Theory of economic growth

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16 Endogeneous growth and the data

Secondary reading: Kremer (1993), Jones (1995)

16.1 Scale effects

- In the R&D models we have assumed that new ideas/technology is produced according to
$$\dot{A} = BL_A A \tag{1}$$
- In the long run the number of researchers, L_A, must be proportional to population ($L_A = s_A L$), so we have
$$\dot{A}/A = Bs_A L$$
- We have also seen that we get a balanced growth path where Y grows at the same rate as technology A
$$\gamma = \dot{Y}/Y = \dot{A}/A = Bs_A L$$
- This implies that growth rates in the long run will increase in population, or the scale of the economy. We call this a scale effect.
- We saw an example of such a scale effect also in the model with governmental provision of a public good.
- Over the long run it is likely that A flows quite freely across countries. Thus, we should probably think primarily of scale effects as taking place over time and at a global scale.
- But do we observe scale effects?
- Kremer (1993) adopts a long run perspective (1.000.000 BC-1990).
- His hypothesis is that population growth should depend positively on the level of population.

- The argument is that since the level of population determines technological growth it will also determine growth of per capita income, and hence (by a simple Malthusian argument), it will determine population growth.

- We would not see such an effect if technological growth was exogenous and independent of population.

- His main findings are

  1. Over most of the period population growth is proportional to the population level.
  2. Among regions that have historically been geographically separated the initially larger (most populous) regions experienced fastest growth.

- These findings are well in line with his hypothesis. A main problem is that his analysis is not really convincing in explaining that growth has leveled off recently.

16.2 Time series evidence

- As we saw, there has been no major increases in growth rates over the last decennia.

- In fact, for an economy such as the U.S. there appears to be no trends in growth rates over time over the last hundred years.

- As argued by Jones (1995) this is bad news for the endogenous growth models also for another reason: Both the simple AK-models and the R&D models predict that changes in several variables lead to permanent changes in growth rates.

- In particular, changes in investment rates should have permanent effects on growth.

- He draws attention to the following observations:

  1. There are only weak time-trends in growth rates.
  2. There are strong upward time-trends in investment rates.
  3. There are strong upward time-trends in resources devoted to R&D.

- He argues that these findings go strongly against endogenous growth models with scale effects.
- He argues that the models are better in line with the data if we replace the R&D production function (1) with

$$\dot{A} = BL_A A^{\phi} \tag{2}$$

  where $\phi < 1$ (while (1) had $\phi = 1$).
- As above we then have

$$\gamma(A) = \dot{A}/A = Bs_A LA^{-(1-\phi)}$$

  Now $\gamma'(A) < 0$ for a given L, so the growth rate is ever declining (towards 0) unless we have population growth. The level of population growth n thus ties down γ^* in the long run.

$$\gamma^* = n/(1-\phi)$$

- The revised production function (2) can be integrated into the R&D models without altering their basic microeconomic insights.
- However, we are than back in a situation where policy affects growth only during the transition, and has level effects but not growth effects in the long run.
- Based on present knowledge it is hard to judge a priori whether we should trust (1) or (2).
- It is a major problem for theories of endogenous growth that two such rather similar specifications yield so dramatically different results.

17 Growth and infrastructure

Secondary reading: Hall and Jones (1999), Acemoglu, Johnson and Robinson (2001)

17.1 Institutions

- Attempts at explaining cross-country differences in economic performance based on variations in inputs (capital and human capital) show large residuals of unexplained productivity differences.

- Further, we are left with the question: Why do capital accumulation and education attainment levels differ so much?
- Differences across countries in institutions and government policies, in short social infrastructure, seems a plausible fundamental determinant both of productivity differences and differences in accumulation.
- By social infrastructure we understand the institutions and government policies that provide the incentives for individuals and firms in an economy.
- Incentives can encourage productive activities or instead encourage predatory behavior such as rent-seeking, corruption and theft.
- Productive activities are vulnerable to predation. Thus prevalence of predation can have two types of negative effects on productivity.

  1. People use resources on protecting their production from diversion rather than on productive activities.
  2. People have too weak private incentives to engage in productive activities.

- The first type of reason can explain productivity differences, the second differences in factor accumulation.
- Control of diversion by social action generally can benefit from economies of scale in protecting against predation. Successful social action can also serve to abolish the need for protection by moving the economy from a bad to a good equilibrium.
- Note however, that if the government can make and enforce rules it can itself turn into a highly effective agent of diversion (rent-seeking, corruption).

17.2 Some evidence

- To assess the empirical role of social infrastructure we want to estimate the equation

$$\log Y/L = \alpha + \beta S + \epsilon \tag{3}$$

  where S is an index of social infrastructure.

- There is a major problem with estimating (3), namely that there is every reason to expect that social infrastructure is itself dependent upon production (Y/L). That is, S is endogenous.

- It is thus likely that (3) holds jointly with

$$S = \gamma + \delta \log Y/L + X\theta + \eta \tag{4}$$

  where X is a collection of other variables influencing social infrastructure.

- To be able to estimate (3) we must therefore use an instrument variable approach.

- A legitimate instrument is a variable that is correlated with S but uncorrelated with ϵ (that is, it does not have a causal impact on Y/L).

- The instrumental variable approach is based on first regressing S on Y/L and the instrument(s) and then entering the predicted values from this regression in the regression (3).

- Note that we do not have to include as instruments everything that explains S, we only need at least one of the factors that explains it. (That is, we do not need to a have very good model for explaining S).

- There are therefore two challenges here: 1) finding suitable indicators of social infrastructure, 2) finding good instrument variables. Where the last is perhaps the most difficult one.

- Two of the most important contributions to this literature are Hall and Jones (1999) (HJ) and Acemoglu et al. (2001) (AJR)

- The two studies differ primarily in their choice of instruments.

- HJ uses up to four instruments

  1. Distance from the equator
  2. The fractions of the population speaking English
  3. The fractions of the population speaking another European language
  4. Frankel-Romer predicted trade share based on a gravity model of international trade

- The three first instruments are supposed to reflect the early European influence on countries during the era of colonization. These appear to be appropriate instruments:

  1. in as far as European influence lead to development of better social infrastructure, and to the degree that these effects where permanent.
  2. If these factors have no independent impact on production today.

- Using these instruments HJ find evidence of a strong effect of social infrastructure on production. And argue that according to their results differences in social infrastructure can explain between 25.2- and 35.1-fold differences in output. (While the richest country in their sample has 35.1 times the output of the poorest).

- They also show by decomposing production according to a neo-classical production function that social infrastructure contributes both by way of productivity and by way of higher levels of the inputs.

- Further, they find that this result is rather robust. They also report results suggesting that social infrastructure is indeed *the* fundamental determinant of economic performance

- Their choice of instruments can, however, be criticized.

  1. Their notion of European influence is crude and theoretically the link is weak.
  2. Ethnolinguistic fragmentation is probably endogenous (depends on Y/L?).
  3. The geographical instruments might be correlated with ϵ.

- In light of this critique Acemoglu et al. (2001) (AJR) provide a more elaborate perspective on the colonial impact story.

- As their instruments AJR instead use the mortality facing settlers during colonization.

- Their story is as follows: High settler mortality lead to 'extractive state' colonies (e.g. the Belgian Congo) while low mortality lead to permanent settlements of Europeans (e.g. Australia) with subsequent development of the appropriate institutions for running these new 'European' societies.

- Their evidence is similar to that reported by HJ. But their instrument does appear to have a better foundation.

- To sum up: It seems evident that social infrastructure is fundamental to the question why are some countries so rich and some so poor. However, we still lack knowledge about which institutions are the most important and what are effective policies for implementing or improving these institutions.

References

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