Problem Set #2: Long-Term Economic Performance

Revised: October 22, 2014

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 attached spreadsheet. Download this pdf file, open it with the Adobe Reader or the equivalent, and click on the pushpin:

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 remaining difference in GDP per person comes from.

   Use the Penn World Table summary spreadsheet,

   http://pages.stern.nyu.edu/~dbackus/2303/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)		
Hours worked (h)		

   (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. If you incorporate hours data into your calculations, how does your calculation of TFP change? How does this affect your assessment of the relative productivity of Korea and the US? (10 points)

Suggestion. If you have Korean friends or classmates, ask them what they think.

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
Hours (h)	2193	1703	1.288

(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:

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

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 5.657 in Korea and 9.826 in the US. (The use of hours data changes the units, so they're not comparable to the previous numbers.) The ratio is 0.576, which is well below our earlier calculation of 0.681. Evidently part of what we attributed to productivity before was really a difference in hours worked. Or else, as someone suggested in class, they're not really working all of that time.

2. *La Dolce Vita (35 points).* Like most of Western Europe, Italy grew rapidly after World War II. It differs from some of the other European countries in slowing almost to a halt over the last decade, even before the crisis took hold. The question is why.

   We'll start by looking at the numbers. Complete the following table using the same source as the previous question:

	1950	2000	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)			

   (a) Compute the "average annual continuously compounded growth rates" of GDP per capita and GDP per worker over the periods 1950-2000 and 2000-2011. (The long phrase in quotation marks is a signal to use logarithms.) (10 points)

   (b) 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)

   (c) Use the World Bank's Doing Business rankings, and any other sources you deem relevant, to assess Italy's business environment. What are its strengths? Its weaknesses? What factors would you blame for Italy's malaise? (10 points)

   Suggestion. If you have Italian friends or classmates, ask them what they think.

> **Solution:** The idea is to take a quick look at Italy's economic performance. To make the numbers easier to manage, I've divided Y/L and K/L by 1000, which changes the units of TFP, too. The growth rates, of course, are the same either way. See the spreadsheet for details.

(a) The numbers are

	1950	2000	2011	Growth Rates	
				1950-2000	2000-11
Y/POP	3.596	28.734	29.051	4.157	0.100
Y/L	10.105	72.449	71.678	3.94	(0.097)
K/Y	2.718	3.446	4.769	0.475	2.954
K/L	27.465	249.637	341.831	4.414	2.857
L/POP	0.356	0.397	0.405	0.218	0.181

Growth rates are percentages. Numbers in parentheses are negative.

To take one number: the (average annual continuously compounded) growth rate of GDP per capita for the period 1950-2000 is

$$\gamma = \ln(28.734/3.596)/(2000 - 1950) = 4.157\%.$$

(We give 3 digits here to allow you to compare your own numbers, but it's excessive accuracy, not justified by the quality of the data.) The other growth rates are computed the same way. If you're not sure why this works, refer to the discussion of growth rates in the math review.

For the later period, the growth rate is 0.100% (zero, really), so there's been a sharp drop in economic performance. If you look more closely, it's not simply a reflection of the financial crisis; growth stopped before that.

(b) We use the production function $Y/L = A(K/L)^{1/3}$, so TFP is $A = (Y/L)/(K/L)^{1/3}$. In growth rates, this becomes

$$\gamma_{Y/L} = \gamma_A + \alpha\gamma_{K/L}$$
$$1950\text{-}2000: \quad 3.940 = 2.468 + 1.471$$
$$2000\text{-}11: \quad -0.097 = -1.050 + 0.952.$$

We see here that almost all of the drop growth comes from productivity. For whatever reason, productivity stopped growing. In fact, it's going down. But why?

(c) Italy remains one of the more prosperous countries in the world, with a long and distinguished history and culture. The World Bank ranks it 24th in GDP per capita. Many of its institutions, however, are well below that. Doing Business ranks Italy 73rd in overall ease of doing business, 84th in ease of starting a business, 131st in difficulty and expense of

paying taxes, and 160th in efficiency of enforcing contracts. This is a picture, in short, of a country with some fundamental economic problems.

The Economist Intelligence Unit comments in its *Country Commerce* report:

- "The main attraction for foreign companies to set up operations in Italy is the size of the domestic market. Deterrents include the complexity of Italy's legal system; inefficiencies in public administration; inadequate infrastructure, particularly in the south of the country; and often high regulatory barriers to entry."

- "Italy's rigid labour market consists mainly of two tiers of highly protected workers with lifetime jobs and those newly hired with short-term contracts that include little or no security. The European Commission has long called for changes to labour market legislation but the contentious nature of such reform in Italy resulted in very little progress."

The World Economic Forum's *Global Competitiveness Report* says: "Italy was 49th this year, with a lack of clear political direction over the past year increasing business uncertainty. ... Its labor market remains extremely rigid, hindering employment creation. Italy's financial markets are not sufficiently developed to provide needed finance for business development. Other institutional weaknesses include high levels of corruption and organized crime and a perceived lack of independence within the judicial system, which increase business costs and undermine investor confidence."

It's not hard to imagine that such things cut into productivity, with the results we noted earlier.

3. *Labor market conditions (30 points).* Your first day on the job at General Electric, you are given two hours to collect information for a 5-minute presentation to your group summarizing the labor market conditions a manufacturer would face in Brazil, the Czech Republic, and Taiwan. Once you get over your initial panic, you contact your Global Economy professor, who suggests you start with:

- The Bureau of Labor Statistics' International Labor Comparisons, especially the section titled Hourly Compensation Costs in manufacturing, which includes labor costs in a number of countries collected on a comparable basis.

- The Barro-Lee dataset includes information about the education level of the population. (In my experience, it's easiest to download the whole thing and look at the countries you want.)

- 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. To access the reports go to NYU's Virtual Business Library, click on Country Information, then EIU Country Commerce, login as directed using your NYU id and pw, click on Country Commerce again, and choose the country of interest.

Use this information to put together a short report summarizing labor market conditions in these three countries. A summary table or chart would be ideal.

Solution: We care about both cost and quality here, including the quality of institutions. Here's a table of some of the numbers you might have found:

	Brazil	Czecho	Taiwan
Hourly direct pay (USD)	7.53	8.77	8.08
Hourly total compensation (USD)	11.20	11.95	9.46
Average years of school (age ≥ 15)	7.6	12.1	9.1
Minimum wage (monthly, USD)	441	428	630
Severance (weeks, 10 years experience)	17	13	43
Paid leave (days per year)	26	20	14
Labor market efficiency (index)	3.8	4.3	4.6

The lines represent different sources; in the order they appear, BLS, Barro-Lee, and Doing Business. The last line comes from the World Economic Forum and was not one of the sources given to you.

Some of the highlights from the human resources sections of the EIU's *Country Commerce* reports:

- Brazil: Brazil has a highly regulated and costly labour system for the formal sector, and there continues to be a sizeable informal sector that employs many workers.

  The 1988 federal constitution legalises unions, collective-bargaining negotiations and the right to strike in both the public and private sectors. The constitution also sets overtime rates, provides a monthly minimum wage and regulates working hours. It lists a variety of labour entitlements, including maternity leave, annual leave, worker's compensation, social services, medical assistance and unemployment benefits.

  Labour costs in Brazil are high. This is mainly because of the many mandatory charges and taxes attached to employment. Although wages remain quite moderate, they account for at most two-thirds of the total costs of hiring labour.

- Czecho: The Czech Republic has a highly skilled workforce, particularly in technology and engineering. Educational and literacy levels are high. Companies report few difficulties in recruiting skilled and unskilled workers, particularly in industrial areas.

  Czech labour law derives from the Communist-era Labour Code of 1965, though it continues to evolve. ... Changes introduced in January 2011 exempt workers with tenure of less than two years from mandatory three-month severance pay in the event of involuntary termination. The revision, made with the goal of boosting job-creation, cut severance for newer employees to one month's wages for those with less than one year of service and two months' wages for those with 12 years on the job.

- Taiwan: Taiwan does not recognise Western-style labour rights, and employers set wages unilaterally. Both will probably change as the TCTU (a labour union umbrella group) and other unions gain power. ... Nine years of schooling are compulsory, and a full 12 years is common. ... Workers are entitled to 7 days paid leave after 1-3 years of service, 14 days after five years, and up to 30 days for service over ten years. ... The 2002 Labour standards Law reduced the workweek from 48 hours to 42. ... Minimum dismissal notice for blue-collar workers varies with time of service, with 30 days for those employed more than three years.

My summary: the countries aren't wildly different, particularly in the total cost of labor (including fringe benefits and taxes). The most obvious differences are

- Brazil: lowest education level.

- Czech Republic: the most educated of the three, part of the EU (is market access important?).

- Taiwan: a little cheaper, but minimum wage and severance are higher.