Barreto, Spring 2014, DePauw University

NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Econ 390: Macro Topics

# Exam 1: Economic Growth—SUGGESTED ANSWERS

*15 Questions. First ten questions worth 5 points and last five are 10 points.*

Use the chart below, created using Maddison’s *World Economy* data, to answer questions 1 – 5.



Q1) What two things are wrong with this chart? (There are actually three so I’m giving you a break.)

1. Missing a title
2. Missing a y axis label
3. When printed without color, it’s very hard to see which country is which. Actually, even with color the chart stinks because it’s hard to see which country is which. I’m not a fan of the markers either.

Q2) Botswana is the country doing really well compared to the other countries on that chart. From 1970 (when it seemed to take off) to 2008, real GDP per person went from 650 (GK$) to 4,800. Compute the CAGR in the *Intro* sheet. Label your answer clearly and report it here: \_\_5.4%\_\_\_\_\_.

CAGR = (4800/650)^(1/38) – 1 ≈ 5.4%.

Q3) Does the Rule of 70 seem to be working here? Explain and show your work in the *Intro* sheet.

The Rule of 70 is an approximation to roughly calculate the time it would take for something growing at a constant rate to double. Growing at 5% per year, the Rule of 70 says we’ll get doubling every 70/5 = 14 years or so. From 650, doubling to 1300 would occur by 1984 and doubling again to 2600 would be achieved by 1998, 5200 in 2012 so yes, it looks like the Rule of 70 works (once again).

Q4) Botswana’s Real GDP per person growth rate is outstanding, but that doesn’t mean that Botswana is a rich country. Then why do we care about the percentage change so much?

Because the percentage change determines future prosperity. It is true that we care about the level of GDP per person, but a high rate of growth will produce a high level of GDP in the future. Were Botswana to maintain a 5% growth rate, doubling every 14 years or so, this would produce a fantastically rich GDP in a few decades. Conversely, growth at say 1% would imply 70 years to double and prolonged poverty for centuries. Adam Smith had it right, everyone is happy when an economy is growing rapidly.

Q5) What fundamental lesson does the chart convey?

There are a couple of possible answers here. One is the amazing variability in economic performance. Another is the deep ignorance of our current understanding of growth and why some countries succeed and others do not. Maybe I’ll read something else that’s a reasonable answer to this open-ended question.

Read the *Intro* sheet to get a sense of what is going on, then go to the *EqPath* sheet to answer the remaining questions on this exam.

Q6) Describe how the value for *k* at the end of the 1st year, 0.00057, is determined. I want a description of how the variables in the model (y, c, i, and k) are related to each other. A flow chart would be nice.

C

f(L, K)

Y

new K

I

-K

K and L make Y, which is then split into C and I according to the value of s. I is added to K, but we also subtract the used up K (K) to get new K for the next round.

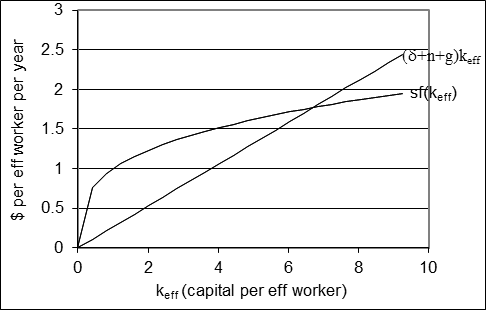
Q7) What does the value of cell H14, 0.00057, tell you?

If we’re at the steady-state. It is not zero, so we’re not there, but we are very close because 0.00057 is a pretty small number. This is the amount we will add to k next round so it won’t change k (or y or c or i) very much.

Q8) If the economy started from an *Initial k* of 1 instead of 6.7, would *k* at the end of the 1st year be bigger or smaller? Explain why.

Definitely bigger. We would be farther away from and below steady-state k so the economy would add a lot of k, producing catch-up growth.

Q9) Below is the canonical graph of the Solow Model for the economy with s=1%. Explain how this graph works. I mean, the intersection is obviously important, but what does it tell you and *why* does it tell you that?



The intersection tells you the steady-state solution. The curve tells you investment and the line contains the subtractions from k (via depreciation, pop growth, and fake pop growth). If k is below the intersection, to the left, then additions to k are greater than subtractions and k rises (moves right). Vice versa if k starts above or to the right. Only at the intersection do additions and subtractions equal each other and k remains unchanged. This is the definition of the steady-state.

Q10) In the graph above, explain why it is incorrect to conclude that *g* increases will lower *k\** and, thus, hurt the economy.

Because the x axis is in efficiency units meaning that we have imaginary workers as a way to model tech change and solve the model. To see what’s happening in the real economy, we have to remove these imaginary workers and see the path of the real economy. Looking at the real economy will show that increases in g shift up the steady state path of y and c, helping the economy.

*These are 10 point questions so they require more work and explanation.*

**Exam1S2014Answers.xls is a companion workbook to this Word doc.**

Q11) Copy the *EqPath* sheet and rename it *NCP*. Click the  button. Run the economy for 50 years.

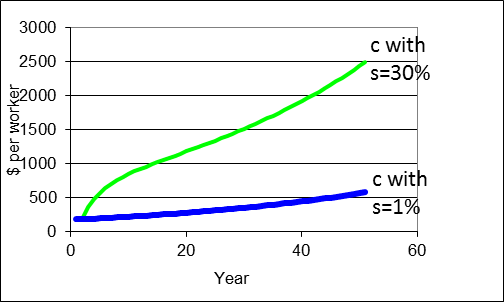
1. Why can’t you see *y* in any of the charts? Is it being plotted or is something wrong in this workbook?

Output is in every chart and plotted correctly, it’s just that s is so low that c (or C) is very close to y (or Y) and you can’t see output. More technically, it’s the order of the SERIES that determines the order in which they are plotted and if we changed y from 1 to 2, you would see y and not c.

1. What result could the NCP highlight to defend their position that *s* should not be changed? Please give me a specific number and explain why this supports the NCP’s position.

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The NCP could point to a stellar 2.4% growth rate in y (real GDP per person). This is way above the 2% per year growth rate that is considered very good for a modern economy.

Q12) Copy the *EqPath* sheet and rename it *NSP*. Do NOT click the  button. Change *s* to 30% and run the economy to its steady state. What result would the NSP show the NCP to convince them that they are idiots? Explain.

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In Year 51, with s=1% we get a 2.4% rate of growth in y and a value of 573 for c.

When we increase s to 30%, in Year 51 we have a similar 2.4% growth rate in y (because we are close to the steady-state) and c is 1700! Conclusion? The NCP are idiots. If you would like to make the case via a chart, here is how I would do it:

Q13) In a town hall meeting, the NCP’s Aglutton says, “The NSP’s plan will cause *c* to crater! The transition will kill us! I don’t care about what others would do for me, I just want to consume!” Is this correct? (Not the ethics of Aglutton’s position, but the claim about *c* cratering.) Answer by discussing the transition and directly compare numbers in the spreadsheet to explain your answer below.

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Here is a comparison of the first four years for the two economies, s=1% on the left and s=30% on the right:

The key data are in column c. Yes, it’s true that c will fall to 126.8328 in the second year and this is the famous transition that is the core of the problem in raising s, but c’mon, by next year c explodes to 246.6208, making the transition incredibly short-lived.

Q14) Should the NSP attempt to move the saving rate even higher? Why or why not? Do something in Excel to help support your answer and explain below what you did and what it shows.

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No. s=30% is the Golden Rule level of s. Any value of s other than 30% will produce lower c in the steady state.

Here is Year 51 for s=29%:



Here is Year 51 for s=30%:



Here is Year 51 for s=31%:



In other words, s=30% will produce the highest possible path for c. It is true that a higher s will produce a higher path for y (compare 2464.46 to 2430.07), but as Aglutton said, “I consume, therefore I am.” It really is all about c.

Q15) In your *NSP* sheet, you should see that the Econ will enjoy an insane 94.45% increase in *y* a year after they raise *s.* What kind of growth is this? Explain. Draw a chart using data from Excel to support your explanation and reproduce a rough, hand-drawn version below. If you can’t do it in Excel, at least give me the hand-drawn version with your answer.

This is catch-up growth. The economy is far, far away from it’s steady-state with s=30% so it zooms forward really fast to catch-up to its steady-state path, which can be envisioned as a magnet.

The chart in Excel (in sheet *Q15*) looks like this: Hand drawn version would be this:

The thick line is the steady-state path for y and the thin line is the actual path from the *NSP* sheet (where Year 1 had s=1% and then we increased s to 30% the following year). Notice how the thin line is rapidly attracted to its path for s=30%. The little hiccup (going sideways) at the beginning is because year 1’s low investment is passed on to year 2 and it’s not until year 3 that investment, and thus y, starts to grow rapidly.

Notice also how y goes to its steady-state path in a curve and not directly. It goes faster at first then slows down as it merges in, kinda like a car merging into a highway. Hmmm, gotta use this analogy in class next time . . .

**Save your workbook one last time. When you turn in your exam, I will check to make sure it is in your I drive folder.**