Chapter 10 Selected Answers

Problem 10.1:

(a)

Table 10.1.1. Catching Up

	GDP per capita in 2008 (constant 2008 dollars)	Growth rate needed for Catch Up to U.S. 2008 Level in: (percent per year)	
		100 years	200 years
United States	46,900		
Burundi	400	4.9	2.4
Ethiopia	800	4.2	2.1
Russia	16,100	1.1	0.5

(b) Using data from the *CIA World Factbook* (online; accessed in September 2010) [*different sources of may produce somewhat different answers*]:

Table 10.1.1.
Catching Up Times at Current Growth Rates

	GDP Growth Rate (percent per year)	Population Growth Rate (percent per year)	GDP per Capita Growth Rate (percent per year)	Time to Catch Up (years)
Burundi	3.5	3.7	–0.2	diverges
Ethiopia	8.7	3.2	5.5	76
Russia	–7.9	–0.5	–7.2	diverges

Problem 10.4:

Table 10.4.1

Accounting for Growth in Hong Kong and Singapore

Country	Annualized Growth Rates (percent per year)			Contribution to GDP Growth of:		
	Output	Labor	Capital	Labor	Capital	Technology
Hong Kong	4.6	2.2	4.9	29	41	30
Singapore	4.8	3.0	6.3	33	61	6

(*Interpretation of the data is left to the student*.)

Problem 10.5: 0.4 percent.

Problem 10.10. Table 10.10.1 shows that the speed limit rose by less than ½ percentage point between the two cycles. A substantial fall in relevant population (labor force) growth was more than offset by the increase in the rate of productivity growth. Actual growth was very close to the speed limit in the first period. It was, however, about 1/3 below the speed limit in the second cycle – one of many indications that the economy underperformed in the first decade of the millennium.

Table 10.10.1.

The "Speed Limit" and Actual GDP Growth

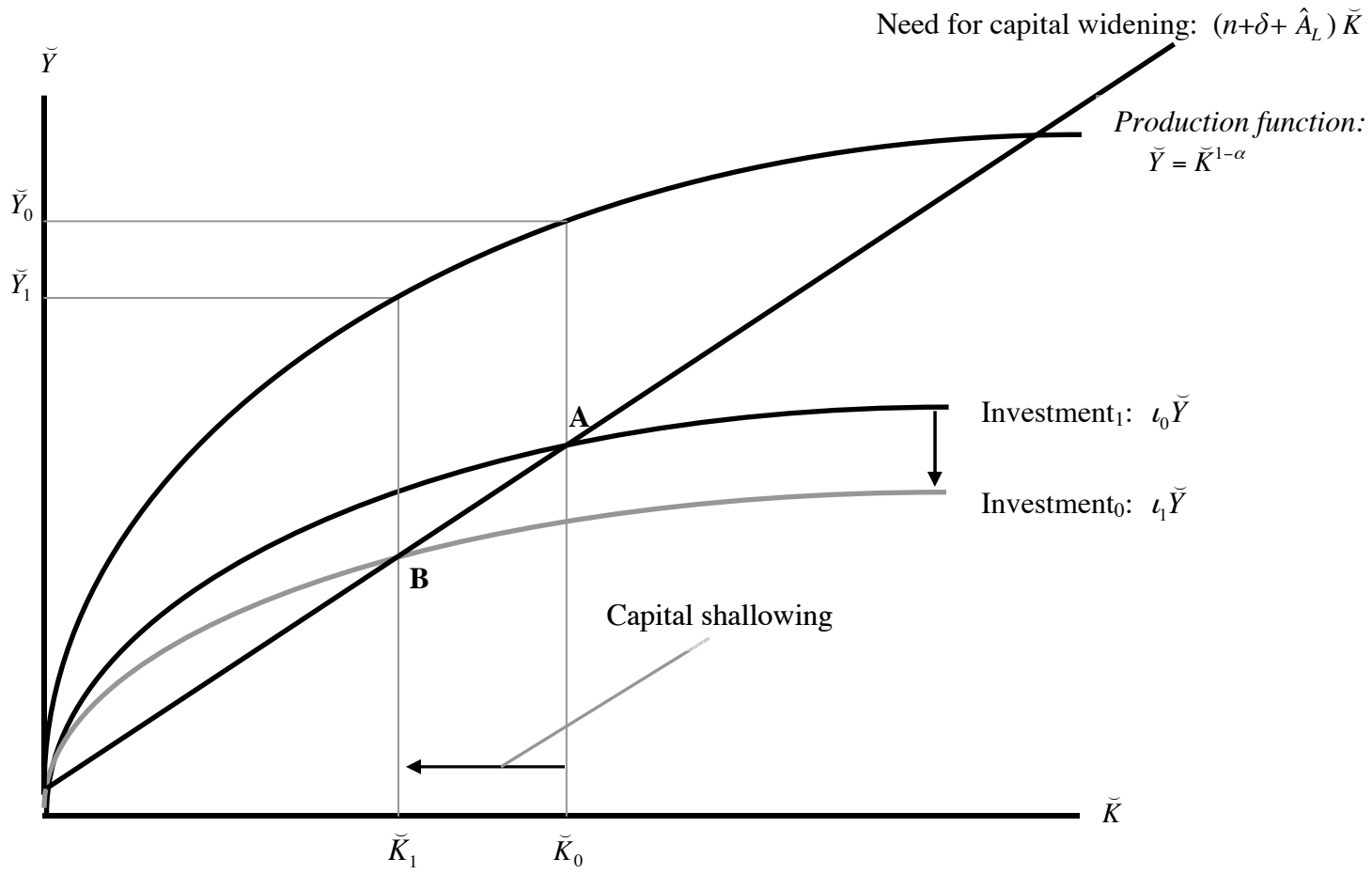
	Labor Productivity	Population (i.e., Labor Force)	"Speed Limit"	GDP
1990:3 to 2001:1	2.09	1.28	3.37	3.27
2001:1to 2007:4	2.82	0.98	3.80	2.52

Data are average growth rates computed as compound annual rates from quarterly data.

Problem 10.12.

(i) Figure 10.12.1 is a modified version of Figure 10.11 in which the rate of investment falls rather than rises. Since there is no technical progress, we can assume that $\breve{A}_L = 1$ and that any variable with a "smile" can be read as that same variable without the smile divided by L rather than $\breve{A}_L L$. A decrease in the rate of investment (a fall in ι) shifts the investment function downward. The steady state shifts from point A to point B. As a result the steady state level of capital per worker falls from $\breve{K}_0$ to $\breve{K}_1$ and the steady state level of GDP per worker falls from $\breve{Y}_0$ to $\breve{Y}_1$. Thus, in the long run (i.e., the steady state): GDP per worker falls, capital per worker falls, but since the speed limit, $n+\delta+\hat{A}_L = n+\delta$ remains unchanged, the rate of growth of GDP is unaffected. In the short run, neither GDP per worker nor capital per worker will be affected instantaneously. Instead, since GDP must be lower for any given future work force, the rate of GDP growth and capital growth must slow down below the speed limit and thus below the rate of growth of the workforce plus depreciation. Similarly, the rate of growth of capital will fall, so that capital spread over more workers and capital is not replaced as fast as it depreciates. Thus, in the short run, GDP per worker begins to fall rapidly, capital per worker begins to fall rapidly, though both converge to the speed limit as the steady state is approached. The rate of GDP growth falls, but also converges to the speed limit over time.

Figure 10.12.1
The Effect of a Decrease in the Rate of Investment



Problem 10.15.

(a) (*Left to student*)

(b) Scatter diagrams shown in Figures 10.15.1 and 10.15.2 with regression lines and R^2. Correlations: OECD countries $R = 0.13$; OECD countries $R = 0.11$.

(c) (*Left to student*)

Figure 10.15.1
Investment Shares and GDP Growth Rates in OECD Countries

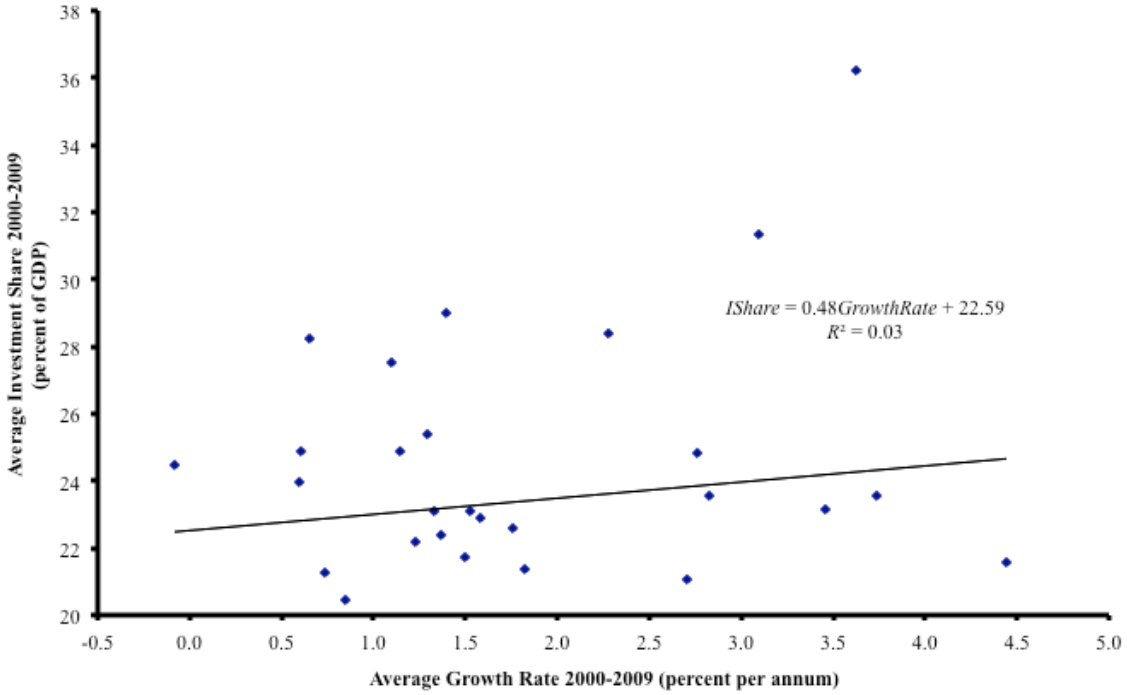


Figure 10.15.2
Investment Shares and GDP Growth Rates in Non-OECD Countries