

Macroeconomic analysis

Exam assignment – Sample with results

Data file `data_exam.txt` contains following quarterly time series

<code>time</code>	Vector of time
<code>gdp</code>	Real GDP
<code>cpi</code>	Consumer price index
<code>irs</code>	Short-term deposit interest rate (% p.a.)
<code>irl</code>	Long-term deposit interest rate (% p.a.)
<code>m</code>	Money stock (monetary aggregate)
<code>inv</code>	Real investment
<code>unr</code>	Unemployment rate (in %)

Some useful advices for the beginning

- For calculation of inflation rate use logarithmic approximation. Work with year-on-year inflation (change of prices between current quarter and corresponding quarter in the previous year).
- Use the same inflation rate for calculation of the real interest rate
- Convert interest rate and unemployment rate into decimal expression (i.e. 0,10 = 10 %). With deviations from trend values (gaps) work also in decimal expression.
- Logic of marking: logarithm of a variable is denoted with letter l before the name of variable (e.g. $lcpi_t$ is logarithm of consumer price index). The gap (deviation from trend) is denoted with “hat” above the letter (e.g. \hat{y}_t is gap of output).

Task 1

Structural equation (derived from microeconomic foundations) that describes Okun’s law has this form:

$$\hat{y}_t = -\alpha \hat{u}_t + \omega_t,$$

where \hat{u}_t is gap of unemployment rate, \hat{y}_t is gap of GDP and α is labor intensity of production. (The gap (deviation from trend value) is estimated by Hodrick-Prescott filter with $\lambda = 1600$).

Estimate this regression model, verify statistical significance of the parameter. Compare estimated value of parameter α with economic theory (assume two factors Cobb-Douglas production function). What is utilization of individual factors of production.

Answer

Part of m-file

```
[lgdp_trend, lgdp_gap] = hp(lgdp, 1600);  
[unr_trend, unr_gap] = hp(unr, 1600);  
b = ols(lgdp_gap, unr_gap);  
alpha = - b(1,1);
```

Results

b =

-0.8711 -10.3728 1.9842

alpha =

0.8711

Interpretation

Parameter α is statistically significant, $| -10.37 | > 1.98$. Parameter α should be positive, Okun's law then express negative relationship between the gap of unemployment rate and output. When the economy is above potential it uses more labor (as factor of production) and thus the unemployment decreases. In addition, Cobb-Douglas production function $Y_t = F(K_t, L_t) = K_t^{1-\alpha} L_t^\alpha$ assume that α (labor intensity of production) should be $\alpha \in (0, 1)$. Our result $\alpha = 0.87$ is in accordance with the theory. Based on this result the labor is more intensively used in production of output. Capital participates only 13 % on production of the output.

Task 2

Estimate behavior of GDP gap as autoregressive process of the first order – AR(1) >> M-FILE

$$\hat{y}_t = \alpha \hat{y}_{t-1} + \epsilon_t,$$

where \hat{y}_t is the gap of GDP, α is autoregressive parameter ϵ_t is random (cyclical) shock. Make estimation for two periods, the first and the last decade (you have quarterly data, one decade is 40 observations). Explain meaning of the autoregressive parameter α .

Calculate after how many quarters the shock is smaller than 10 % of its original value. Calculate standard deviation of GDP gap in this model, i.e. “average” value, how much the actual GDP deviates from its trend value. Based on these results compare flexibility and variability of the economy in both periods.

Answer

Part of m-file

```
n = length(gdp);
per1 = (2:41); % first decade
per2 = (n-39:n); % last decade

y1 = lgdp_gap(per1);
X1 = lgdp_gap(per1-1);
[a vare1] = ols(y1,X1);

alpha1 = a(1,1);
n1 = log(0.1)/log(alpha1);
stdy1 = sqrt( vare1/(1-alpha1^2) );
```

```

y2 = lgdp_gap(per2);
X2 = lgdp_gap(per2-1);
[b vare2] = ols(y2,X2);

alpha2 = b(1,1);
n2 = log(0.1)/log(alpha2);
stdy2 = sqrt( vare2/(1-alpha2^2) );

```

Results

```

[alpha1, alpha2] =
    0.8801    0.8452

```

```

[n1, n2] =
    12.6022    9.5713

```

```

[stdy1, stdy2]*100 =
    0.8071    0.7171

```

Interpretation

The parameter α express the degree of flexibility of the economy in reaction to cyclical shocks. The larger is this parameter, the longer is the influence of the shock ϵ_t in subsequent periods.

The economy was less flexible in the first decade than in the last one, parameter α is higher and thus the persistence of shock is longer (over 12 quarters). Output was more volatile in the first decade (standard deviation of GDP gap was 0.81 % in the first decade compared to 0.71 % in the last decade).