**Answers to questions for An Introduction to Geographical Economics**

**Chapter 10 Dynamics and economic growth**

**Question 10.1**

Economists often use the idea of instantaneous price adjustment, meaning that after a shock has occurred prices adjust so fast that everybody and everything in the economy remains in equilibrium. In the model of geographical economics this is, however, not the case for labor (see equations (10.1) and (10.2)). Discuss why a very swift reallocation of labor across regions may not necessarily be a good thing. Also (*) what is the (implicit) assumption in the models of geographical economics in this book about the adjustment behavior of manufacturing firms?

**Answer 10.1**

According to equation (10.1) manufacturing labor migrates to the region with the highest real wage. The extent to which a particular regional real wage differential induces manufacturing workers to migrate is given by the parameter $h$. High (low) values for this parameter indicate a swift (slow) speed of adjustment of the spatial distribution of the manufacturing labor force to regional real wage differentials. In section 10.2.2 it is shown that if the speed of adjustment parameter $h$ becomes very large the adjustment process may for instance result in the economy ending up in an unstable equilibrium or it may converge to a different long run equilibrium than expected. These examples (recall Figure 10.2) indicate that setting $h$ at a high value is tempting (because when doing simulations this generally reduces the number of reallocations needed to arrive at a long run equilibrium) but there is a downside since it may lead to unpredictable outcomes. Hence the stylized fact that workers do not migrate whenever there is a slight real wage differential between locations may actually be a good thing because it suggests that the speed of adjustment parameter is best given a low value (like $h = 2$ in most of our simulations).

(*) The implicit assumption is that firms always move instantaneously, so there is no need to analyse the migration decision of firms. One could argue whether this assumption (firms move quicker than workers) is always a realistic one. Neary (2001) is a prime example in which for the core geographical economics model this assumption is reversed. Note that in
Box 3.4 we follow Neary (2000) and address for the 2-region core model the question whether or not, starting from a situation where $\lambda_i = 0.5$, a single firm moves to the other region.

**Question 10.2**

In Chapter 5 (section 5.2.2) it was argued that in terms of GDP per capita, convergence has taken place in the post-war period in the countries of the European Union, e.g. Portugal has caught up with Germany. Use the endogenous growth theory to explain this.

**Answer 10.2**

A crucial element in the Baldwin-Forslid growth model and in fact in many endogenous growth models is the presence of positive technical externalities or knowledge spill-overs. Using equation (10.3) these spill-overs exist if $\kappa > 0$. In the case of Portugal and Germany it seems likely that the strength of the inter-location knowledge spill-overs has increased after WWII due to for instance improved communication channels or also, partly thanks to the establishment of the single market in the EU, due to increased trade between Germany and Portugal. An increase of $\kappa$ is particularly important for the initially poorer country, Portugal. The possible increase of $\kappa$ is also relevant from the point of view of the distribution of the footloose economic activity between countries. As Figure 10.11 shows this increase makes it less likely that only full agglomeration is the long-run equilibrium when transport costs (as proxied by $T$) fall in the wake of European integration.

**Question 10.3**

At the end of section 10.3 four “stylized facts” about economic growth were formulated. Discuss how these four facts can in principle be explained by the Baldwin-Forslid model of economic growth and location.

**Answer 10.3**

In the Baldwin-Forslid model firms keep investing in knowledge and hence in new varieties of manufactures, this implies an ever increasing level of income per capita (fact (i)). Persistent differences in economic growth between regions (fact (ii)) can occur when (see equation (10.3)) $\kappa < 1$. In this case of, at least partially, localized knowledge spill-overs any initial difference between the locations in their stock of knowledge will be reflected in different
growth rates. Persistent differences in economic growth can also be explained by inter-regional differences in the discount rate of consumers. A relatively strong preference for present consumption (see Box 10.1) implies relative low savings and this is accompanied by a relatively low stock of capital. The possibility of long periods of low economic growth followed by periods of rapid growth (fact (iii)) could arise in the Baldwin-Forslid model from changes in the knowledge spill-over parameter $\tau$ and/or in the free-ness of trade parameter $T^{1-\epsilon}$. For the initially backward (= low growth) region an increase in $\kappa$ or a fall in transport costs may (but need not) lead to period with higher growth. Also, as Figure 10.11 shows, changes in these two parameters can account for changes over time in the spatial equilibrium distribution of economic activity.

**Question 10.4**
World-wide there has been a clear reduction in transport costs associated with international trade in the last decades (think of the GATT/WTO-inspired reduction in tariffs, the decrease in the costs of communication etc.) Despite this reduction, there has not been a clear convergence in GDP per capita at the global level. Use Figure 10.11 and equation (10.3) to explain why this might be the case.

**Answer 10.4**
Starting with equation (10.3) countries which started out with a lower level of GDP per capita may still end up with a lower level of GDP per capita if for instance 1) “poor” countries, due to their rate of time preference, simply care less about future consumption and hence have a relatively low $K$; 2) despite the fall in transport costs, knowledge spill-overs remain strongly localized; or if 3) even with an increase in knowledge spill-overs the effect of the fall in transport costs dominates with the result (see Figure 10.11) that the tendency towards stable agglomeration (implying sustained differences in income levels per capita) is strengthened.

**Question 10.5**
Section 10.4 deals with so-called simulation dynamics. Suppose globalization (defined as ever-decreasing transport costs) ultimately results in a truly global economy. What would this mean for the degree of economic agglomeration? *Hint: Use Figure 10.7*
Answer 10.5

This is of course very difficult to predict but our simulation experiment in section 10.5.2., upon which Figure 10.7 is based, suggests that a gradual fall in transport costs ultimately leads to a fairly even spatial distribution of the footloose part of economic activity. Starting from a very high level of transport costs (in our example $T = 3$) a step-wise reduction of these costs with 0.1 until $T = 1.01$ results in a lump-shaped pattern with respect to the degree of economic agglomeration. For high levels of $T$ there is spreading of economic activity, for intermediate levels of $T$ the degree of agglomeration clearly increases (see also Figure 10.9), and when transport costs become very low spreading again results. This outcome is not very surprising when one keeps in mind that the simulation experiment in section 10.5.2. is based on the 12 region (neutral-space) racetrack version of our core model that was introduced in Chapter 4 (p. 119) and we have seen various examples throughout our book where the lowering of transport costs leads to the “spreading $\rightarrow$ agglomeration $\rightarrow$ spreading” result (see for instance Figure 7.2 on cities and congestion).

Using a different model that has been briefly discussed in Chapter 6 (see pp. 179-180), Krugman and Venables (1995) also conclude that in their 2-region model globalization (= the gradual reduction of transport costs) leads to the afore mentioned pattern with respect to the degree of agglomeration, at first globalization fosters agglomeration (and leads to real wage differentials between the core and the periphery) but ultimately when transport costs become very low, firms start to re-locate out of the core and into the periphery.

Question 10.6

Figure 10.3 shows some examples of “leap-frogging” (USA over Australia around 1900; Japan over France around 1975). How can this phenomenon be explained in a geographical economics model? Hint: Look at Figure 10.9

Answer 10.6

Figure 10.3. shows the evolution of income per capita (in logs) for the USA, Japan, France and Australia for the period 1890-1990. For all four countries income per capita increased considerably during these 100 years (though with the possible exception of the USA the growth rate varied during this period), also when comparing 1890 and 1990 there has been a convergence of the levels of income per capita. Both facts (growth as such and convergence) can be explained by any textbook neo-classical growth model. Leap-frogging (countries
changing rank with respect to the level of income per capita) cannot be explained with standard growth models. Within a geographical economics model leap-frogging can, however, occur. In the simulation experiment upon which Figure 10.9 is based, it is assumed that transport costs change over time. We already know from Chapter 4 (see for instance Figure 4.2 but also the “sustain and break” analysis in section 4.7) that a change in transport costs may have an important impact on the balance between agglomerating and spreading forces. Changes in transport costs may induce (sudden) changes in the degree of agglomeration and thus the spatial distribution of income with countries overtaking each other as Figure 10.9 shows. Note that in the simulation experiment of Figure 10.9 economic growth is absent, it is only the allocation of distribution of a fixed number of manufacturing workers (and firms) that is analyzed. Nevertheless, even in this static setting the geographical economics approach can explain the occurrence of leap-frogging.

For more information on geographical economics and economic growth, see the “Further Reading” part of this website.