

HW #1: Answer questions 1-3 to the extent possible and turn in the answers typed double space, equations and figures drawn in by hand if necessary in class February 4th (ask question in class Jan 28th). *Sections in italics PhD students only.*

1. Poverty Traps: Review the three poverty trap models discussed in class and in [Sachs et. al \(2004\)](#). (a) Explain the how the poverty trap works using the standard Solow diagram and discussing k^T and k^E or k^* : explain in words why these two levels of k are important (hint: steady-state, thresholds). What are the policy implications of a poverty trap? Contrast this situation with the absolute convergence implied by the simplest Solow model. How is “conditional convergence” a sort of “half-way house” between these two views of how the growth process works? (b) Why according to Sachs et. al. (2004) are most African countries stuck in a poverty trap? What do they propose should be done to break out of this poverty trap? (c) What explanation does Sachs et. al. (2004) for why savings depends on income and why the Inada condition for capital may not hold? *PhD students: see Robelo’s “Stone-Geary” discussion of endogenous savings—why does savings depend on income levels assuming Stone-Geary preferences? What stylized fact about income effects is are Stone-Geary preferences consistent with? What does this imply about cross section growth regressions that regress growth rates on level of savings or investment?*

2. Institutions and Economic Policy: [Acemoglu, Johnson and Robinson or AJR \(2001\)](#) and [AJR \(2006\)](#) reach an interesting but also discouraging conclusion: the persistence of underdevelopment is likely due to long-lived poor institutions, apparently in evidence 200 years ago explain a large fraction of per capita income variation among countries. (a) North (1990) argues “Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction.” ... “In consequence they structure incentives in human exchange, whether political, social, or economic.” Briefly discuss Hall and Jones’ (1999) measure of institutions and what role it plays in their theory of income levels (see Jones on “social infrastructure” in chapter 6 and 7). When [AJR \(2004\)](#) argue institutions are the “fundamental” cause of economic growth, what do they mean? What is the “great reversal” and what caused it? For example they compare the growth of the U.S. vs. Mexico and of the Netherlands and the UK vs. France and Spain—what key institutions do they stress for the U.S vs. Mexico (page 53)? How might this explain why NAFTA has not led to a Korean style surge in Mexican growth? (b) In [Second Best Institutions](#) and [“Growth strategies”](#) Rodrik distinguishes between “stimulating” and “sustaining” growth. What policies “stimulate” growth in Chile and Uganda for example? Enlarge this list using the “levers for growth” article by [Johnson, Ostroy and Sumbramanian \(2006\)](#). See also [Sachs \(2003\)](#) on geography and institutions and [Rodrik and Subramanian \(2003\)](#) on the “primacy of institutions.”

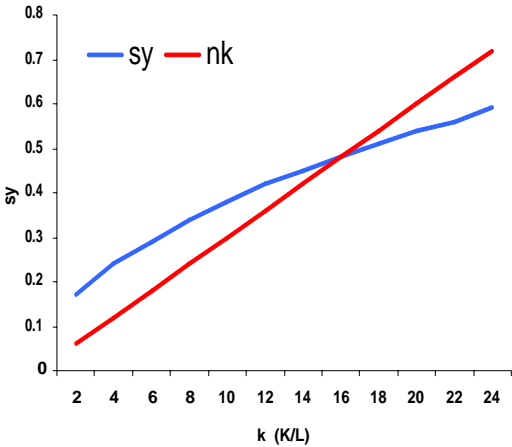
3. Savings, growth and dynamic instability: Take the Harrod-Domar growth model in the [Three Models Handout](#) and set the ICOR is 4 so that $A = .25$ and the savings rate is 12%. (a) What is its Harrod-Domar or “warranted” growth rate? What happens to growth if s rises to 20%? What stylized fact or conventional wisdom regarding the causes of growth does this result imply? (b) Is there any tendency toward convergence, conditional or absolute, in the HD growth model? If savings and productivity rates are higher for rich countries, how will their growth rates compare to those of poor countries. (c) There is one “warranted” rate of savings (s) that makes $Y^S = Y^D$ in the HD model, given A . *What happens to Y^S and Y^D if investment increases beyond the warranted rate? Use an example similar to that of the handout to illustrate this effect with or without contribution of investment to current output (that is, $Y=A(K+I)$ or $Y=AK$). How does this example to illustrate the “surprising” dynamic instability or “razor’s edge” property of the Harrod-Domar mode?. What is the source of this dynamic instability? What are the policy implications of this instability?*

4. Savings and Growth in the Solow Model: The diagram below plots the savings function $sy = sk^\alpha$ for $\alpha = .5$ and $s = .12$ over a range of values capital stock per worker k . (a) Why does the slope or MPK of this production/savings function decline as k increases? Explain intuitively how this would lead one to expect poor countries to grow faster than rich ones. Does this result depend on capital flows or trade between countries? (b) Suppose population growth is 3% (.03) what is the Solow model *steady state capital stock* (k^*) per person given $s=.12$ and $\alpha=.5$? How would an increase in s to .24 affect k^* and y^* ? Show this in both the Solow diagrams used in class. How does this increase in s affect *short and long term growth* in the Solow model? (c) *Demonstrate steady-state consumption per capita $c^* = (1-s)y^*$ is maximized when $s = \alpha = .5$ (you know c for $s = .24$, compute c^* when $s = .4, .5$ and $.6$ or solve for s such that $\partial c^*/\partial s = 0$).*

Solow Growth Model Example

s = 0.12 savings propensity, capital share $\alpha = 0.5$ and n = .03 population growth rate

k	y	sv	nk	sv-nk
2	1.4	0.17	0.06	11%
4	2.0	0.24	0.12	12%
6	2.4	0.29	0.18	11%
8	2.8	0.34	0.24	10%
10	3.2	0.38	0.30	8%
12	3.5	0.42	0.36	6%
14	3.7	0.45	0.42	3%
16	4.0	0.48	0.48	0%
18	4.2	0.51	0.54	-3%
20	4.5	0.54	0.60	-6%
22	4.7	0.56	0.66	-10%
24	4.9	0.59	0.72	-13%



5. a) Distinguish between absolute and conditional convergence. Illustrate your answer using the growth rate diagrams in the [Three Models handout](#). b) Briefly review the evidence on absolute vs. conditional convergence. (see Barro's Determinates of Growth, Chapter 1). Taken together what does the evidence on conditional international convergence imply about the preconditions for convergence (Lucas has a view on this). c) Discuss how selection bias and Galton's fallacy cast doubt on the empirical evidence regarding convergence. (see Jones Chapter 3) Do these same arguments apply to evidence on conditional convergence? (d) Discuss the implications of the AK endogenous growth model for convergence. e) Are all endogenous growth models inconsistent with convergence? (hint Sobelo) f) What is the essential assumption of endogenous growth models, that is the one that makes them endogenous rather than exogenous growth models? PhD. Students: how would you show this formally?

6. Levine and Renelt (1992) use this basic equation to test the robustness of cross section growth estimates,

$$\hat{\gamma} = -.83 - .35*RGDP60 - .38*GPOP + 3.17*SEC + 17.5*INV \quad R^2 = .46$$

(.85)
(.14)
(.22)
(1.29)
(2.68)

where the per capita growth rate $\hat{\gamma}$ depends on per capital income in 1960 (RGDP0), population growth (GPOP), secondary enrollment (SEC) and investment share of GDP (INV). Compare these results with those in Barro 1998 Chapter 1. What are the major differences in their benchmark models? Which of these results are consistent with the prediction of the endogenous or exogenous growth models (including the augmented Solow model)?

7. Purchasing power parity (PPP) estimates of income in poor developing countries tend to be higher than estimates based on official exchange rates. Compare WEO or WDI \$US GDP estimates to \$PPP per capita estimates for the same year for Vietnam, India, Mozambique, China and Brazil. Why does the PPP conversion factor for poorer countries tend to be higher than for the other countries? Why is it important to use PPP estimates for income levels but not necessarily for growth rates? Why did China's per capita income fall by 1/3 using the new 2005 PPP estimates? What did this revision do to the \$1/day poverty rate in these countries and to fall in poverty since 1980?

8. A useful, encompassing measure of poverty is the Foster, Greer, Thorbecke (FGT) index, where n is total population, q is the population below the poverty line y_p and y_i is the income of poor person i. The income gap or shortfall of each poor

$$FGT = (1/n) \sum_{i=1}^q v_i^\alpha \text{ where } v_i = \frac{y_p - y_i}{y_p} \text{ where } y_p \text{ is the poverty line, } y_i \text{ is the income of household } i, q \text{ is the number}$$

of poor households, n is the number of households in the entire population. Suppose the poverty line is \$400 and there are four poor people with of a total population (n) of 10. The two rural poor people have \$200 in income and the two urban poor have \$300. What is the FGT index when $\alpha = 0$ and when $\alpha = 1$? Show that in the later case the FGT index equals $H*I$, where I is the average income shortfall or $(y_p - \bar{y})/y_p$ where \bar{y} is the average income of the poor. Now compute the FGT when with $\alpha = 2$. Suppose the government redistributes income among the poor so that all the poor have \$250 dollars in income. What is H and I now? How have they changed? Now compute the equal income FGT with $\alpha = 2$. What would happen if we raise α and recomputed the before and after redistribution FGT?

Supplementary Readings

- Barro, R.J. and X Sala-i-Martin (2004) *Economic Growth 2nd edition*, McGraw-Hill, New York Chapter 1.
- Barro, R.J. and X Sala-i-Martin (1991) "Growth and Convergence across States and Regions" *BPEA*, 1, 107-82.
- _____ (1992) "Convergence" *Journal of Political Economy*, 100, 223-51.
- Barro, R.J. "Economic Growth in a Cross Section of Countries" *Quarterly Journal of Economics*, 106, 1991.
- Barro, R.J. (1998) *Determinants of Economic Growth, Chapter 1*.
- Levine R. and D. Renelt (1992) "A Sensitivity Analysis of Cross Country Growth Regressions" *AER*, Sept, 84:2, 942-963.
- Lucas, R.E. (1988) "On the Mechanics of Economic Development" *Journal of Monetary Economics* 22, 3-42.
- Robelo, S. (1992) "Growth in Open Economies" *Carnegie Rochester Conference Series on Public Policy*, 36, pp. 5-46.
- Romer, Paul M., (1986) "Increasing Returns and Long Run Growth," *Journal of Political Economy*, 94:5, 1002-37.