Lecture 8 - Locational equilibrium continued

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1 Introduction

1. Complications to the simple model
2. Introduction to transport

2 Complications to the simple location model

This section simply lists various ways the simple model can be extended to account for features of the real world economy that we have ignored.

1. Not all workers commute to centre or not all businesses export from center
   (a) Many people commute from city centre to suburbs
   (b) What is the center of London?
   (c) The model can be extended by adding several centres.
   (d) For example, suppose there were two centres? What would an equilibrium look like?
   (e) However, the complexity of the model increases with the number of centres and simple analytical statements about the equilibrium become more difficult to make. Computational models of this sort have been studied to understand cities with more than one centre.
2. Varying supply of land at every location or an endogenous supply of land at every location

(a) Rivers, roads, swamps, and hills can make some land unusable for housing or business.

(b) This can be handled by explicitly modeling the supply of land using the supply function $S_L(x)$. This function details what quantity of land is available for use in the urban economy at each location x.

(c) If the supply of land at each location can be altered, that is it is endogenous, the model becomes more complicated. To solve this more complicated model one needs to write down a model of the cost of altering the supply of land and then allow the total supply at each location to be determined in equilibrium as a function of the cost.

3. Transport cost could depend on the number of people in the city, the distance to the centre, or on the number of people commuting through a location.

   (a) Transport costs could be $t(N)$ where transport cost depends on population.

   (b) Transport costs could be $t(x)$ where transport cost depends on x.

   (c) Transport cost could be $t(n_c(x))$ where $n_c(x)$ is the number of commuters per unit land at distance x. Pick a distance x. Everyone who lives farther from the centre than x must commute through x. Therefore the number of people who must commute through location x is

$$N_c(x) = N - \int_0^x N(x')\,dx'$$

   where $N(x)$ is the number of people living at distance x. Then by definition

$$n_c(x) = \frac{N_c(x)}{2\pi x}.$$

   This allows transport cost to depend on how congested the transport network is. The higher is $n_c(x)$ at location x, the more people are crammed onto the network at location x. This model would assume that the marginal transport cost increases with $n_c(x)$.

(d) In each of these cases, equilibrium can be computed and studied. How would you expect the equilibrium in an urban economy to be affected by these alternative assumptions?

4. Moving costs, timing of sales, dynamics

   (a) The basic model has assumed that there is only one period and that each consumer or firm can costlessly move to their desired location. There is no cost of moving and there is no future. In reality, moving costs are important and when making location decisions people worry not only about the current equilibrium but also about future changes in the economy. For example, the rail terminal at Kings Cross is currently under construction. Living next to the construction is not very desirable. However, everyone knows that living near the new rail terminal will be very valuable. Thus, may people are buying properties next to the terminal in expectation of these future changes. If moving costs were zero, that is, if they were exactly equal to zero, then this wouldn't matter. At any point in time equilibrium in the spatial market would be established just as the simple model specifies. At every point in time people would instantaneously move to establish equilibrium. However, if there are moving costs, then this is not the case. To study the economics of spatial equilibrium with dynamics and moving costs requires an explicit model of dynamics. Mills page 148 has a brief discussion of speculation in urban economies. In general, each consumer would take into account both present and future payoffs when making a location choice and would only move when the benefits to moving outweigh the costs. Key parameters that will affect the dynamic equilibrium include 1) the same parameters that determine equilibrium in the static model, 2) expectations about future changes in the values of those parameters, 3) movings costs.

   (b) Some of these issues we will talk about later in the course, some will be addressed at least in part in the homework, others are beyond the scope of this course.

5. Next few lectures,

(a) Focus on intracity transport of people, goods and services

(b) What are the issues involved in transportation?

(c) Some economic models of different aspects of transportation?

(d) Mills Chapter 13

3 Transportation

1. Up to now transportation has played two roles in analysis

   (a) Transportation cost paid to commute or ship goods to the center, $t \cdot x$

   (b) One reason for the existence of a city. All businesses send exports to center because there are IRS to scale in shipping for export, i.e. docks, rail hub, airport

2. This treatment is unsatisfactory in many ways

   (a) What determines t? Is it a constant function of distance?

   (b) What about congestion? Is time of day important?

   (c) What about pricing, ownership and investment in transportation services?

      i. How are services priced? Is this efficient?

      ii. Public vs. private? Why is so much tranportation capital owned by the public? Why are transport services provided by the public?

      iii. What is the theory of transportation infrastructure investment?

      iv. Difference between social welfare and private utility

         A. Taxation/subsidization and regulation

         B. Externalities

         C. Monopoly

   (d) What about multiple modes of transport? Multiple destinations? Utility (or disutility) from time spent travelling?

i. People commuting to work often (but not always) travel at a regular time to a regular destination

ii. People shuttling about to ship, to visit friends, relatives, or just to wander often travel at irregular times and to multiple destinations

iii. Some types of goods best shipped long distance in bulk at a fixed schedule

iv. Other types have multiple destinations and irregular shipment times

v. These have implications, for public policy toward transport infrastructure, the shape of cities, and the spatial organization of cities

A. Different infrastructure required depending on whether transport is needed for multiple destinations at irregular times or for single destinations at fixed times

B. Infrastructure in turn affects people's behavior. If it easy to get around whenever you want you make different choices about where to live, work, etc.

C. Trucks have transformed retailing in the 20th century. Before trucks it was very expensive to restock a store that was not in the center of town.

D. Small town shopping districts in the US are dead and so far have proved very hard to revive. Part of the reason is they can't compete with the cost advantage that shopping malls have in terms of both 1)trucks delivering the goods 2) people's access by automobile

4 Transport of consumers

1. Goals of economic analysis of transportation

   (a) Theoretical model of supply, demand, government policy, and externalities:

      i. Understand efficiency and equity considerations of alternative arrangements

ii. Potential complications due to distortions in economy that might arise due to government intervention, monopoly behaviour, externalities

iii. When private incentives are different from social incentives, possibility for distortion, inefficiency

iv. Seek normative understanding of what government should try to do

A. Tax

B. Regulation

C. Infrastructure investment

D. Public vs private provision

(b) Measure costs and benefits of different modes of transport

i. Costs of supply

ii. Externality, monopoly, and costs of government distortion

iii. Benefits to users, consumers

(c) Problem: how to measure?

i. Costs of supply: relatively easy, see how much is spent providing different modes

ii. Externality costs: measure of damage caused by pollution, injury, congestion

iii. Benefits: how to measure, observe choices households make and how households trade off money against benefits of transportation. How much is household willing to pay to speed up commute by one mile an hour

(d) Predict how demand and supply will respond to technological developments, demographic changes, policy choices

i. Incentives facing consumers, suppliers, and government for each mode

ii. How to measure?

5 Summary of important transport facts

1. For details see charts and tables on website.

2. Trends in aggregate transport in the UK over the past 50 years.

   (a) Travel by automobile has increased from 80 billion passenger miles to 700 billion passenger miles.

   (b) Travel by "other" modes has declined from 180 billion passenger miles to 100 billion passenger miles.

   (c) Total length of track declined from 30,000 km to 16,000 km.

   (d) Total length of roads increased from 300,000 km to 400,000 km.

3. Public investments in the 1990's in the UK.

   (a) Roads: £4 billion annually.

   (b) Rail: Increased from £2 billion to £4 billion annually.

   (c) Rail rolling stock, ports, and airports less then £1 billion annually.

   (d) Operating costs of London underground are approximately double operating revenues.

4. Private expenditures in 2002/2003 in the UK.

   (a) Average motoring expenditures made up 12.5% of the average household budget while average expednitures on other transport made up 2.1%.

5. Congestion in London.

   (a) In the 1990's the number of people entering London during the morning peak increased from 800,000 to 900,000.

   (b) Number entering by private car declined from 150,000 to 100,000.

   (c) Traffic speeds:

      i. 10 mph in central area, 12 mph in inner area, 17 mph in outer areas

6. Pollution in the 1990's in the UK.

   (a) NO_2 (nitrogen dioxide) emmisions declined from 2.6 million tons to 1.6 million.

(b) CO (carbon monoxide) emissions declined from 6.9 million tons to 3.2 million.

(c) VOC (volatile organic carbons) emissions declined from 2.4 million tons to 1.4 million tons.

(d) Lead emmissions declined from 2.3 million tons to 162,000 tons.

(e) PM_{10} (particulates) declined from 298,000 tons to 161,000.

7. Passenger casualties.

   (a) See table on website.