].

$$efp(t) = \hat{B}^{-1/2} n^{-1/2} \sum_{i=1}^{[nt]} \psi(y_i, x_i, \hat{\theta}) \ (0 \leq t \leq 1), \tag{11}$$

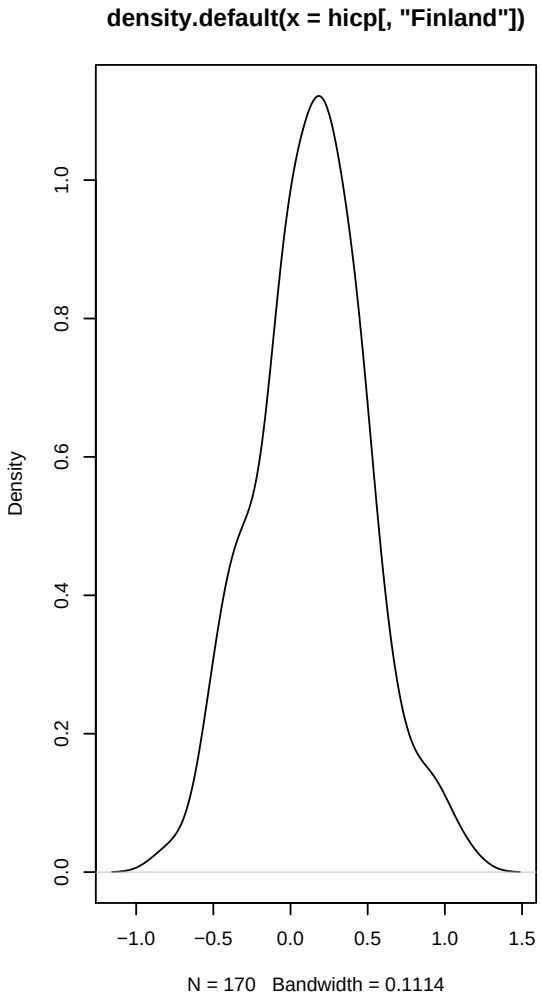
$$efp(.) \xrightarrow{d} W^0(.) \tag{12}$$

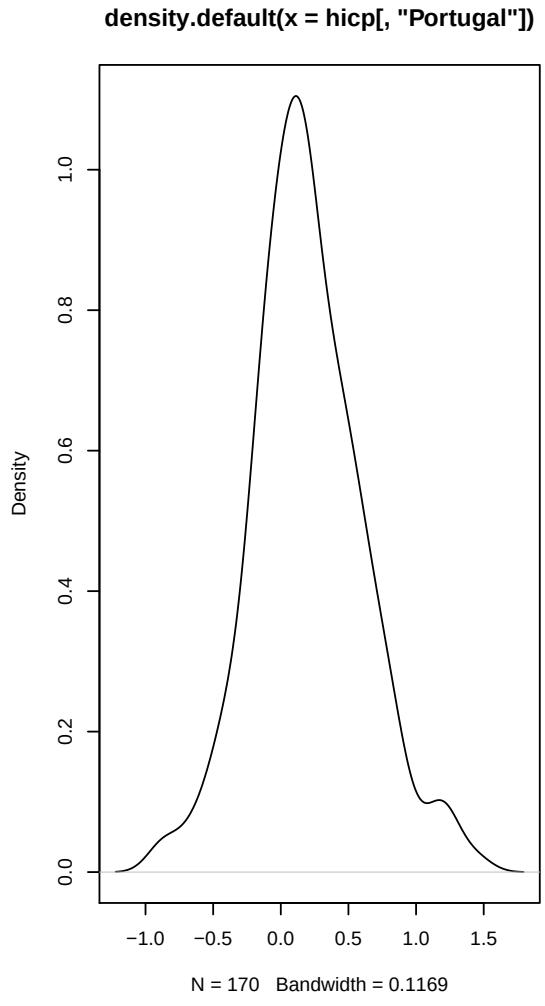
GL–Distribution

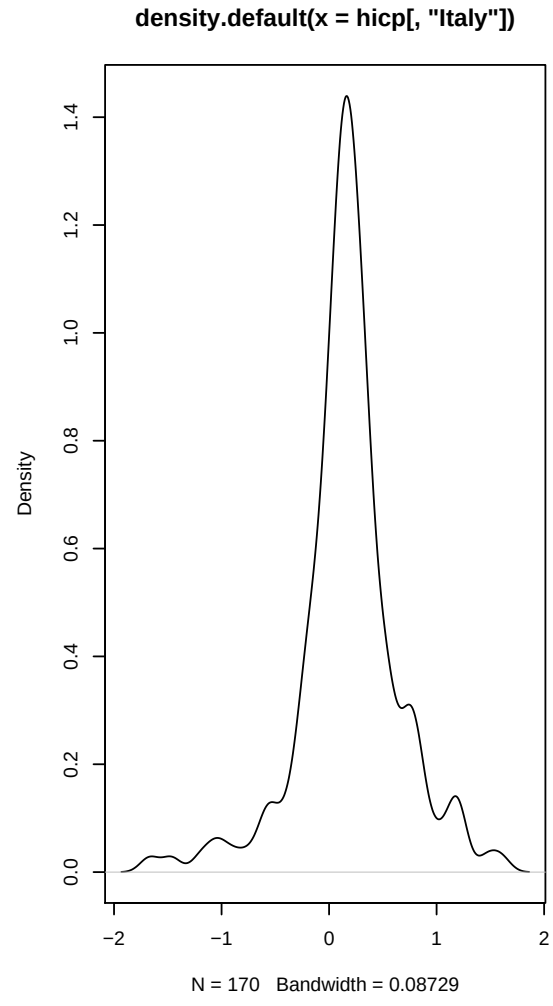
$$f(\pi|\theta,\sigma,\delta) \quad = \quad \frac{\frac{\delta}{\sigma} * \exp^{-\frac{\pi_i-\theta}{\sigma}}}{(1+\exp^{-\frac{\pi_i-\theta}{\sigma}})^{(\delta+1)}} \tag{13}$$

with location (θ), scale (σ) and shape (δ). For b=1 the distribution simplifies to the logistic distribution, for b$<$1 it is skewed to the left and for b$>$1 it is skewed to the right.

Some examples







Test

We use Supremum of LM statistics:

$$S_{supLM} = \sup_{t \in [\pi, 1-\pi]} \frac{\|efp(t)\|_2^2}{t(1-t)} \tag{14}$$

and also supply a χ^2 goodness of fit test for the GL–distribution.

Result Table

Country	Dates	Breakpoints	
Austria	1999–2002	Sep 2007	
Belgium	1999–2002	Dec 1999	
Czech Republic	no–no	Jul 1998	
Denmark	1999–no	Jun 2000	
Estonia	2004–2011	Mar 1998	
Finland	1999–2002	none	
France	1999–2002	Dec 2004	
Germany	1999–2002	May 2000	Dec 2004
Greece	2001–2002	none	
Hungary	no–no	May 1998	
Ireland	1999–2002	Mar 2008	
Italy	1999–2002	May 1996	Dec 2000
Luxembourg	1999–2002	Dec 1998	
Netherlands	1999–2002	none	
Poland	no–no	May 2001	
Portugal	1999–2002	Jul 1992	Mar 2004
Slovakia	2005–2009	Apr 1997	Feb 2004
Slovenia	2004–2007	Jul 2003	
Spain	1999–2002	May 1996	Dec 2000
Sweden	no–no	Jan 1993	
United Kingdom	no–no	Apr 1992	

Table: Dating of break points. First date: entry to ERM II, second date: EURO introduction.

Austria

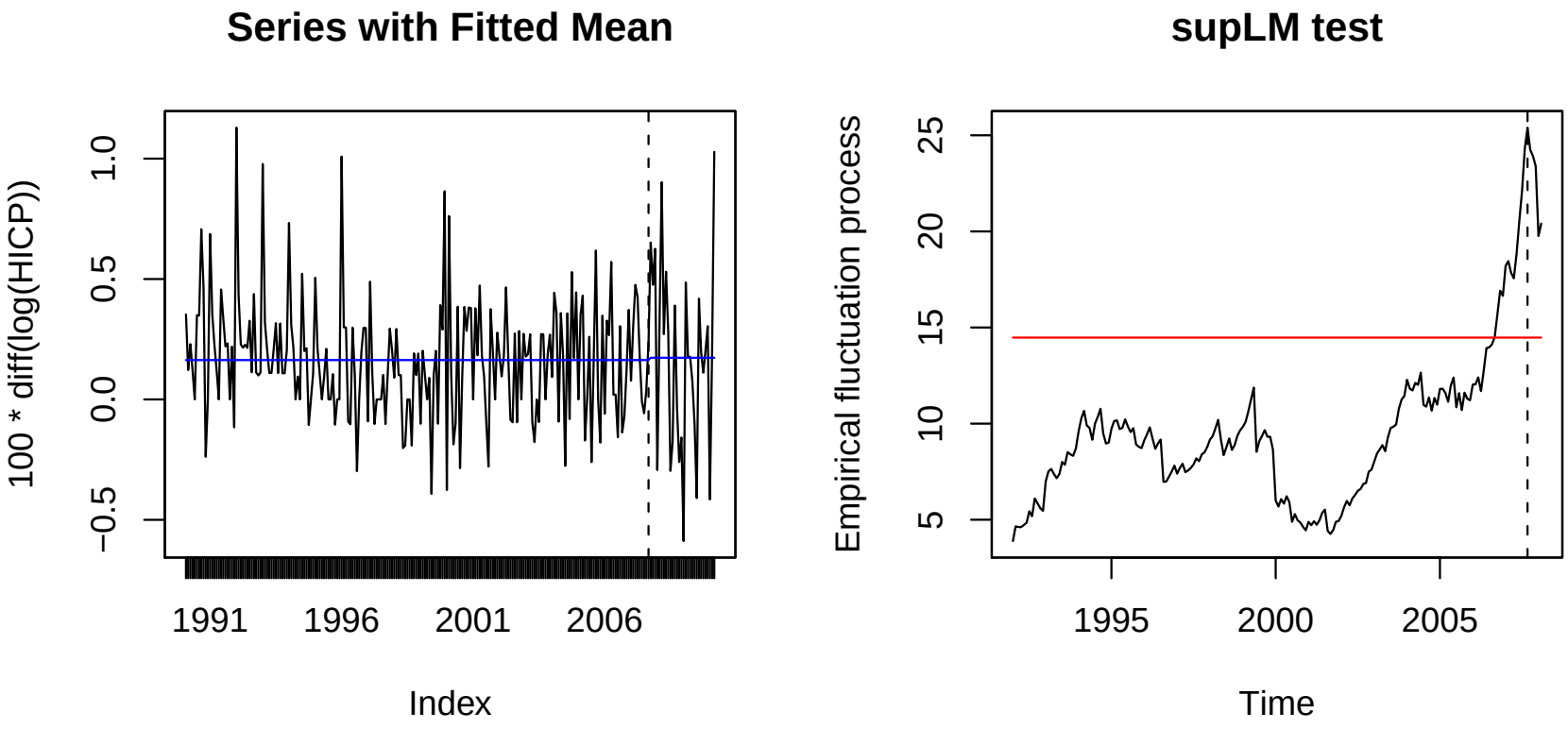


Figure: Series and supLM test for Austria

Austria

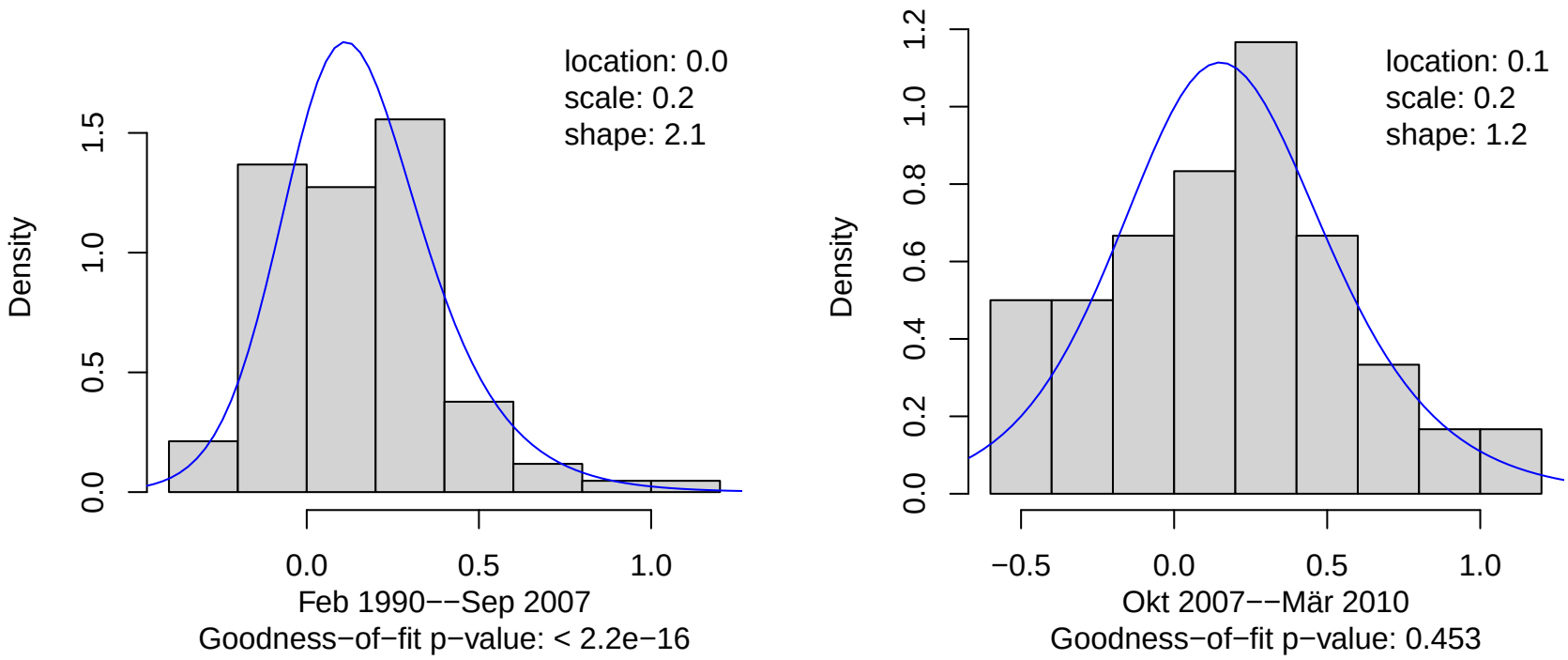


Figure: Goodness of fit test for Austria

Austria

Economic Interpretation:

- Oil price increase
- Increase in mineral taxes
- No change following EURO introduction

Slovenia

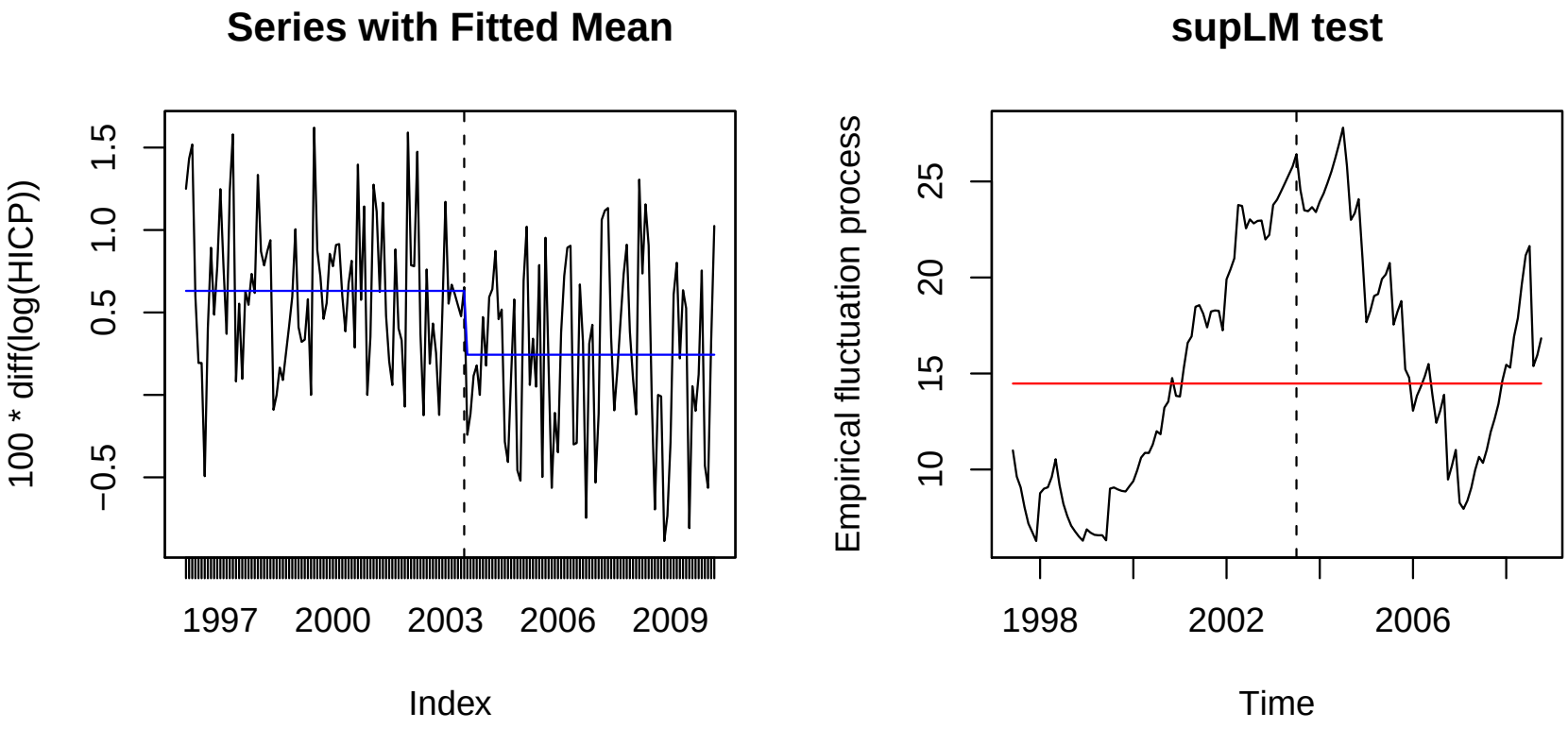


Figure: Series and supLM test for Slovenia

Slovenia

Economic Interpretation:

- had to reach Maastricht criteria
- reached goal in 2005
- from 2003 onwards much lower mean, but higher variance
- most reforms regarding financial sector introduced in 2003
- strong contraction in money supply (M1) starting in 2003