The World Economy Annual Lecture 2016

"Balanced Neoclassical Growth"

Gene Grossman (Princeton University)

Thursday 1st September 2016

The World Economy Annual Lecture 2016 was given by Gene Grossman, the Jacob Viner Professor of International Economics at Princeton University. Professor Grossman began the talk by stating some stylised facts of economic growth based on his collaborative work with Elhanan Helpman (Harvard), Ezra Oberfield (Princeton) and Thomas Sampson (LSE). He noted that the growth of US GDP per capita has been remarkably stable at about 2% per year for the last 150 years. In addition, the data also shows that the physical capital to output ratio and the investment to output ratio have been constant since the 1950s, as were factor shares (capital and labour) until 2000.

At first glance these facts appear to lend support to the neoclassical growth model that predicts balanced growth. However, in order to achieve balanced growth in a neoclassical growth model, according to the Uzawa Growth Theorem, one of two things is required: either a Cobb Douglas aggregate production function, or the absence of capital augmenting technological progress. These requirements seem not to be met in the data: the elasticity of substitution between capital and labour is typically less than 1 (not Cobb Douglas) and we observe falling investment-good prices, which is evidence of investment-specific technical change.

In order to address this problem, in the remainder of his presentation, Professor Grossman presented a neoclassical growth model with endogenous human capital.

The model is characterised by representative family dynasties and individuals with infinitesimally short lives. The social planner maximises the utility of the representative dynasty subject to constraints. Professor Grossman stated that the role of the functional form of the production function is crucial, as in all balanced growth models. Schooling augments the labour supply, making it more productive at any point in time, whilst reducing the productivity of capital. The increased return to schooling gives individuals an incentive to invest more in schooling. This decline in the productivity of capital offsets the increased schooling and the technology augmented capital stock, so that they grow in line with output. The complementarity between capital and schooling here is crucial in order to generate balanced growth. Capital must be more complementary with schooling than it is with raw labour.

Professor Grossman then moved on to present two examples of market economies that are consistent with the model:

<u>Time-in-school:</u>

Individuals inherit capital from their family and maximise dynastic utility. An individual spends a fraction, s, of their life in school and a fraction, 1-s, in the labour force. Firms face a wage schedule which depends on schooling. The returns to education rise over time due to the complementarity between capital and schooling, so individuals choose more schooling over time.

<u>Manager-Worker:</u>

An alternative scenario is that individuals face a discrete choice: either to spend a fraction of time, m, training as a manager, or to work their entire life as a production worker. The productivity of workers depends on the schooling and the supervision they receive from the manager. Schooling grows over time as a result of the accumulation of capital, which then raises the marginal product of managers. This increases the incentive to train as a manager, so schooling increases over time. Again, the complementarity between capital and schooling is key here.

Overlapping Generations

Professor Grossman concluded his talk by introducing an Overlapping Generations model in order to address some of the limitations of the simpler instantaneous lifetimes framework. In this model, individuals live for 3 periods: schooling, work and retirement, which enables earnings to vary over the life cycle and the composition of the labour force to change over time. Technology with a Mincerian wage equation is crucial in order to maintain balanced growth when faced with the composition of the labour force changing over time and different amounts of capital allocated to different workers.

The main feature of this model is that it captures the linear growth in educational attainment that has been observed in the US. Capital accumulation raises the return to schooling, so each cohort has an incentive to stay in school for longer, which offsets the growth in capital stock. The longer time spent in school causes the labour force participation rate to fall exponentially. The Mincerian wage equation for log wages is a non-linear function of schooling and experience. Finally, Professor Grossman presented simulation results which confirmed that for reasonable parameter values, the capital share grows when technological progress slows down.

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