

A dynamic model of economy with social stratification

Nicholas Olenev^{1,2}

¹ *Dorodnicyn Computing Centre of RAS, Moscow, Russia; nolenev@yahoo.com*

² *People's Friendship University of Russia, Moscow, Russia;*

The paper presents a method of identification for a dynamic model of economic growth with social stratification. The model is a modification of a model presented in [1]. Here for describe an economic model for a stratum it is used the Uzawa-Lucas model [2-4] on the data of Russian economic statistics by application of high performance computations on multi-processors systems [5-7].

An optimal control problem for a typical household of a stratum dynasty can be formulated by the following way:

$$\int_0^{\infty} e^{-\rho t} (\ln c + \phi \ln \frac{n}{m} + \psi \ln N) dt \longrightarrow \max_{u, c, n}, \quad (1)$$

$$\dot{h} = B(1 - u)h, \quad (2)$$

$$\dot{N} = (n - M\mu(h))N, \quad (3)$$

$$\dot{k} = Ah_a^\gamma k^\alpha (uh)^{1-\alpha} - (n - M\mu(h) + \delta)k - c - qnh, \quad (4)$$

Here the control variables are a part of time for job $u(t)$, per capita consumption $c(t)$, and the number of children defined by fertility $n(t)$. State variables are the physical capital $k(t)$, the human capital $h(t)$, the size of dynasty $N(t)$, mortality $m(t) = M\mu(h)$, $\mu'(h) < 0$, $\mu(0) = \mu_+ > \mu(\infty) = \mu_- > 0$. Parameters are the discount rate $\rho > 0$, the utility weights ϕ and ψ , the intensity of schooling $B > 0$, the depreciation rate of physical capital $\delta > 0$, the technological level $A > 0$, the exponent $\gamma \geq 0$, the output elasticity of physical capital $0 < \alpha < 1$ in production, the cost of child rearing $q > 0$.

GDP for the whole economy, the population and the value the average human capital are determined as sum of all strata S .

$$Y_a = \sum_{i=1}^S y_i N_i, \quad (5)$$

$$N_a = \sum_{i=1}^S N_i, \quad (6)$$

$$h_a = \sum_{i=1}^S h_i N_i / N_a, \quad (7)$$

The author of the work was supported by the Russian Foundation of Basic Research (project no. 13-07-01020).

REFERENCES

1. *Olenev N.N.* Model ekonomicheskogo rosta s sotsialnoy stratifikatsiey // *Per-vaya rossiyskaya konferentsiya "Sotsiofizika i sotsioinzheneriya"* (8-11 iyunya 2015g.) - Moskva: MGU im. M.V. Lomonosova, 2015. S.49. In Russian.
2. *Lucas R.* On the Mechanics of Economic Development. *Journal of Monetary Economics*, 1988, 22(1), pp. 3-42.
3. *Uzawa H.* Optimum Technical Change in an Aggregative Model of Economic Growth. *International Economic Review*, 1965, 6. pp. 18-31.
4. *Olenev N.* Identification of the Uzawa-Lucas Model for World Economy// *International scientific conference "New challenges of economic and business development - 2014"*. May 8-10, 2014. Riga, University of Latvia. Abstracts of reports. PP.87-88.
5. *Olenev N.* Parallel algorithms of global optimization in identification of an economic model// *Proceedings of Scientific Seminar of CEDIMES-Russie occidentale and Dorodnicyn Computer Centre Modeling of social and economic systems*. Moscow: CEDIMES-Russie occ., Vol. 1, No. 1, 2015. P.45-47.
6. *Olenev N.* A Ramsey type model with an endogenous production function for study of economic systems // *10th International Conference "Economic Integration, Competition and Cooperation"* (April 22-24, 2015) . Book of Abstracts. Opatija-Croatia-Hotel Ambassador: University of Rijeka, 2015. P.54.
7. *Kamenev G.K., Olenev N.N.* Study of the Russian Economys Identification and Forecast Stability Using a Ramsey Type Model // *Mathematical Models and Computer Simulations*, Vol. 7, No. 2, 2015, P.179-189. ISSN: 2070-0482 (Print). 2070-0490 (Online).