NYU STERN

The Global Economy
Professor David Backus

Midterm Examination

Revised: March 12, 2010

You have 75 minutes to complete this exam. Please answer each question in the space provided. You may consult one page of notes and a calculator, but devices capable of wireless transmission are prohibited.

I understand that the honor code applies: I will not lie, cheat, or steal to gain an academic advantage, or tolerate those who do.

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(Name and Signature)

1. *Growth in Korea.* Korea has been one of the world's great success stories since the end of the Korean War, but there's still some debate about why. Was it a classic productivity story, or did capital formation and hours worked play important roles? We know, for example, that the saving rate and hours worked are both relatively high. Your mission: to check the numbers.

   You go to the Global Economy resource page and find:

Country	Year	Y/L	K/L	K/Y
Korea	1960	5,964	9,322	1.52
Korea	2007	47,723	210,432	4.41
US	1960	37,318	102,655	2.75
US	2007	84,342	274,080	3.25

   Data are from the Penn World Tables, Version 6.3. Y is real GDP and K is the stock of capital (plant and equipment, computed with a depreciation rate of 6%). Both are PPP-adjusted and measured in 2005 US dollars. Employment L is the number of people working. We refer to Y/L as output per worker and K/L as capital per worker.

   (a) *Productivity.* Compute total factor productivity for each country at both dates. How did the ratio of Korean to US productivity change between 1960 and 2007? How does it compare to the analogous ratio for output per worker? (10 points)

   (b) *Growth.* Compute (average annual continuously compounded) growth rates of output per worker for the two countries. Which is larger? (10 points)

(c) *Growth accounting.* Decompose growth in GDP per worker into its components. How much of Korea's growth in output per worker was due to productivity? How much to capital formation? What about the US? How important does Korea's high saving rate seem to be? (10 points)

(d) *Hours worked.* You read in the *Wall Street Journal* that Koreans work exceptionally long hours. The OECD reports that the average employee in Korea worked 2266 hours in 2007, while the average American worked only 1799 hours. How would this information change your calculation of TFP? Does it change your assessment of the relative productivity of Korea and the US? (10 points)

Solution: The question consists of calculations and their interpretation (the impact of saving and hours worked on economic performance).

(a) We compute productivity the usual way: if the production function is $Y/L = A(K/L)^\alpha$ then $A = (Y/L)/(K/L)^\alpha$ where (again as usual) $\alpha = 1/3$. The results are reported in the last column:

Year	$(Y/L)_K/(Y/L)_{US}$	A_K/A_{US}
1960	0.16	0.36
2007	0.57	0.62

The result: evidently there's been a much larger increase in output per worker than in productivity. So it's not all productivity.

Grading: 10 points for the calculations.

(b) Growth rates are computed using natural logarithms. (We denote natural logs by "log," but they're LN in Excel and on TI calculators.) For example, the growth rate in Korea's output per worker is

$$\gamma_{Y/L} \;=\; \log(47723/5964)/47 \;=\; 0.0442 \;=\; 4.42\%.$$

The same calculation for the US gives us a growth rate of 1.73% per year. It's clear that Korea grew faster — in fact, we knew that from the previous question, because the ratio of Korea to the US rose sharply.

Grading: 10 points for the calculations.

(c) The usual growth accounting exercise. The numbers are

$$\begin{aligned} \text{General:} \quad & \gamma_{Y/L} \;=\; \gamma_A + \alpha\gamma_{K/L} \\ \text{Korea:} \quad & 4.42 \;=\; 2.21 + 2.21 \\ \text{US:} \quad & 1.73 \;=\; 1.04 + 0.70. \end{aligned}$$

Compared to the US, Korea's growth rate of productivity is more than twice as large. But the contribution of capital per worker is three times

as large. Productivity still accounts for half of the growth in output per worker, but that leaves half for capital.

You can see the same thing in several of the numbers here: capital per worker has been more important in Korea than in the US. In that sense, the high saving rate has played a role.

Grading: 8 points for the calculations, 2 for noting the connection between the growth in capital per worker and saving.

(d) This question is intentionally more demanding, designed to give experts a chance to show off. Here we modify the production function to include hours of work: $Y/L = A(K/L)^{\alpha}h^{1-\alpha}$. As a result, productivity ("corrected" for hours worked) is now 4.65 in Korea and 8.78 in the US. (The use of hours data changes the units.) Relative productivity is 0.53, which is considerably less than the ratio of 0.62 we found earlier. In words: part of what we attributed to productivity before was really long hours. Put another way: Korea looks better (relative to the US) in a comparison of output per worker than in a comparison of TFP, because output per worker includes a contribution from long hours. We can't assess the contribution to growth, however, because we're missing the 1960 hours data.

Grading: 4 points for the formula, 4 for the calculation, and 2 for a sensible comment about what it means.

2. *Ghana v. India.* As a summer intern at Booz & Company, you have been asked to prepare a short report on the possibility of opening call centers in Ghana aimed at the US market. Your report would serve as input to a sales pitch to Genpact, the global outsourcing firm, to help them identify attractive locations to expand their business. Like other companies in this space, Genpact started in India, whose low wages and large population of educated English-speakers made it a good choice. Now, with business growing and wages rising in India, Genpact is expanding into new countries. Ghana is a former British colony that has been growing rapidly in recent years after a period of unusually stable politics. Its official language is English.

   You put together a table of numbers using links from the resource page of your Global Economy course:

Indicator	Ghana	India	Source
GDP per capita (dollars)	1,572	2,932	IMF
Literacy (%)	58	61	CIA Factbook
Expected schooling (years)	9	10	CIA Factbook
Absence of corruption (index)	39	34	Transparency Intl
Control of corruption (index)	57	46	World Bank
Government effectiveness (index)	52	52	World Bank
Rule of law (index)	51	58	World Bank
Employment rigidity (index)	27	30	Doing Business
Severance costs (weeks of pay)	178	56	Doing Business
Quality of infrastructure (rank)	76	89	World Ec Forum
Quality of electricity (rank)	101	106	World Ec Forum
Quality of education (rank)	74	37	World Ec Forum

Indexes are on a scale of 100, ranks out of 133.

Using these numbers — and your own experience and business judgment — you jot down ideas organized around these questions:

(a) What features of a country would make it a good choice for this business? (10 points)

(b) Based on the evidence here, what are the strengths and weaknesses of Ghana relative to India as a location for this business? (10 points)

(c) Overall, would you favor expansion into Ghana? Why or why not? (10 points)

Solution: The challenge here is to take a random collection of data and use it to form a coherent view of the quality of the local business environment *for this particular business*. Good answers tied these measures to the needs of call centers, less good answers typically listed the measures and simply noted which country looked better.

(a) Here's a guess of the main issues in (roughly) declining order of importance: wages, English-speaking, literate and somewhat educated, flexible labor market, good telecommunications infrastructure, and general business-friendly environment. Most of the indicators can be mapped into these categories.

Grading: 10 points for something close to this or something logically coherent on its own terms, partial credit otherwise. It's essential that the answer address this specific business.

(b) Overall they're pretty similar. Wages are likely lower in Ghana, since GDP per capita is. English isn't the official language India, but it's a common second language and many Indians speak English. In Ghana,

English is the official language. Literacy and education are a little lower in Ghana, but there's not much difference. It's not clear how good the infrastructure is, but related measures (electricity, general infrastructure) are similar or somewhat better in Ghana. The countries are similar on employment rigidity (Ghana is slightly less rigid), but Ghana has higher severance costs. (It's not reported in the table, but severance payments here are for workers with 20+ years of employment, so the number may not be typical for this business.) As for the general environment: rule of law, control of corruption, and effectiveness of government are all similar in the two countries.

Grading: 10 points for similar discussion.

(c) I'd say the two countries are similar in most respects. If you can run this business in India, you can probably run it in Ghana, where wages are lower. The one source of concern is severance costs — we might want to look more closely at this.

Things I'd want to collect more information about: wages for the appropriate skilled people, political situation, how severance works, whether this quality of education measure is relevant to me.

Grading: 10 points for this or other logical argument.

3. *Miscellany.*

(a) *Real and nominal.* In 2009, nominal GDP in the US fell by 1.3% and real GDP fell by 2.4%. What do the two numbers represent? Why are they different? (10 points)

(b) *Minimum wage.* Milton Friedman once said that the minimum wage was blatant discrimination against people with low skills. What do you think he had in mind? Do you agree? (10 points)

(c) *Chinese wages.* With Chinese wages rising rapidly, some observers have suggested that China will no longer be able to compete effectively with US producers. Do you agree? Why or why not? (10 points)

Solution:

(a) Real GDP is (roughly) an index of quantities produced valued at base-year prices. Any change reflects changes in the quantities, since we are using the same prices at all dates. Nominal GDP is the current value of good produced: the sum of current price times current quantity. Changes thus reflect changes in both prices and quantities. The difference in their

growth rates is therefore (approximately) the change in prices or inflation: 1.1%.

Grading: 9 points for defining the two concepts, 1 for noting that inflation is the difference.

(b) Milton was a slippery devil, but this is basically right. One approach to this is based on our supply and demand diagram. Here labor is homogeneous and some workers get higher wages than they would otherwise, while others aren't hired at all: the minimum wage prices them out of the market. Of course, labor isn't homogeneous, people have different skills. If you think (to keep things simple) that there's a range of skill, from low to high, who do you think will be left unemployed by a minimum wage? Why the low-skilled? If your skill level corresponds to $5 an hour, and the minimum wage is $6, then firms are unlikely to hire you. On the other hand, if your skill level is $10, the minimum wage is irrelevant.

Grading: 10 points for a logical argument noting that the minimum wage treats people differently depending on their skill. 6 points for an analysis based on the supply and demand diagram.

(c) The central issue here is that hiring is based on wages relative to productivity. In our trade model, that's exactly what happened: wages reflected productivity. So if wages are going up, the question is why. If productivity is going up, too, there should be no impact on trade and the statement is wrong. That has to be the first-order effect: we know China is growing rapidly as productivity rises, and that must be reflected in wages.

Grading: 10 points for a logical argument that relates wages to productivity.