Hansl for Dynamic Macroeconomics

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Motivations

- Is Hansl a valid alternative to the standard numerical software in order to solve Dynamic Macroeconomics problems?
- In order to do that we have to do a comparison between Hansl and the standard numerical program used to solve Macroeconomics problems.
- We replicate the exercise proposed by Fernandez-Villaverde et al (2014) using Hansl and we compare the results with several alternative program.
- Among the others: *Python*, *Matlab*, *R*.
- The aim of this context is not to write the best code, eg in Matlab, but to write the same script for every program,
- We are interested in *relative speed*, not *absolute* one.

The Stochastic Neoclassical Growth Model

$$\max_{\{c_t, k_{t+1}\}} E_0 \sum_{t=0}^{\infty} (1-\beta)\beta^t \log c_t \tag{1}$$

subject to the usual resource constraint

$$c_t + k_{t+1} = z_t k_t^{\alpha} + (1 - -\delta)k_t \tag{2}$$

z_t is an AR(1) shock approximated by a transition matrix Π of the kind

The Stochastic Neoclassical Growth Model

$$z \in \{0.9792, 0.9896, 1.0000, 1.0106, 1.0212\}$$

$$\Pi = \begin{bmatrix} 0.9727 & 0.0273 & 0 & 0 & 0 \\ 0.0041 & 0.9806 & 0.0153 & 0 & 0 \\ 0 & 0.0082 & 0.9837 & 0.0082 & 0 \\ 0 & 0 & 0.0153 & 0.9806 & 0.0041 \\ 0 & 0 & 0 & 0.0273 & 0.9727 \end{bmatrix}$$

Solution method: Value function iteration 1

- As in Fernandez-Villaverde et al (2014) we rely on the *Value function iteration* methods to solve the problem.
- First of all, we set the problem in recursive form using the *Bellman equation*

$$V(k,z) = \max_{k} (1-\beta)(zk^{\alpha} - k^{'}) + \beta E_t(V(k^{'}, z^{'})|z) \quad (3)$$

- We calibrated the parameters in a standard way $\beta = 0.95$, $\alpha = \frac{1}{3}$ and $\delta = 1$.

Solution method: Value function iteration 2

- Choosing $\delta = 1$ allow us to obtain a *close* form solution of the problem.
- We choose a grid of $17,820$ points for the state variable k uniformly distributed around the steady state.
- We impose a tolerance of *1.0e-0.7* for convergence.
- This allow us to achieve convergence after 257 iterations, independently from the programming language.

Fernandez-Villaverde et al (2014) results

- Fernandez-Villaverde et al (2014) experiment took place both on a *window* and *Mac/Linux* machine
- Window 7, 12GB Ram, processor i7.

Table: Time performances

Programm	Time
C++	1.13s
Fortran	1.27s
Java	1.59s
Julia	2.04s
Matlab	6.74
Python	117.40
R	371.40
Mathematica	473.34

Our experiment

- Window 7, 8GB Ram, processor i3.

Table: Time performances

Programm	Time
Matlab	9,95s
Python	117s
Gretl	646s
R	700s

Conclusions

- Can Hansl be a valid alternative to R and Python in computational macroeconomics ? Maybe...
- Next step
  - Replicate our experiment on Mac/Linux
  - Parallelization