Problem set 3 – model solutions

Question 1

	Output per capita		Capital per capita		Total factor productivity	
	Continuous	Discrete	Continuous	Discrete	Continuous	Discrete
Finland	4.53 %	4.63 %	5.28 %	5.42 %	1.23 %	1.24 %
Sweden	3.27 %	3.32 %	3.63 %	3.70 %	0.76 %	0.77 %
Germany	5.41 %	5.56 %	5.56 %	5.72 %	1.86 %	1.88 %
Italy	5.29 %	5.43 %	4.63 %	4.74 %	2.60 %	2.63 %
United Kingdom	2.54 %	2.57 %	3.15 %	3.20 %	0.35 %	0.35 %

I chose Finland, Sweden, Germany, Italy and the United Kingdom. You could have chosen any other European countries, provided that information exists, so former socialist countries could not be included. In the table, growth rates are calculated with both continuous and discrete method, but the results do not differ between them remarkably. The annual growth rates for output and capital per capita are calculated for years 1950—1973. The annual growth rates for total factor productivity are calculated for years 1954—1973 since there were no data before 1954.

We see that the annual growth rates of output and capital per capita were high in all the countries. However, Finland, Germany and Italy grew substantially faster than Sweden and the United Kingdom. Same can be observed when it comes to the growth of TFP, which was especially robust in Italy. Sweden and United Kingdom were already in 1950 economically very developed countries whereas with output per capita and TFP considerably higher than in the other countries that were still suffering from war damages in 1950. In this sense there has bee a catching up process: countries with initially low levels of output per capita and TFP have grown faster. In 1950, Finland's and Germany's output per capita were only 64 % and 52 %, respectively, of United Kingdom's value, but in 1973 they had the same output per capita as the United Kingdom. Italy's output per capita was only 46 % of United Kingdom's value 1950 but 86 % in 1973. In terms of TFP, Italy had already passed the United Kingdom in 1973.

Capital per capita was also lower in Italy and Germany than in Sweden or United Kingdom in 1950, but Finland's capital per capita was about the same as in the United Kingdom in 1950. The fast growth of capital per capita in Finland, Germany and Italy may also be explained by the type of economic growth as the countries industrialized rapidly.

Question 2

1. Output y is a function of capital per capita k, labor productivity h and total factor productivity A: $y = Ak^{\alpha}h^{1-\alpha}$. Total factor productivity A can then be solved from equation $A = \frac{y}{k^{\alpha}h^{1-\alpha}}$
2. Differences in y seem to be mostly explainable by differences in A rather than differences in h and k. In all countries except in Great Britain, $k^{\alpha}h^{1-\alpha}$ is of very similar size, although the values of k and h vary. But due to large differences in A, total there are notable differences in y. However, values of A are very similar in all countries except in the United States, where total factor productivity is very high relative to others.
3. $k^{\alpha}h^{1-\alpha} = \frac{y}{A} = \frac{0.71}{0.87} \approx 0.82$

   Assuming α = 1/3 and k = 1.14: $h^{2/3} = \frac{y}{Ak^{1/3}} <=> h = (\frac{y}{Ak^{1/3}})^{3/2} = (\frac{0.71}{0.87*1.14^{1/3}})^{3/2} \approx 0.69$

Value of h is now very low compared to other countries, where it is over 0.8 in each. Therefore, the measurement error, i.e., value 0.87 of A, does not seem plausible and A is likely to be smaller.

Question 3

1.

- In competitive markets, the wage equals the marginal product of labor (MPL). The higher is the marginal product of labor, the higher are wages. Holding A, K and α constant, we see from the equation of MPL: $MPL = (1-\alpha)AK^{\alpha}L^{-\alpha}$ that MPL is decreasing in L. This means that if countries are identical in technology, the amount of labor must be smaller in the country where the marginal product of labor and wages are higher.
- Yes, differences in A could explain differences in labor demand. The marginal product of labor is increasing in A. Therefore, a country with a higher A can have a higher marginal product of labor even with a larger amount of labor. That is, the demand of labor increases in total factor productivity.

2.

The marginal product of labor is increasing in K. This means that when K grows, demand of labor and wages increase. Increased demand of labor triggers an inflow of migrants. That is, the labor force employed in the region that grew in capital increases and that of the region that did not grow decreases.

Question 4

1. Fixed exchange rates are problematic if a country faces an idiosyncratic economic shock (i.e., shock specific to that country) or a larger economic shock than other countries. With a fixed exchange rate, the central bank cannot act as a lender if last resort or cut interest rates to boost the economy. Countries with fixed exchange rates effectively do not have own monetary policy. The exchange rate cannot be depreciated to increase export demand.

   Stability is the advantage of fixed exchange rate systems. Flexible exchange rates may disrupt foreign trade and depreciating currency increases inflation.

2. The United States have a system of federal taxes and transfers that smooth the effect of economic shocks. High labor mobility is important when facing economics shocks. In Europe, there are no federal taxes and labor mobility between countries is low, which makes it harder to respond to economic shock. Countries that face idiosyncratic economic shock cannot change their interest rates or depreciate/appreciate their currency, because the Eurozone has common monetary policy. Moreover, the Euro is hard to abandon.

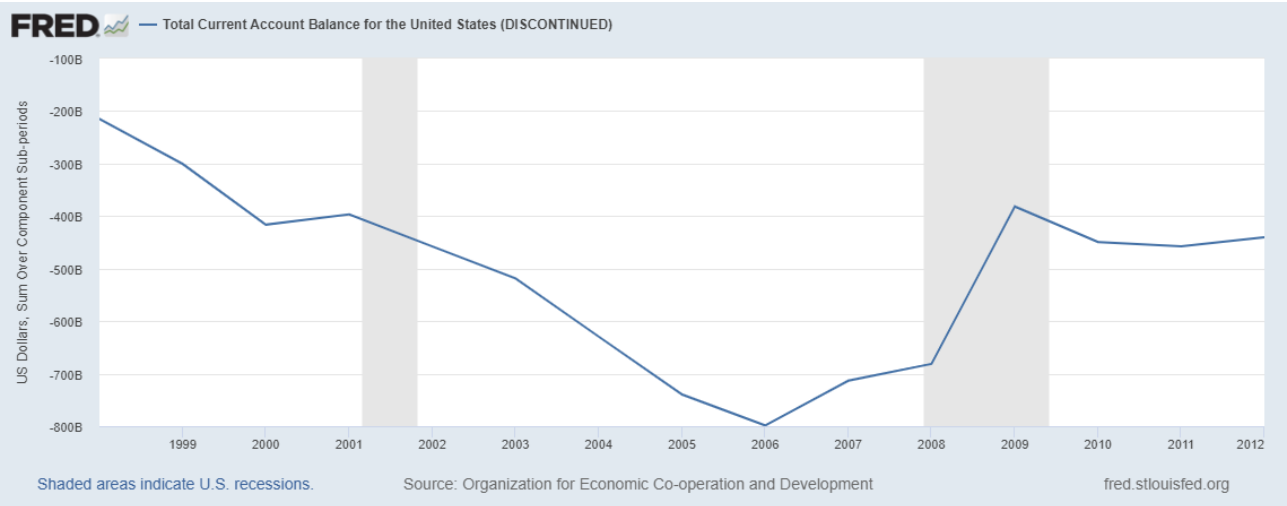
Question 5

1. I retrieved the data from Database called "Total Current Account Balance for China (DISCONTINUED)". Direct link here: https://fred.stlouisfed.org/series/BPBLTT01CNQ637S. FRED's visualization of the data can be directly downloaded as a png-file (it's ok if you downloaded the data and drew a graph yourself, for example in Excel). I took the sum of annual current account balance (the default in the graph is quarterly) in U.S. dollars.

China's current account surplus has grown tremendously. The current account balance has been positive throughout the period from 1998 to 2012. This mean that exports have exceeded imports. In the late 1990s and early 2000s, the current account balance was positive but quite modest, under $50 billion every year. Since 2004, the current account surplus started to grow remarkably and reached over $400 billion at its peak value in 2008. Since that, the surplus fell quite a lot and fast, but has remained a significantly larger than in the early 2000s. In 2009-2012, the current account surplus has been about $150-$250 billion.

2.

The U.S. total current account can be found from database "Total Current Account Balance for the United States (DISCONTINUED)", direct link here: https://fred.stlouisfed.org/series/BPBLTT01USQ637S. I again took the sum of annual current account balance (the default in the graph is quarterly) in U.S. dollars.



The U.S. current account balance has been negative all the time between years 1998 and 2012, which means that imports have exceeded exports. From 1998 to 2006 the current account balance became was declining almost each year; starting from about -$200 billion in 1998 and ending to about -$800 billion in 2006. Since 2007, the balance started to become less negative, becoming

-$400 billion in 2009. Since that, the balance has been quite stable, hovering around -$400 and -$450 billion. When compared to China, we can see that when China's current account surplus increased drastically, the deficit of the U.S. increased an vice versa. A likely reason is that the increase in China's surplus was driven by export to the United States, which then worsened the U.S. current account balance. And the increase in the balance of the United States (i.e. the balance became less negative) since the 2007, is maybe explainable by a fall in Chinese imports, which is why the current account surplus of China has decreased, although remaining strongly positive.

3.

According to the article, net financial capital flows should in theory be from richer countries, where physical capital per worker is higher and hence returns to capital are lower, to poorer countries, where capital is less abundant and there are more unexploited investment opportunities. However, the opposite is true in reality: many industrial economies are running current account deficits, while emerging market economies are running surpluses. This phenomenon is known as capital 'flowing uphill'.

While these 'uphill' flows appear to be a paradox, problems with developing countries such as poor infrastructure, institutions such as the legal system, corruption, and inability to repay foreign debt can lower the risk-adjusted returns to investment, explaining why capital does not flow from these countries in the levels that theory suggests.

4.

During Globalisation I, capital was flowing 'downhill': In the late 19th century, high income countries ran current account surpluses and lent to low income countries, financing the construction of railways and other infrastructure.

The pattern in Globalisation II contrasts with that of Globalisation I when capital flowed downhill: In point 3, we discussed reasons why capital flowed from poorer to richer countries, and Figure 18.10 shows that US FDI went predominantly to European countries with manufacturing wages higher than that in the US.

The situation can be compared. Many manufacturing industries requiring relatively cheap labour in factories shifted production to China. China thus became an exporting giant in the first decade of the 2000s, while the US has transformed to a services-based economy. There is a similarity with the late 19th century, insofar as China is importing capital (like Argentina) in order to finance rapid economic development. There are differences, however. In the late 19th century, the capital was supplied and owned by European investors (financial institutions) and went into railways and other infrastructure owned by Argentinian and US firms. In China, the capital has been supplied by western firms, who retain ownership of the productive capacity created.

Question 6

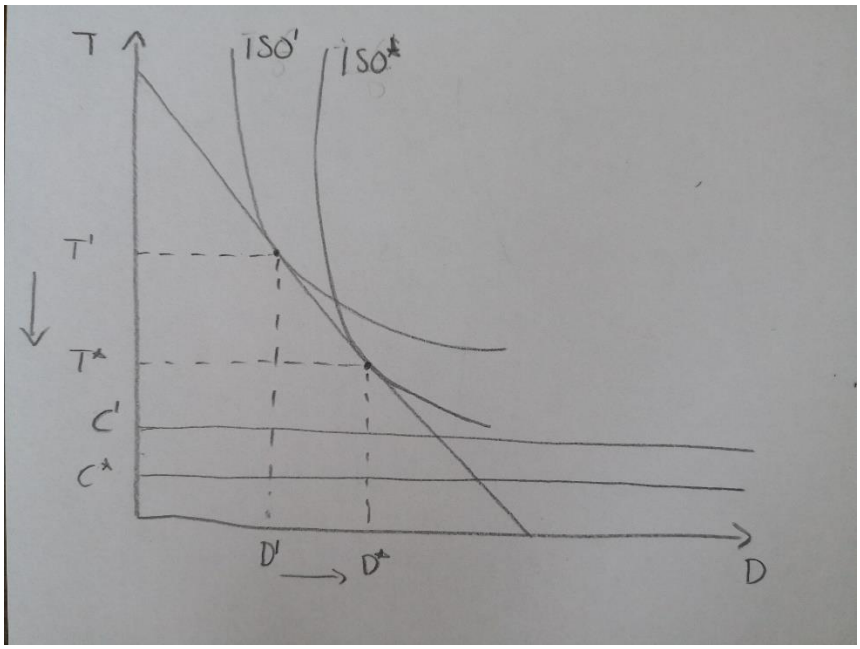
1.

Suppose the dictator pays the cost of providing public services, C, out of her own pocket (eventually financed by the tax payers). Suppose the dictator can instead finance the expenditure with loan D. The annual cost of the loan is rD, in which r is the interest rate. If $rD < C$, then it is worthwhile for the dictator to finance the expenditure with loan, because this would be cheaper than paying the cost C. However, this requires that the dictator can roll on debt forever (which the governments usually do), i.e., she repays the old debt with a new one.

Otherwise, if the debt was repaid without taking a new one, the dictator should save for the repayment, and the total costs of providing the public services would actually be higher, or the dictator would have to levy higher taxes in the future. If the people anticipated these future higher

taxes, they would probably require lower current taxes for any given duration of dictator's term, i.e., the duration curve would probably become steeper. The theory that taxpayers are perfectly forward-looking and anticipate that government spending financed with debt implies corresponding future tax increases is called Ricardian equivalence. By this theory, the way the government finances its spending does not matter, since the people adjust their behavior and expectations perfectly. But in this exercise, we assumed that the Ricardian equivalence does not hold, and the dictator really can provide the public services cheaper by borrowing.

2.



In this graph we have depicted the old costs of providing the public services as C'. The optimal choices of duration and tax rate are D' and T', which are given by the point in which the duration curve is tangent to the isorent curve ISO'.

Thanks to borrowing, the costs of providing the public services fall to C*. Since the absolute value of the slope of the isorent curve is given by equation $\frac{T-C}{D}$, we see that with C* < C', $\frac{T-C^*}{D} > \frac{T-C'}{D}$, that is, the slope becomes larger in absolute value, i.e., it becomes steeper. So, now we have the new isorent curve ISO*. With a steeper isorent curve, the new optimal combination of tax rate and duration is found in points T* and D*, respectively.

3.

We see that T* < T' and D* > D'. That is, when the costs of providing public services decrease, the dictator lowers the tax rate and stays longer in the office. The dictator lowers the taxes, since she can get the same private rent with a lower tax rate than before, because the costs of providing public services are smaller. Staying in the office longer becomes cheaper than earlier, because the dictator must trade off less private consumption to prolong her period. Collecting more tax revenue, instead, still require the same decrease in term duration as earlier. For this reason, the dictator substitutes term duration for tax revenue, i.e., chooses to stay longer in the office by lowering the tax rate.