Malthus to Solow

Hansen and Prescott

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1 Introduction

- 1800 — watershed of the human economy.
- before 1800, stagnant economy with population growth.
- after 1800, growing economy with demographic transition.
2 Motivation

• Traditional stagnant economy can be well explained by theory of Malthus, which believe the fixed land supply is the hurdle to the economic progress.

• Modern growing economy can be well explained by the theory of Solow, which think that the technological progress is the engine of economic long run growth.

• Neither the theory Malthus nor that of Solow can explain both the stagnant epoch and growing epoch all at once.

• The paper attempts to unify both theory without impairing their existing explaining power and without introducing the structural change (smooth transition).
3 Approach

- 1 good + 3 factors + 2 sectors (technologies)
- Malthus sector
  \[ Y = \gamma_m K_{mt}^\phi N_{mt}^\mu L_t^{1-\phi-\mu} \] (1)
- Solow sector
  \[ Y = \gamma_a K_{at}^\theta N_{at}^{1-\theta} \] (2)
- Preference of household
  \[ U(c_{1t}, c_{2t}) = \log c_{1t} + \beta \log c_{2t} \] (3)
4 Main results

• Proposition 1. It is always profitable to operate the Malthus sector.

• Proposition 2. The solow sector would be operated sooner or later.
• Economic implication:
  - At the initial stage, only Malthus sector is operated and the economy is stagnant.
  - As the capital accumulation and population propagation continue, the relative price of capital and labor relative to land would decrease because the land supply is fixed.
  - Thus it would be also profitable to operate the Solow sector which requires only the capital and labor input. Fixed land supply as a hurdle of traditional economic progress could, therefore, no long handicap the economic growth.
  - In the end, the economy will converge to the Solow sector only economy. The economic progress is driven by the exogenous technological progress.
5 Comments

- Elegant abstraction — one good economy, exogenous population growth pattern, exogenous technological progress
- Straightforward implication — the change of relative price
- Smooth transition — capital is a media to avoid the structural change of the economy
6 Critique

1. Some conditions for the proposition 2 are not mentioned

\[ \gamma_s > \left( \frac{r_k}{\theta} \right)^\theta \left( \frac{w}{1 - \theta} \right)^{1 - \theta} \]  

We can write it as

\[ \left( \frac{\gamma_s}{\gamma_m} \right)^t > \frac{\phi^\theta \mu^{1 - \theta}}{\theta^\theta (1 - \theta)^{1 - \theta}} K_{mt}^{\phi - \theta} N_{mt}^\mu + \theta - 1 \]  

\( \theta > \phi \) is explicitly stated in the paper, but silent about the other necessary conditions such as the relationship between \( \gamma_s \) and \( \gamma_m \), the sign of \( \mu + \theta - 1 \). In the subsequent calibration exercise, the author evaluate the parameter such that \( \gamma_s > \gamma_m \) and \( \mu + \theta - 1 = 0 \). Otherwise, condition (4) is not necessarily satisfied.
2. Why the Malthus sector does not include the land rent as the operating cost? Equation (4) and proposition 1 contradict each other. Equation (4) is

\[
\max_j Y_j - wN_j - r_k K_j - r_L L_j, \quad j = M, S
\]

In Proposition 1, the profit of Malthus sector is calculated by

\[
\max_j Y_j - wN_j - r_k K_j, \quad j = M, S
\]

3. without mathematically analyzing the dynamical property of the system, some economic constraints are directly imposed on the system to get the numerical results. \(\Rightarrow\) Dangerous to do so!

4. Inconsistent calibration, matching English economy prior to 1800 and industrialized economy after World War II. \(\Rightarrow\) Match different economy with the same model!
7 Extension

• Why the economic transition from the stagnant epoch to the modern epoch is different in different countries? ⇒ The preconditions for the economic transition or the industrial revolution.

• How to endogenize the demographic transition?

• How to endogenize the technological progress ($\gamma_a$ and $\gamma_m$)? ⇒ Combine with Lucas (1998).

• During the transition, the relative price of manufacturing good to agricultural good changes enormously. ⇒ Introduce two-sector, two-good economy.

• Calibrate the model to match Chinese economy.
Suggestion

Please send our presentation/discussion files to Professor Yuen at cwyuen@hku.hk.

So we can share them from his homepage http://www.econ.hku.hk/~cwyuen/seminar.

My file is produced by LaTeX type setting language. Anyone interested can have a discussion with me. We can learn it together.

Thanks!