

Problem Set #2: Long-Term Economic Performance

Revised: October 30, 2013

You may do this assignment in a group. Whatever you hand in should be the work of your group and include the names of all of the contributors.

Solution: Brief answers follow, but see also the spreadsheet posted on the course website.

1. Sources of Korean success (35 points). The Republic of Korea (“South Korea”) has been one of the great economic success stories of world history. Since the end of the Korean War in 1953, GDP per capita has risen by a factor of almost 20. Over the same period, US income rose by a factor of 3. As a result, the gap between the two countries has shrunk dramatically. In 1953, average income in Korea was about 10% of US income, but by 2010 (the most recent comparable number) it was about 65%.

Was Korea a classic productivity story, or did capital formation and hours worked play more important roles than in other countries? We know, for example, that the saving rate and hours worked are both unusually high. Let’s check the numbers and see where the differences in GDP per person come from.

Use the Penn World Table spreadsheet, posted at

http://www.weebly.com/uploads/3/2/4/5/3245755/pwt80_globaleconomy.xlsx,

to fill in this table for 2011:

	South Korea	United States
GDP per person (Y/POP)		
GDP per worker (Y/L)		
Capital-output ratio (K/Y)		
Capital per worker (K/L)		
Employment rate (L/POP)		

Note that you may have to compute some of the entries yourself from the numbers in the spreadsheet.

- (a) What is the ratio of GDP per person in the two countries (Korea over US)? (5 points)
- (b) Use the production function to derive total factor productivity (TFP) in each country from the numbers in the table. What is the ratio of the two countries? How does it compare to the ratio you computed in (a)? (10 points)
- (c) Overall, what factors contribute to the difference in GDP per person? How important is capital? (10 points)

- (d) You have heard that Koreans work exceptionally long hours. The OECD Employment Outlook reports that the average employee in Korea worked 2090 hours in 2011, while the average American employee worked only 1787 hours. How would this information change your calculation of TFP? How does it change your assessment of the relative productivity of Korea and the US? (10 points)

Solution: Brief answers follow.

See the spreadsheet for the calculations. The table becomes

	Korea	USA	Ratio
GDP per person (Y/POP)	29,272	42,140	0.695
GDP per worker (Y/L)	58,864	93,038	0.633
Capital-output ratio (K/Y)	3.981	3.146	1.265
Capital per worker (K/L)	234,314	292,659	0.801
Employment rate (L/POP)	0.497	0.453	1.097

- (a) The ratio is $0.695 = 29,272/42,140$: Korea has, by this measure, a living standard about 70% of the US's. The rest of the question is devoted to explaining the sources of this difference.
- (b) We compute productivity the usual way from measures in output and inputs. If the production function is $Y/L = A(K/L)^\alpha$, then $A = (Y/L)/(K/L)^\alpha$ with (as usual) $\alpha = 1/3$. Thus for Korea we have $A_K = 58,864/234,314^{1/3} = 955$. The ratio of productivities is 0.681, which is a little bit less than the ratio of GDP per capita.
- (c) What we have in mind is a level comparison:

$$\begin{aligned} \frac{(Y/POP)_K}{(Y/POP)_{US}} &= \left(\frac{(L/POP)_K}{(L/POP)_{US}} \right) \left(\frac{A_K}{A_{US}} \right) \left(\frac{(K/L)_K}{(K/L)_{US}} \right)^{1/3} \\ &= 1.097 \times 0.681 \times 0.929 = 0.694. \end{aligned}$$

You see here that most of the difference comes from productivity.

- (d) This question is intentionally more demanding. We modify the production function to include hours of work. There's more than one route to this answer, among them $Y = AK^\alpha(hL)^{1-\alpha}$. Productivity ("corrected" for hours worked) is now 5.841 in Korea and 9.516 in the US. (The use of hours data changes the units, so they're not comparable to the previous numbers.) The ratio is 0.614, which is well below our earlier calculation of 0.681. In words: part of what we attributed to productivity before was really a difference in hours worked.

2. Brazil by the numbers (35 points). Let's re-examine Brazil's recent economic perfor-

mance to draw our own conclusions about its trends and drivers.

Fill in the following table using the same source as the previous question:

	1980	2005	2011
GDP per capita (Y/POP)			
GDP per worker (Y/L)			
Capital-output ratio (K/Y)			
Capital per worker (K/L)			
Employment rate (L/POP)			

- Compute the (average annual continuously compounded) growth rates of GDP per capita and GDP per worker over the periods 1980-2005 and 2005-2011. (10 points)
- Use our growth accounting methodology to allocate growth in GDP per worker to growth in productivity and capital per worker. Which factor changed most between the two periods? (15 points)
- Use the World Bank's [Doing Business](#) rankings to assess Brazil's business environment. What are its strengths? Weaknesses? In brief, what role do you think these factors played in the country's recent economic performance? (10 points)

Solution:

- See the spreadsheet for calculations. The table becomes

	1980	2005	2011
GDP per capita (Y/POP)	4,802	7,378	8,659
GDP per worker (Y/L)	11,554	15,312	16,805
Capital-output ratio (K/Y)	2.177	3.861	3.813
Capital per worker (K/L)	25,153	59,120	64,083
Employment rate (L/POP)	0.416	0.482	0.515

In the earlier period, annual GDP per capita growth and GDP per worker growth were 1.718 and 1.126 percent, respectively. In the later period, these growth rates were 2.666 and 1.551, a marked acceleration.

- In the earlier period, contributions to output per worker growth were -0.013 from productivity and 1.139 from K/L. That is to say, over 100 percent of growth was accounted for by capital accumulation. In the later period, this trend reverses, with 1.103 due to productivity growth and 0.448 from K/L. About two thirds of recent growth in output per worker came from productivity gains.

(c) Brazil is currently below the median overall ranking of the 189 countries surveyed by Doing Business. Of the institutional topics surveyed, the country generally does poorly on the regulatory environment (taxation, starting a business), the conduct of business (trade, financing) and enforcement (contracts, claims during insolvency). This low level of institutional quality was no doubt contributing to the long period of zero productivity growth. Strengths for the country include getting electricity and protecting investors. To the extent that these are both related to investment in capital - particularly physical capital - it would help to explain the positive contribution of K/L to growth in both periods.

3. Labor market conditions (30 points). Your first day on the job at General Electric, you are given 4 hours to collect information for a 5-minute presentation to your group summarizing the labor market conditions a manufacturer would face in Mexico, Poland, and Singapore. Once you get over your initial panic, you contact your Global Economy professor, who suggests that you look at the following websites:

- The Bureau of Labor Statistics' [International Labor Comparisons](#) page, especially the section titled Hourly Compensation Costs, which includes wage costs in a number of countries, collected on a comparable basis.
- The World Bank's [Global Development Indicators](#) and the [Barro-Lee dataset](#), which include information about the education and literacy of the population.
- The World Bank's Doing Business website, which includes institutional information about the labor market, labeled [Employing Workers](#).
- The Economist Intelligence Unit's Country Commerce Reports, particularly the section on human resources, which describes the legal and business environment governing employment. Access the reports by: going to NYU's [Virtual Business Library](#), click on Country Information, then EIU Country Commerce, login as directed, click on Country Commerce, and choose the country of interest.

Use this information to put together a short report summarizing labor market conditions in these three countries.

Solution: The basic tradeoff here is between cost (the wage data) and quality, including the quality of the institutions you'd be dealing with. Here's a table of some of the numbers you might find for 2012 (or 2010/1 when 2012 is not available), but yours may differ depending on the source:

	Mexico	Poland	Singapore
Hourly compensation (USD)	6.36	8.25	24.16
Highest level of education primary (% pop.)	20	20	27
Highest level of education tertiary (% pop.)	9	15	18
Average years of schooling (total)	9.1	9.8	9.1
Minimum wage (monthly, USD)	128	410	0
Severance (weeks, 10 years experience)	30	13	0

The lines represent different sources; in the order they appear, BLS, Barro-Lee, Doing Business.

A quick summary:

- Singapore: educated workers, flexible labor market, expensive.
- Mexico: low wages, low skill, difficult to fire people.
- Poland: higher skilled workers, somewhat more flexible labor market but with highest minimum wage, part of the EU.