Quantitative Economics for the Evaluation of the European Policy

Dipartimento di Economia e Management

Co-funded by the Erasmus+ Programme of the European Union

Project funded by

European Commission Erasmus + Programme –Jean Monnet Action

Project number 553280-EPP-1-2015-1-IT-EPPJMO-MODULE

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17/11/2016

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Growth accounting

Growth accounting is another approach to calculate the contribution of each individual factor to the overall growth.
Assume that production function can be expressed as it follows:

$$Y = F(K, A, H); \tag{1}$$

then take the logarithm of both sides and the first derivative with respect to time:

$$\frac{\dot{Y}}{Y} = g_Y = \epsilon_K \frac{\dot{K}}{K} + \epsilon_A \frac{\dot{A}}{A} + \epsilon_H \frac{\dot{H}}{H} = \epsilon_K g_K + \epsilon_A g_A + \epsilon_H g_H, \tag{2}$$

where:

$$\epsilon_Q = \frac{\partial F}{\partial Q} \frac{Q}{Y}, \text{ with } Q \in \{K, A, H\} \tag{3}$$

is the **elasticity of production to factor** Q.

From the theoretical model to the econometric model

Eq. (2) suggests to estimate the following model:

$$g_{Y,i} = \beta_0 + \beta_1 g_{K,i} + \beta_2 g_{h,i} + \beta_3 g_{L,i} + \varepsilon_i, \tag{4}$$

where β_0 is an estimate of $\epsilon_A g_A$, β_1 of ϵ_K, β_2 and β_3 of ϵ_H taking into account that $H = hL$.

Remarks:

- we estimate **without any constraint** on βs.
- we estimate with average growth rate in the period 1995:2008 to avoid business cycle fluctuations affect the estimate

From the theoretical model to the econometric model

	Dependent variable:
	g_Y
g_K	0.309***
	(0.051)
g_h	0.054
	(0.055)
g_L	0.095
	(0.075)
Constant	0.011***
	(0.002)
Observations	257
R^2	0.151
Adjusted R^2	0.141
Residual Std. Error	0.012 (df = 253)
F Statistic	14.965*** (df = 3; 253)
Note:	*p<0.1; **p<0.05; ***p<0.01

Remarks

- The signs of all coefficients are right
- The magnitude of intercept is plausible for a value of g_A equal to 0.02 and a ϵ_A of about 0.5
- The value of the coefficient of g_K is statistically significant at the usual confidence levels, plausible is technology were Cobb-Douglas (in particular, with $Y = K^{\alpha} (AH)^{\gamma}$ $\hat{\alpha} = 0.31$)
- The value of the coefficient of g_h is not statistically significant at 5%, even though its sign is right. The magnitude is however very low and not plausible.
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Estimate with annual data

If you try with annual data we get a lower adjusted R^2 but higher statistically significant coefficients.

Endogeneity can be at work due to the synchronization of many variables with business cycles (e.g. growth of output and growth of employment).

Alternative methodology

Alternative methodology of analysis impose further restrictions on the production function and on how factors are paid (Solow, 1957)

Two crucial assumptions:

- Production function is assumed to be to constant returns to scale (e.g. Cobb-Douglas $Y = K^{\alpha}(AH)^{1-\alpha}$).
- Factor are paid to their marginal productivities, i.e. $r = \partial Y/\partial K$ and $W/P = \partial Y/\partial L$ with $H = hL$.