

Problem Set #2: Endogenous Growth, Poverty Traps and Convergence (*italics for PhD students only*)

1. Asian Growth Miracle (or not): a) Briefly summarize Paul Krugman's and [Alyn Young's](#) "[myth of the East Asian Miracle](#)" argument using growth accounting and the augmented Solow model to illustrate your answer. Does the evidence provided by [Bosworth and Collins \(2003\)](#) support their argument (for example, has there been TFP growth in China or not)? See also IMF-Nicholas Crafts (1999). [nearly all of the articles mentioned here are on the course CD "corereadings/empirical evidence/EastAsianGrowthDebate" including the full WB-TEAM report]. b) Briefly sketch an explanation of the Asian growth miracles consistent with the endogenous growth models (AK or HD) and Solow model TFP vs. no TFP explanations of the Asian growth miracle (see the WB-Team report page 68 and the readings in part a). Discuss the implications of these explanations for long-run growth. *PhD students: What alternative explanations does Lucas (1993) offer in [Making a Miracle?](#)* c) Following the method of Jones Chapter Exercise #1 page 75 (see [answers](#) posted): pick 3-4 Asian countries and 3-4 other countries and compute their steady states (using "A" estimates from the TFP worksheet). What do the steady state computations of Jones suggest about future Asian growth (at least China)? What implications do these alternate explanations of East Asian high growth have for future growth rates in the Asian countries you chose? d) *In an appendix to Chapter 5 the TEAM report argues that growth Granger causes investment, but not vice versa. Discuss how this observation could be consistent with the low savings poverty trap "poverty trap" model— see Sachs et. al. (2004) or Ros (1999) page 59-60 and Robelo page 27 eq (44). Briefly discuss the two steady states in this framework, if possible using the Solow and AK diagrams. Could technology based poverty trap models also account for this result— growth determining investment? (See chapter 5 of Ros).*

2. Demand-side poverty traps: a) Briefly discuss two versions the "big push" or market demand poverty trap due to Rosenstien-Rodan and formalized by [Murphy, Schliefer and Vishny \(1989\)](#) (see BSIM Chapter 1 page 75 or Krugman's "[Fall and Rise of Development Economics](#)" or Ros, 1999, Chapter 5). What can the government do to encourage growth of the more efficient modern sector (displacing the traditional sector)? This will always lead to less but more productive employment, unless... (b) Illustrate this last point using the monopolistic competition-free trade example used in class. Why does firm size tend to increase in the open economy shoe industry? Might this lead to political opposition to opening trade? What will happen to employment and wages in the shoe industry after the economy opens up to trade?

3. Empirical Evidence: The basic growth equation used by [Levine and Renelt \(1992\)](#) to test the robustness of Barro's 1989 cross section growth estimates,

$$\gamma = -.83 - .35*RGDP60 - .38*GPOP + 3.2*SEC + 17.5*INV \quad R^2 = .46$$

(.85) (.14) (.22) (1.3) (2.7)

where the per capita growth rate γ depends on per capital income in 1960 (RGDP0), population growth (GPOP), secondary enrollment (SEC) and investment share of GDP (INV). (a) Briefly compare the RHS variables above with those in [Bosworth and Collins \(2003\)](#) Table 10, [Barro 1997 Table 1](#) and in BSIM Chapter 12 Table 12.3. Which variables are added, which are dropped, broadly speaking? (b) Discuss the extent to which the above results are consistent with the predictions of endogenous (HD or AK) and exogenous growth models such as the augmented Solow model? (c) *Briefly outline the stepwise method Levine and Renelt advocate to determine the robustness of cross section regression RHS variables.*

4. Hybrid Models and the roots of endogenous growth: (a) Briefly discuss the "Sobelo" and "Learning by Doing" model of Villanueva where long term growth depends on savings rate. Illustrate both models using the diagram with growth rate on the vertical axis. Which properties associated with endogenous and exogenous growth models do these hybrid models share? *Formulate a definition of endogenous vs. exogenous growth models, which can distinguish between both of these hybrid models.* (b) In his [15 years of growth theory](#) Sala-i-Martin's argues "...research shows that the conditional convergence hypothesis is one of the strongest and most robust empirical regularities found in the data. Hence, by taking the theory seriously, researchers arrived at the exact opposite

empirical conclusion: the neoclassical model is not rejected by the data, whereas the AK model is.” Discuss this statement in light of the Sobelo model discussed above. What sort of evidence could be used to distinguish between these two classes of models, broadly defined? (see also [McGratten’s “In Defense of AK models”](#) on the CD under empirical evidence). *PhD only: What evidence does Jones use to argue against endogenous growth in chapter 8?*

5. Evidence for conditional convergence and poverty traps: (*PhD students—optional for Masters*) Import the [Jones Table C.1 Excel file](#) [Jones file for Appendix C](#) and put the data into [Eviews Workfile](#) some other multivariate regression program (even excel will do this, just not very quickly). (a) Carefully regress growth rates 1960-97 or $g(60-97)$ on the level of income per capita in 1960 (Y_{60}). What does this regression tell you about absolute convergence among this group of countries? (b) Now add years of schooling (u) or the savings rate provided (S_K) or population growth to this regression. What happens to the coefficient on 1960s per capita income? Which of these regressions demonstrate conditional convergence? Explain. Pick three pairs of countries with similar levels of schooling—put them in a table showing schooling years, initial 1960 income and the growth rate for 1960-97 (all taken directly from Table C.2). Does the evidence in your table support conditional convergence? Explain why, why it doesn't. (c) Regress the level of GDP per capita in 1997 (Y_{97}) on the S_K , n and $y(60)$ then do a second regression adding u (years of schooling). Compare these R^2 for this regression? What does this say about explanatory power of the Solow-Swan and Mankiw-Romer-Weil version of the neoclassical (Solow) growth model? (d) (optional) How does Jones proceed to explain savings/investment rates in Chapter 7—does this exercise overcome the endogeneity problem associated with savings and schooling? Explain. (e) optional for everyone: What can be done to validate obtained from the regressions such as those in #1 above which may suffer from simultaneous equation bias? (e) Use the coefficient computed above to draw some conclusions regard the speed of convergence using Table 11.1 assuming a capital share α of .4.

6. Endogenous growth with Government: (a) Show how Barro's growth model with government investment is a special case of the "AK" model where in Barro's notation $y = k^{1-\alpha}g^\alpha$ and $g = \tau y$ (see the [Barro model handout](#)). (b) Describe the private sector's maximization problem. Why might growth be sub optimal if investment decisions are left to the private sector? Describe the solution to the social planner's problem. What is the optimal tax rate? Relate this to optimal savings rate discussed in problem set #1. (c) What are the empirical implications of this model for the relationship between growth and public sector spending shares? Suppose taxes are unpopular in democracies, but that large public sector are appealing to authoritarian governments: use the optimal tax diagram to show the tax rate these two countries are likely to choose. Will democracies grow faster? (optional for anyone: Compare with the predictions of this model with [Barro 1997 Tables 1-3](#) results for democracy and growth.)

7. Endogenous growth with trade: