

Regional income and employment determination

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Some regions have higher income levels and better job prospects than others. Why should this be so? What factors determine the income level and job prospects of regions? Why is it useful to be able to predict the future growth and development of regions, or the consequences of national business fluctuations for regional income and employment levels? Major new investments have large economic impacts on a region's income and employment and it is essential for policy makers to have accurate forecasts so that these effects are taken into account in the physical and economic plans for the region. It is also useful to be able to predict the impact of plant closures on the regional economy, especially if the plant is an important employer.

Numerous attempts have been made to model the underlying economic structure of regions in order to gain a better understanding of the factors determining regional economic variables such as income and employment. Regions differ considerably in their geographical and economic size, demographic characteristics, industry mix, labour force skills, age of plant and machinery, trading links with other regions, consumption patterns and many other fundamental economic characteristics. Nevertheless, it is possible to construct general models, which can be used to explain the determinants of income and employment in all types of region regardless of the vast differences between them. Two main routes have been taken, one based on the Keynesian income–expenditure approach to modelling the national economy, and the other based on input–output analysis. The present chapter focuses on the Keynesian income–expenditure model, which has been modified for use at local and regional level. In the second chapter, an entirely different approach, based upon the input–output model, is discussed and evaluated.

There are two main reasons why economists construct regional economic models. First, large organizations such as electricity generating companies and water authorities need forecasts of demand for their output for at least 15 years ahead because of the long-run nature of their investment projects. Power stations and water plants are expected to have lives of over 30 years, thus making it imperative that their investment plans dovetail with the economic and demographic developments of the region in which they operate. Regional forecasts play a critical role in such investment planning, and private forecasters provide long-run forecasts for companies needing such information. Second, regional models are constructed in order to estimate the impact of possible new industrial developments in particular locations. Opening up a new motor vehicle assembly plant or a new power station can be expected to have both short-run effects during the construction phase and long-run effects when the new plants become fully operational. The full economic impact of such large investments and their phasing over time need to be estimated so that the implications for public expenditure (on schools, houses, hospitals, recreational facilities and other social overheads) can be adequately addressed.

The present chapter is in seven sections. Section 1.1 introduces the notion of feedback. Any change in the demand for goods and services produced by a locality (or a region) will have further effects on the local economy over time through indirect effects on other industries and induced effects through the household sector. Section 1.2 explains how the Keynesian national income–expenditure model can be adapted and applied to localities and regions. Several contrasting applications of the regional multiplier model are then discussed and appraised in section 1.3, which is followed in section 1.4 by a discussion of the major weaknesses of the regional multiplier approach. Ways of overcoming these weaknesses are then examined in sections 1.5 and 1.6. Section 1.5 discusses the importance of a region's balance of trade position in determining its long-run equilibrium income level, and section 1.6 explains why it is crucial to take more care over modelling the supply side of the regional economy if accurate predictions are to be made. Finally, section 1.7 provides an introduction to a more comprehensive approach to modelling the regional economy.

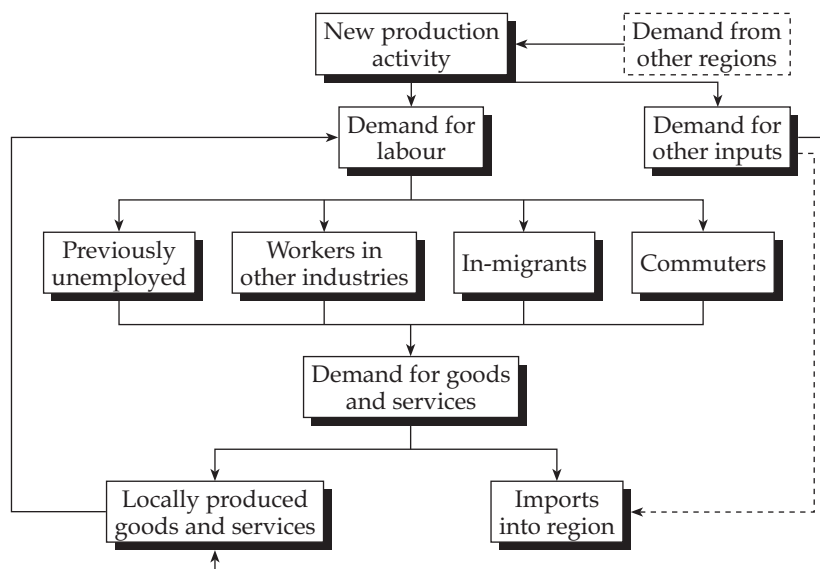


Figure 1.1 The effect of a new production activity on a region's employment, output and imports.

1.1 Impact analysis: indirect and induced effects

At the very heart of all regional economic models is the notion of internal feed-back through input–output linkages between economic agents such as firms and households. Firms are linked to other firms through the goods and services they buy from each other. Households sell their labour services to firms and buy goods from them. These linkages occur both within regions and between regions.

The way in which an injection of expenditure works its way through a regional economy can be demonstrated by considering the impact of a new productive activity. Suppose a new plant is to be built in a particular locality. A model can be constructed to estimate the effect of the new plant on local income and employment. This includes not only the direct impact of the plant itself on local income and jobs, but the indirect and induced effects as well. Indirect effects occur in industries supplying components and other inputs, such as transport and commercial services, to the new plant. Induced effects occur as those employed in the new plant spend some of their income on locally produced goods and services.

A simplified illustration of the way in which a new production activity can be expected to affect the local economy is demonstrated in figure 1.1. The new plant requires labour. This may be obtained in various ways: by attracting existing workers from other industries in the locality; by employing unemployed workers; by inducing persons not currently in the labour force to join it; and by attracting labour from other localities. The impact of the new plant spreads to other local industries both through direct purchases from other industries in the locality and through additional purchases of locally produced goods and services, which

result from the increase in income and employment. Further impacts occur due to feedback effects. Industries producing for local consumption require more labour and more inputs from the construction industry in order to expand capacity to meet the extra demand for their own output. This multiplier process continues until the initial injection (i.e. the additional output produced by the new plant) has worked its way through the local economy. It is useful to think of this happening as consecutive rounds of expenditure occurring through time until the multiplier effect works its way through the system, but in practice the expenditure effects are likely to be extremely complex with one round overlapping another (Sinclair and Sutcliffe 1978).

1.2 The Keynesian income–expenditure approach

The model

The Keynesian approach to modelling the regional economy is virtually identical to the simplest open economy version of the Keynesian income–expenditure model, the only difference being that all the expenditure variables refer to the regional (or local) economy instead of to the nation. The model begins with the familiar income–expenditure identity:

$$Y = C + I + G + X - M \quad (1.1)$$

where Y is regional income, C is regional consumption, I is regional investment, G is government expenditure, X is regional exports and M is regional imports. Investment, government expenditure and exports are all assumed to be exogenously determined (denoted by a zero subscript):

$$I = I_0, \quad G = G_0, \quad X = X_0 \quad (1.2)$$

Consumption and import expenditure are assumed to be partly exogenous and partly dependent on disposable income:

$$C = C_0 + cDY \quad (1.3)$$

$$M = M_0 + mDY \quad (1.4)$$

where DY is disposable income and is given by

$$DY = Y - tY \quad (1.5)$$

where t is the rate of income tax. On substituting equations (1.2)–(1.5) into the regional income–expenditure identity (1.1), we obtain

$$Y = k (C_0 + I_0 + G_0 + X_0 - M_0) \quad (1.6)$$

Table 1.1 Values of the regional multiplier from equation (1.7) for various combinations of the tax rate t and the marginal propensity to consume locally produced goods ($c - m$)

<i>Marginal propensity to consume locally produced goods ($c - m$)</i>	<i>Tax rate, t</i>		
	0.1	0.2	0.3
0.1	1.10	1.09	1.08
0.2	1.22	1.19	1.16
0.3	1.37	1.32	1.27
0.4	1.56	1.47	1.39

where k is the regional multiplier and is given by

$$k = \frac{1}{1 - (c - m)(1 - t)} \quad (1.7)$$

The multiplier

The critical variable in the Keynesian regional multiplier formula is the marginal propensity to consume locally produced goods ($c - m$). The numerical importance of $c - m$ can be seen from table 1.1, which shows the effect on the regional multiplier of varying the tax rate and $c - m$. A low value for $c - m$ results in a multiplier that only just exceeds unity, and this is the case even with a tax rate as low as 10 per cent. The multiplier is clearly sensitive to changes in $c - m$, rising quite rapidly as it increases. Since the marginal propensity to consume locally produced goods ($c - m$) has a crucial effect on the magnitude of the regional multiplier, it is worth exploring the factors that may be expected to affect it. Several factors are likely to be important. First, a region's size is likely to affect its $c - m$ since import leakages are likely to be large for small regions. The marginal propensity to import into the region is therefore likely to be large for small regions, thus reducing $c - m$. Some support for this negative relationship is offered in figure 1.2, which shows a significant negative relationship between a country's dependence on trade and its GDP across 105 countries for which data were available (from the World Bank's database).

Second, a region's marginal propensity to consume locally produced goods ($c - m$) will be affected by its industry mix. Highly specialized regions will depend heavily on imports because of their specialization. In practice, even very large regions which have a highly diversified industry mix rely heavily on trade with the outside world because of intra-industry trade.

Third, a region's marginal propensity to import may be affected by its location, especially in relation to other local labour markets. If inward commuting into a region is high due to the region's nearness to other labour market areas (such as when a town is surrounded by other towns), this will lead to a smaller multiplier. The reason is obvious: commuters will tend to spend their earnings in the region where they live rather than in the region where they work. This will raise a

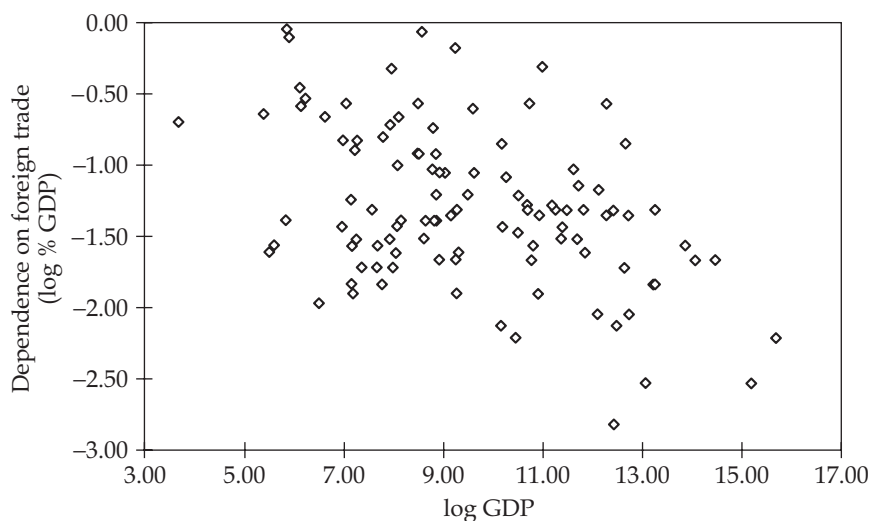


Figure 1.2 Dependence on foreign trade versus GDP, 105 countries, 1994.

region's marginal propensity to import. The geographical location of a region will also affect the propensity of its residents to spend locally, since the absence of shopping facilities in nearby regions will encourage local shopping, thus reducing the marginal propensity to import. We shall return to the question of the influence of geographical location on the size of the regional multiplier later in this chapter.

It is clear from the previous section that the magnitude of the regional multiplier will vary according to the characteristics of each individual region or locality for which it is being estimated. There is no single numerical value which can be used for all regions or all localities. Each case is unique and should be treated as such. Estimates of the regional multiplier are therefore region-specific. Indeed, regional multipliers are usually estimated for specific projects in specific locations and the multipliers are project-specific as well as region-specific. Different projects in the same region may well have different multiplier consequences (allowing for differences in the size of projects).

Early work on the estimation of regional multipliers concentrated upon obtaining broad estimates of the regional multiplier for 'typical' regions. Archibald (1967), for example, used the national Family Expenditure Survey to estimate the marginal propensity to consume locally produced goods for a typical region. Goods and services that are likely to be purchased locally (such as expenditure on car maintenance, retail services, local government services, cinemas, health care, education, etc.) were first identified, and total expenditure on these items was then summed. This exercise was repeated for a number of years to obtain an annual time series L_t , which is a measure of that part of national expenditure which is spent locally. Regressing this on personal disposable income produces an estimate of the marginal propensity to consume locally produced goods out of disposable income:

Table 1.2 The proportion of total expenditure on locally produced goods and services by staff and students at Nottingham University

<i>Expenditure category</i>	<i>Academic and related staff</i>		<i>Students</i>	
	<i>% of total income</i>	<i>Proportion of income spent locally</i>	<i>% of total income</i>	<i>Proportion of income spent locally</i>
Food	19	0.25	17	0.25
Housing, rent	17	0.15	28	0.85
Travel, vehicles	15	0.21	12	0.30
Durable goods, gifts	12	0.25	10	0.25
Drink, tobacco	7	0.25	15	0.30
Clothing, footwear	7	0.25	5	0.25
Fuel, light, power	5	0.10	2	0.10
Miscellaneous	18	0.27	11	0.25
Total	100	0.22	100	0.43

Source: Bleaney et al. (1991)

$$L_t = \alpha + \beta DY_t \quad (1.8)$$

where L is national expenditure on locally produced goods and services, DY is national disposable income, α is a constant reflecting that part of L which is independent of DY , β is an estimate of the marginal propensity to spend on locally produced goods and services, and t is time.

Since β is an estimate of the marginal propensity to spend on locally produced goods and services ($c - m$), this can now be used to provide an estimate of the regional multiplier (such as that given by equation (1.7)). Using this method, Archibald estimated that $c - m$ was approximately 0.23 for the hypothetical region which he had in mind when identifying locally produced goods and services. With a tax rate of 0.2, this gives a multiplier value of around 1.2.

Most multiplier studies now use a similar basic methodology to that developed by Archibald, but derive specific estimates for the particular region being studied; that is, they are region-specific. Consider, for example, the approach used by Bleaney et al. (1992) to estimate the impact of Nottingham University on the economy of Nottingham. An estimate of the marginal propensity to spend on locally produced goods and services is obtained for students and staff separately, since students spend a far higher proportion of their income locally than do university staff. Students also have a different pattern of expenditure from staff, spending a far greater proportion of their income on housing and on drink and tobacco (see table 1.2). Moreover, a far higher proportion of expenditure on housing stays within the Nottingham economy than is the case for staff. One of the reasons for this is that students' rental payments flow to local landlords (including the university), whereas the mortgage repayments of staff flow to building society head offices outside Nottingham. At the foot of the second and fourth columns in table 1.2 are the propensities to spend locally by staff (0.22) and

students (0.43) respectively. (The value of 0.22 for staff is obtained by multiplying the first column by the second and then summing across all categories of expenditure; and similarly for students.)

More complex regional multipliers can be constructed by adding more realism to the model. Two obvious modifications involve the treatment of the government sector. On the expenditure side, an allowance can be made for the effect of changes in income on transfer payments (such as unemployment benefit). As regional income declines, unemployment will increase and cause an increase in government expenditure. We therefore have

$$G = G_0 - gY \quad (1.9)$$

where G_0 is the autonomous component of government expenditure and gY is that part of government expenditure induced by changes in income in the region. For example, if $g = 0.1$, then government spending falls by £10 for every £100 increase in regional income. When equation (1.9) is incorporated into the model, regional income is given by the following formula:

$$Y = \frac{1}{1 - (c - m)(1 - t) + g} (C_0 + I_0 + G_0 + X_0 - M_0) \quad (1.10)$$

Further realism can be added to the regional multiplier by allowing for expenditure taxes as well as income taxes. An expenditure tax dependent on consumption expenditure, for example, could be incorporated into the model by a suitable modification to the consumption function. This is straightforward and need not be pursued here.

Another modification is to allow for the interaction between regions. One region's imports are another region's exports. Suppose region B increases its imports from region A. This additional demand for A's output will have multiplier effects in region A. The resultant increase in A's income will raise A's demand for B's exports and B's income will increase in turn. The initial increase in the demand for A's output therefore has feedback effects and the whole process begins again, continuing until the additional income generated in each round diminishes to zero. It is a simple task to modify the multiplier formula to take such interregional repercussions into account in a two-region economy. As more regions are added, however, the multiplier formula becomes increasingly complex. In practice, interregional feedback effects are likely to be very small provided that the region itself is small in relation to other regions. These interregional feedbacks are therefore ignored in applications of the regional multiplier model. This is fine provided that the region in question is small relative to the size of the national economy.

The multiplicand

The previous discussion of the regional multiplier emphasized the critical role of the leakages from regional expenditure which occur after the initial expenditure injection. In practical applications of the regional multiplier, however, it is found

that the impact of an expenditure injection is far more likely to be influenced by leakages from the initial expenditure injection itself. It is extremely important to discover how much of the initial expenditure injection actually stays inside the region. In other words, the import content in the initial expenditure injection needs to be estimated in order to calculate the impact of this on the regional economy through the multiplier process.

There are two reasons why it is important to measure the first-round leakages as accurately as possible. First, the first round of expenditure is usually very large relative to the second and subsequent rounds of expenditure. Second, the leakages from the first round may be very large relative to the size of the initial expenditure injection. An example of the latter is provided by McGuire's (1983) estimates of the impact of nuclear power stations on regional income and employment in two Scottish towns, Dounreay and Torness. At the Dounreay plant, for example, 57 per cent of the inputs required to operate the plant each year were imported from other regions. The leakages in the construction phase were even larger: 90 per cent of the inputs were imported into the Torness region. It is clearly crucial to take these leakages into account when estimating the first round of the multiplier.

The significance of the first round in determining the multiplier consequences of any given expenditure injection into the regional economy can be demonstrated by considering an income–expenditure model (see Brownrigg 1971). To keep it simple, this model has no government sector and the only leakages are the import content embodied in consumption, investment and exports. Since the import content varies between different types of goods, however, the import function must allow for this explicitly. The model consists of the regional expenditure identity and two expenditure equations:

$$Y = C + I_0 + X_0 - M \quad (1.11)$$

$$C = C_0 + cY \quad (1.12)$$

$$M = M_0 + m_c C + m_i I_0 + m_x X_0 \quad (1.13)$$

The import equation argues that in addition to an increase in an autonomous element M_0 , imports will increase whenever expenditure on C , I or X increases. The effect on M , however, will vary between C , I and X depending upon the numerical value of m_c , m_i and m_x , all of which are between 0 and 1.

The effect of any change in autonomous spending (C_0 , I_0 , X_0 or M_0) on regional income can be estimated from the above model once it has been solved for regional income. This is done by substituting equations (1.12) and (1.13) into the regional income–expenditure identity (1.11), from which we obtain

$$Y = k [(1 - m_c) C_0 + (1 - m_i) I_0 + (1 - m_x) X_0 - M_0] \quad (1.14)$$

where

$$k = \frac{1}{1 - c(1 - m_c)} \quad (1.15)$$

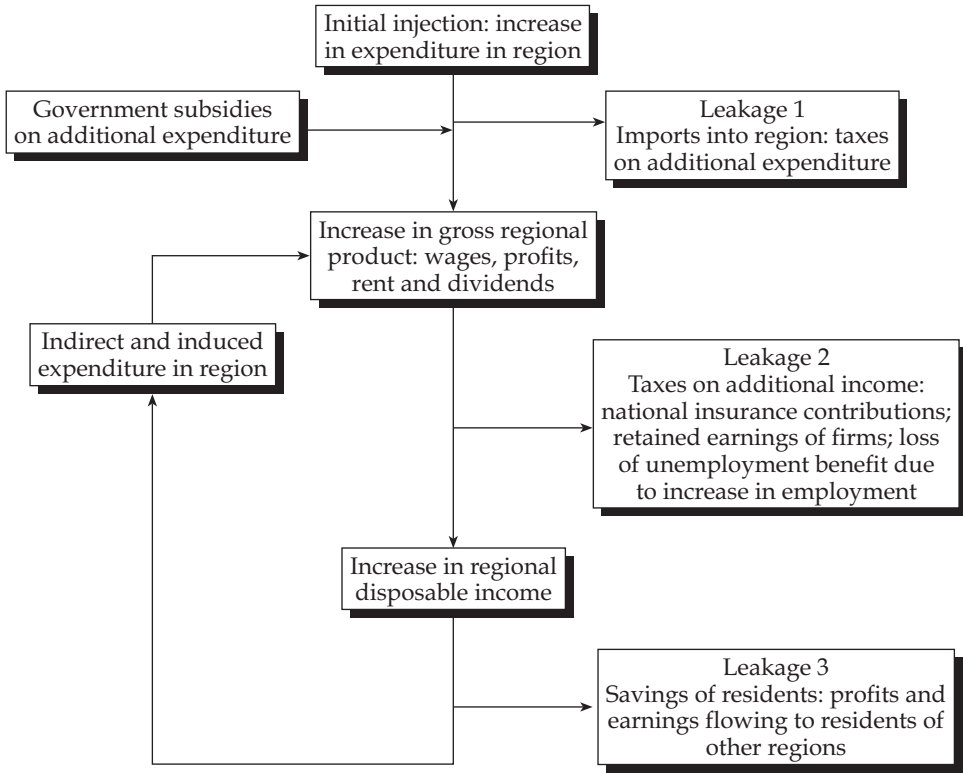


Figure 1.3 Leakages during the first round in the multiplier process: two measures of regional income.

To demonstrate the importance of the different leakages associated with different types of injection, suppose we have the following data:

$$c = 0.7, \quad m_c = 0.6, \quad m_i = 0.8, \quad m_x = 0.7$$

Suppose also that $\Delta C_0 = 100$. By taking first differences of equation (1.14) and substituting the above values into the resulting equation, we obtain

$$\Delta Y = k (1 - m_c) \Delta C_0 = 1.39 \times 0.4 \times 100 = 55.6$$

If we now do the same for $\Delta I_0 = 100$ and $\Delta X_0 = 100$, we obtain

$$\Delta Y = k (1 - m_i) \Delta I_0 = 1.39 \times 0.2 \times 100 = 27.8$$

$$\Delta Y = k (1 - m_x) \Delta X_0 = 1.39 \times 0.3 \times 100 = 41.7$$

Notice that $k = 1.39$ is obtained by substituting $c = 0.7$ and $m_c = 0.6$ into equation (1.15).

A further important consideration when estimating the leakages from the first round of expenditure concerns the actual measure of regional income which is being used (Sinclair and Sutcliffe 1978; 1984). The two most commonly used measures of regional income are gross regional product (GRP) and regional disposable income (RDI). The difference between these two measures of regional income is simply that RDI is less than GRP because of the leakages that occur between earning an income and receiving it. Figure 1.3 shows these leakages together with the leakages that occur between the initial expenditure injection and the creation of GRP. It also shows the leakages that occur after income has been received by households. The multiplier effects of any given injection of expenditure will therefore depend upon the type of income change being investigated. Only after the definition of income has been specified can the multiplicand itself be calculated (by taking into account the appropriate leakages).

1.3 Applications of regional multiplier analysis

This section describes three quite different applications of the regional multiplier in order to demonstrate the wide variety of problems to which the concept has been applied. We turn first to the calculation of tourism multipliers for Malaga on the Costa del Sol.

Estimating the multiplier effects of tourist expenditure

An interesting application of regional multiplier analysis is the estimation of various tourist multipliers by Sinclair and Sutcliffe (1984). Their aim is to demonstrate the importance of estimating the first and second rounds of the multiplier process separately. They also stress that to obtain meaningful and accurate estimates of the regional multiplier it is first necessary to define the type of income under investigation. Only when this has been done is it possible to measure the leakages from the first and second rounds of expenditure accurately. This approach allows for separate multipliers to be calculated for two different definitions of regional income (i.e. disposable income and gross income) and to show how long it takes for the multiplier process to work itself through the regional economy. The main results of applying their method to tourist expenditure in Spain's resort area of Malaga can be used to demonstrate the potential value of regional multipliers, particularly to local and regional planners.

The two main findings of the Malaga study were as follows. First, the regional multiplier is substantially larger for gross income than for disposable income. For every £1 of expenditure by tourists in Malaga, for example, disposable income rises by £0.54 whereas gross income rises by £0.72 (see table 1.3). It is also shown that the multiplier effect varies enormously between different types of tourist expenditure, with tourists staying in flats and villas having the lowest multiplier effect on local income because rentals leak to owners who reside in other regions. Second, table 1.4 shows that the effect of an increase in tourist expenditure on

Table 1.3 Estimated multipliers for different types of tourist expenditure

<i>Type of tourist expenditure</i>	<i>Effect of £1 of expenditure on</i>	
	<i>Disposable income</i>	<i>Gross income</i>
Expenditure by tourists in flats and villas	0.36	0.47
Food, drink and entertainment	0.40	0.53
Accommodation	0.50	0.66
Miscellaneous	0.75	0.99
Total expenditure	0.54	0.72

Source: Sinclair and Sutcliffe (1984: 330–1)

Table 1.4 The effect of an increase in tourist expenditure on local disposable income: the pattern of income change over time

<i>Year</i>	<i>% change in disposable income</i>		
	<i>First round</i>	<i>Second and subsequent rounds</i>	<i>Total effect</i>
1	69.9	8.4	78.3
2	69.9	18.2	88.1
3	69.9	25.2	95.1
4	69.9	29.4	99.3
Long run	69.9	30.1	100.0

Source: Sinclair and Sutcliffe (1984: 334)

local income takes over four years to work its way through to its ultimate long-run level. This demonstrates the importance of time in the multiplier process.

The income and employment effects of local government financial assistance

Local government spends money on economic development initiatives such as providing factory premises, industrial sites, advisory services for small businesses and direct financial assistance to small firms (Armstrong 1988). Since the purpose of these initiatives is to increase local income and employment, it is important to assess their impact on the local economy. The purpose was to investigate the extent to which the multiplier effects of given expenditure injections vary between different types of firms in different local authority areas. Lancaster was selected as one of the areas because of its rural hinterland (and its relative remoteness from alternative major shopping areas); and Stockport was selected because of its location within the large Manchester conurbation.

The injection of expenditure into a locality's income stream is affected by (1) the wages and salaries paid to extra workers, and (2) the additional material inputs

which a firm requires to increase production. For manufacturing firms, a large proportion of expenditure on material inputs can be expected to leak out of the locality in the form of goods and services imported from other localities. These will include the purchase of inputs such as energy, fixed assets and commercial services. There will therefore be a large leakage of expenditure out of the locality in the initial injection itself. Armstrong (1988), for example, shows that the propensity to import inputs into a locality varies enormously between different types of firm. The leakages from the initial injection are therefore potentially very important in determining the income and employment effects of any expenditure injection, particularly in small local economies. The import content in the expenditure injection can be incorporated into the impact model as follows:

$$\Delta Y = k [J_1 + (1 - m)J_2] \quad (1.16)$$

where ΔY is the increase in local income, J_1 are the wages and salaries of the extra workers employed, J_2 are operating expenditures such as purchase of fixed assets and all indirect costs, and m is the propensity to import items (of type J_2) into the local area.

Import leakages play a large part not only in determining the size of the expenditure injection but also in determining the size of the local multiplier. This is typically small for assistance to manufacturing firms in local authority areas. There are two reasons for this:

- 1 Companies recruit part of their workforce from nearby localities. These commuters will spend very little of their income in the local area in which they work.
- 2 Those who work and live in the locality will spend part of their income in other localities, especially if shopping facilities in nearby towns are attractive.

The extent to which these two factors affect the multiplier will largely depend upon a locality's remoteness. The multiplier is likely to be smaller for localities situated within or near to a conurbation since inward commuting and outward shopping by local workers will be higher than for an area which is geographically remote from other localities. This point is clearly demonstrated by comparing Lancaster (a free-standing town surrounded by agricultural hinterland) and Stockport (part of the Greater Manchester conurbation). Only about 5 per cent of Lancaster's workers are inward commuters compared with 22 per cent for Stockport; and Stockport residents have twice as high a propensity to shop in nearby centres compared with Lancaster. In practice, the expenditure leakages from local districts are so large that the multiplier consequences of any expenditure injection are likely to be very small. Estimates of the multiplier for four manufacturing firms located in Lancaster, for example, range between 1.1 and 1.2.

The main lessons for local authorities which are planning to provide financial and other types of aid to firms in order to stimulate economic development in their own local area are as follows:

- 1 The multiplier impacts are likely to be small due to expenditure leakages into neighbouring localities.
- 2 Local councils have little power to influence the size of an individual company's multiplier effects other than through the provision of good shopping facilities in the local area.
- 3 If the local impact of financial assistance to firms is to be maximized, those administering such schemes need to take account of the extent to which a company employs inward commuters (rather than local residents) and the extent to which it purchases material inputs from within the locality. Small firms, for example, are likely to rely more heavily on local inputs (such as transport, banking and other services) than are branch plants of national and multinational firms.

From a wider policy viewpoint, the main lesson is that local authorities need to co-ordinate their economic development policies since the benefits of such policies will spill over into neighbouring localities. Acting independently will lead to under-funding of local economic development unless the free-rider problem is faced head on.

The impact of higher education on the regional economy

Universities have a substantial economic impact on the regions in which they are located. They employ many workers, occupy large areas of land and spend a substantial amount in the local economy. In addition to the effect they have on the local economy through the multiplier effects of their expenditure, universities can have much wider effects through the outputs they produce such as knowledge, skills and amenities. Traditionally, far greater emphasis has been placed upon the backward linkage effects of universities on their local economy through expenditures on inputs. Important though these effects may be, universities may have a wider role in determining a locality's economic development through forward linkages (Felsenstein 1996; Luger and Goldstein 1996).

How might universities contribute to local economic development? To answer this question, it is necessary to consider the potential backward and forward linkages between a university and its local economy (see figure 1.4). The backward linkages are well known. These include the demand for local output across a very wide range of service activities provided by the private and public sectors. In addition, universities employ workers who spend a proportion of their income locally, thereby having further multiplier effects. Their positive effects on local income and employment will be offset to some extent by the displacement of some local service activities as a result of the provision of these services on the university campus. Furthermore, the additional pressure on local public services may lead to additional social costs such as congestion and pollution. It is not usual for multiplier studies to take such negative effects into account even though they may be substantial in some cases.

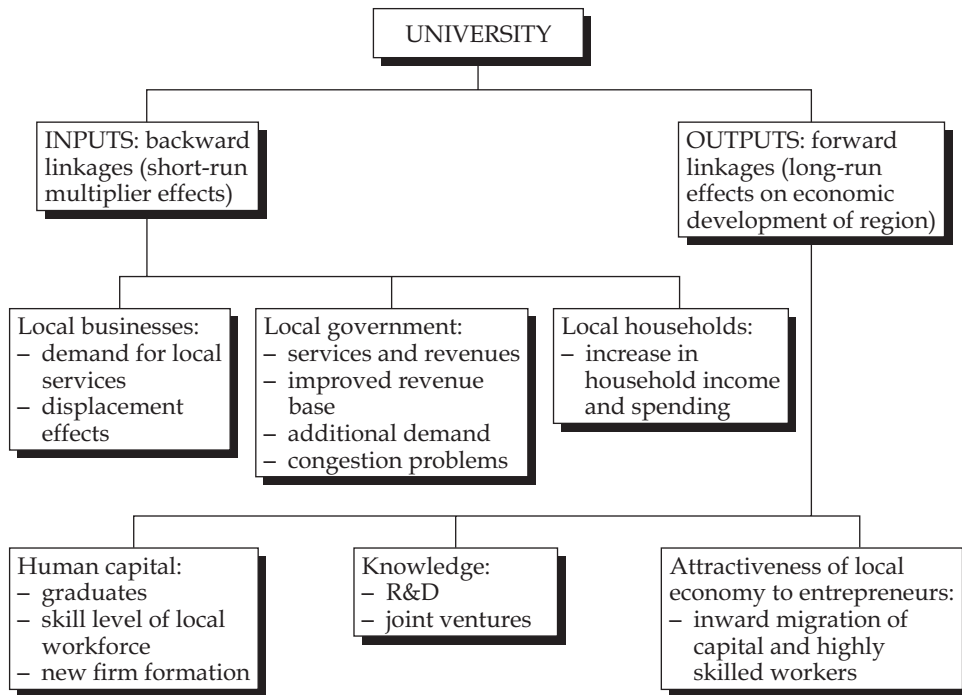


Figure 1.4 The impact of higher education on the local economy through backward and forward linkages.

The possible forward linkage effects of universities on the local economy are less well researched than the backward linkage effects. Universities not only produce highly skilled human capital but also employ highly skilled workers in a wide variety of disciplines and this high concentration of skills is likely to have several beneficial effects on the local economy. First, to the extent that a region is able to retain its graduates, a university will enhance the quality of the local workforce through the training these graduates acquire. Second, the existence of a university acts as an incentive for firms to expand their activities in the area in order to take advantage of its highly skilled graduates. Third, a university's highly skilled staff may provide expert advice to local development agencies as well as to local firms in a wide range of business-related activities, such as marketing, finance and product development. Economists, for example, are often involved in the evaluation of regional development projects in the area in which their university is located; business and management schools offer customized courses for the managers of firms located in their region; and engineering departments may be involved with local firms in developing new processes and new products. Finally, the presence of a university in an area enhances the cultural as well as the economic attractiveness of an area, thereby increasing the area's image not only to mobile firms but also to highly skilled workers.

1.4 Weaknesses of regional multiplier analysis

Despite the widespread use and popularity of regional multiplier analysis, this approach to measuring economic impacts does have several major weaknesses. First, regional multiplier analysis does not take capacity constraints into account. If a regional economy faces capacity constraints, an expenditure injection may have little, if any, effect on regional income. Producers may respond to an increase in demand by raising their prices rather than by increasing output, or they may contract out the extra work to other firms in other regions. Alternatively, the production bottlenecks may be in industries that supply households with goods and services, in which case the effect of an expenditure injection may be to increase the marginal propensity to import (thereby reducing the regional multiplier). Over the longer run, the existence of production bottlenecks will induce further investment in order to expand the region's productive capacity.

Second, regional multiplier analysis has been criticized for failing to allow for interregional feedback effects. According to the regional multiplier model described in section 1.2, an increase in regional income will result in an increase in imports. Since these imports are another region's exports, this will raise income in other regions, which in turn will increase their own imports. Such interregional feedback effects are not allowed for in regional multiplier analysis. This will not matter, however, in the case of small regions since feedback effects will be very small. Only where the region is relatively large in relation to the entire system of regions will the feedback effects be worth taking into account.

Third, the calculation of multiplier effects would be more useful if it were recognized that the multiplier effects of a given expenditure injection occur over time, and that it may take several years for the full multiplier effects to work through the local economy. Sinclair and Sutcliffe (1989) argue that insufficient attention has been paid to estimating the timing of income changes resulting from expenditure injections. Attention is usually focused on the long-run multiplier consequences.

Fourth, regional multiplier analysis provides only a very aggregative picture of the impact of expenditure injections. Planners and policy makers need to know the effect of these injections not only on the output and employment of the regional economy as a whole, but also on particular industries. Section 1.6 explains how the regional multiplier approach can be extended to provide more detailed information about the ways in which expenditure injections can affect a regional economy.

Fifth, the impact of expanding firms will depend heavily on the extent to which individual firms purchase inputs from the region rather than importing these inputs from other regions. This will vary between firms for many reasons, such as the ability of the region to provide the necessary inputs and the location of the region in relation to other potential suppliers. Collis and Roberts (1992), for example, estimate that foreign-owned companies investing in the West Midlands purchased 20 per cent of their material inputs from within the region, whereas the corresponding estimate for Wales is 14 per cent (Phelps 1997). The difference

is probably a consequence of the West Midlands having a larger and more diversified industrial base.

Finally, apart from some notable exceptions, money has largely been ignored in regional modelling (Dow and Rodriguez-Fuentes 1997). More often than not, regional models do not include any reference to the effect of money on the regional economy. It is usual to assume that money is neutral so that regional economic analysis is conducted entirely in terms of real variables. Monetary changes are assumed to have no real effects on the variables of central importance, such as output and employment.

But is this assumption realistic? One of the reasons why money has been ignored in regional economic analysis is the lack of regional monetary data. This lack of data has probably been instrumental in diverting the attention of regional economists away from the role of money as a determinant of regional economic activity. In fact, money is assumed to respond to regional differences in economic activity rather than help to explain why such differences occur. The national monetary authority, for example, is assumed to determine monetary conditions which then affect the macroeconomy in various ways. These monetary effects are then transmitted to all regions by the linkages between regional and national variables rather than by any specific monetary changes within the regions themselves. There is no role for money within individual regions since the regions do not have their own monetary policy instruments. Moreover, regions are very open economies which means that money and goods flow freely across regional boundaries without any obvious constraints. The money supply is therefore assumed to respond to money demand at regional level. This is why regional models of income determination and economic growth have traditionally excluded monetary variables and focused almost exclusively on real variables.

It has been convincingly argued, however, that money will affect regional economic development through either the cost of credit or its availability (Dow 1987), both of which may vary between regions. Firms in peripheral regions, far away from central financial markets, may find it more difficult and more expensive to obtain credit for financing working capital and investment in new productive capacity. The constraint on credit availability may arise because of a lack of the information needed by financial institutions for assessing risk and potential profitability. Local branches of national banks may find it difficult to create credit in response to the demand for loans to finance investment, especially in less prosperous regions where loans are believed to be more risky, and hence more expensive.

We turn now to discuss some of the ways in which these weaknesses of the regional multiplier model have been addressed.

1.5 A multi-region model of income determination

A major weakness of the single-region model of income determination is that it fails to take interregional feedback effects into account. It is quite obvious, however, that one region's exports are another region's imports and this means that

income changes in one region will be transmitted to other regions. Some insight into these interregional feedback effects can be obtained by considering a world in which there are only two regions. This may seem rather simplistic, but the general principles are the same as in a multi-regional model. A further advantage of developing a two-region model is that it allows us to take a region's balance of trade into account in determining its long-run equilibrium income level. Balance of trade deficits can only be sustained over the long run in very restrictive circumstances (i.e. if other regions are willing to finance such deficits indefinitely). The influence of a region's balance of trade on its equilibrium income level over the long run therefore needs to be carefully investigated.

The determination of equilibrium income in a two-region model

Suppose there are two regions, North and South, which trade with each other. For the time being, assume that there are no supply constraints. Each region's output is therefore determined by the demand for its output. Consider the demand for the North's output y_n . This will depend upon demand within the North itself (i.e. consumption, investment and government spending) and on the demand for its exports from the South. The South's demand for the North's output will depend upon its own income y_s . The demand for the North's output can therefore be expressed as follows:

$$y_n = \alpha + \beta y_s \quad (1.17)$$

where y_n is income (= output) in the North, y_s is income (= output) in the South, α is the autonomous demand for the North's output, and β is a measure of the responsiveness of the demand for the North's exports when the South's income increases. Since the coefficient β is likely to be a positive fraction, the North's demand function will be as shown in figure 1.5a.

A demand function for the South's output can be constructed in exactly the same way as for the North. The South's demand for goods and services is given by the following expression:

$$y_s = \gamma + \delta y_n \quad (1.18)$$

where γ is the autonomous demand for the South's output, and δ is a measure of the responsiveness of the demand for the South's exports when the North's income increases. The South's demand function is shown in figure 1.5a.

In order to find the equilibrium output levels in the North and the South, we now need to consider the two functions simultaneously. The reason for this is clear. We cannot determine the equilibrium income in the North unless we know the South's income; and we cannot determine the equilibrium income in the South unless we know the North's income. The joint equilibrium for the North and the South occurs at the intersection of the two functions at point A in figure 1.5a, which shows that equilibrium income is y_n^* in the North and y_s^* in the South.

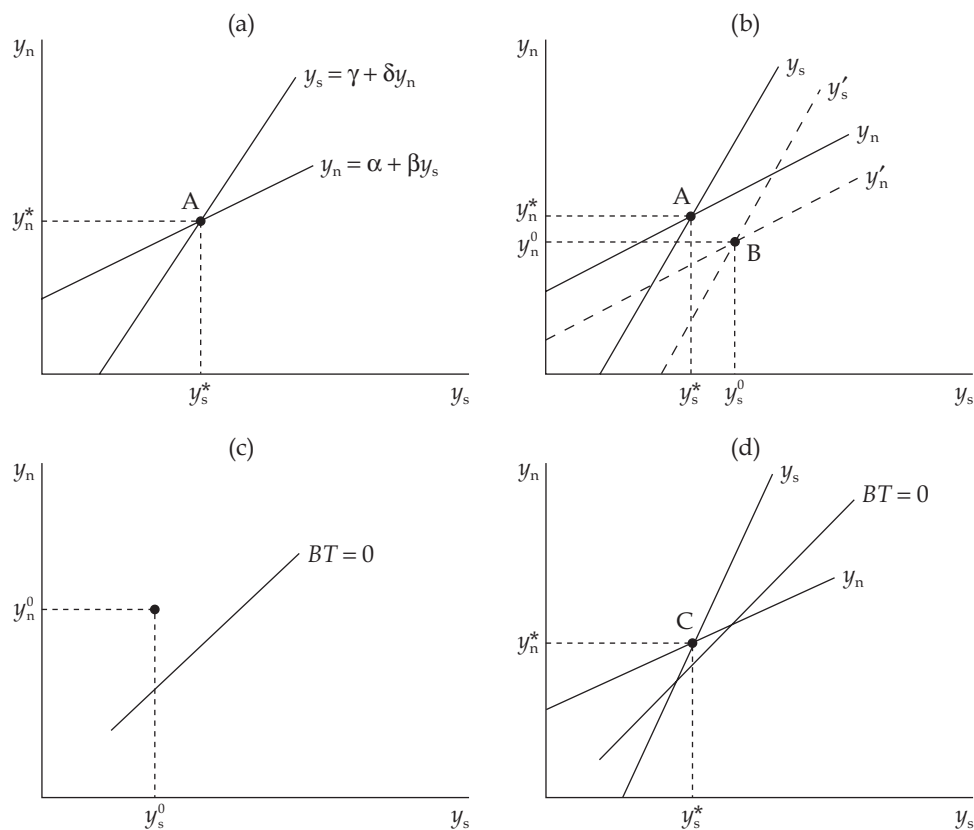


Figure 1.5 Equilibrium income levels in a two-region model.

We now need to ask what would happen if autonomous expenditures in either the North or the South change. For example, suppose that the North's wealth declines and the South's wealth increases (e.g. due to the South's assets increasing in value while the North's assets decline in value). This would result in a downward shift of the y_n function and a rightward shift in the y_s function if we assume that autonomous expenditure is positively related to wealth. Hence, in figure 1.5b a new joint equilibrium income level would be established at point B.

The balance of trade function

The balance of trade function now needs to be added to the model. The reason for this will become clear later. It can be shown that the North's balance of trade will improve as income in the South increases (since the South will import more from the North as its income increases) and the South's balance of trade will improve as income in the North increases (since the North will import more from the South as its income increases). In other words, for the balance of trade to be in

equilibrium ($BT = 0$) in both regions simultaneously, the balance of trade function must slope upwards as shown in figure 1.5c. Thus, if income in the North is at y_n^0 (and income in the South is at y_s^0), the North will have a balance of trade deficit (and the South will have a corresponding surplus). Balance of trade equilibrium will be regained either if the South's income increases (thereby causing its imports from the North to increase) or if the North's income falls (causing it to reduce its imports from the South).

*The effect of the balance of trade on equilibrium income
in the North and South*

The two income functions and the balance of trade function can now be combined in order to examine the effect of trade imbalances on equilibrium income in both regions. Figure 1.5d shows a situation in which the two regions are in simultaneous equilibrium with respect to their income levels but a balance of trade deficit exists in the North (offset exactly by a corresponding surplus in the South). What will happen as a result of this disequilibrium in the balance of trade between the two regions?

Before answering this question, it is necessary to consider the relationship between a region's balance of trade and its balance of payments. The first question to be answered is, 'Does a region have a balance of payments?' Although the flows of goods and money across regional borders are not recorded, this does not mean that regions do not have a balance of payments. A region must have a balance of payments in practice since these flows of goods and money are a reality. Interregional transactions are very substantial and the consequences of any structural imbalances in a region's transactions with the rest of the world therefore need to be carefully considered. In particular, these structural imbalances can have serious consequences for the 'real' regional economy, namely, output and employment. It is therefore necessary to describe very briefly the component parts of a region's balance of payments with the rest of the world.

A region's balance of payments is defined as follows:

balance of payments	=	balance on current account	+	balance on capital account
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where:

balance on current account	=	balance of trade	+	net transfer payments
balance of trade	=	exports	-	imports
net transfer payments	=	net government transfers (e.g. taxes, income support)	+	net income from rest of world (e.g. dividends, interest on savings)

and where:

$$\begin{array}{rcl} \text{balance on} & = & \text{net long-term} & + & \text{net short-term} \\ \text{capital account} & & \text{investment (e.g. inward} & & \text{investment (e.g.} \\ & & \text{direct investment)} & & \text{government bonds,} \\ & & & & \text{equities, savings)} \end{array}$$

Since regions do not have foreign exchange reserves and since the balance of payments must balance (by definition), it follows that the current account and the capital account must sum to zero. This means that any deficit on the trading account (i.e. imports exceed exports) must be offset somewhere else in the region's balance of payments. Hence, if a region suffers a loss of its export markets and its trade balance deteriorates as a result, the trade deficit balance has to be 'paid for' in one or more of the following ways (Dow 1986):

- 1 The government can increase transfer payments into the region. Indeed, this is automatically achieved through fiscal stabilizers such as unemployment benefit.
- 2 The region's residents may run down their stock of savings.
- 3 The region's residents may borrow from the banking system (which implies a net transfer of cash balances into the region from within the national banking system).
- 4 The region's residents may sell assets, such as bonds and securities, to residents in other regions in order to pay for the excess of imports over exports.
- 5 Firms outside the region may invest directly in the region.

These various ways of financing a trade deficit indicate that the deficit region will continuously lose assets unless the government is willing to finance the deficit indefinitely through income transfers into the region. The region's stock of wealth will be gradually depleted and this will reduce the ability of the region's residents to borrow on favourable terms from the banks. Expenditure by the region's residents will consequently be reduced as assets are sold off to pay for the excess of imports over exports. This will be reinforced by a decline in asset values since the fall in regional income will induce a corresponding fall in the value of the region's fixed assets, such as the housing stock, industrial plant and commercial property. Out-migration will induce further deflation in the region. Exactly the opposite will happen in the South since the North's persistent trade deficit is the South's persistent trade surplus.

The consequence of the fall in the North's wealth due to the persistent trade deficit is a downward shift in the North's income function (as already shown in figure 1.5b). The opposite will occur in the South, which will experience a rightward shift in its income function. The adjustment process will continue until a new equilibrium is established such that the y_n , y_s and balance of trade functions intersect at the same point (i.e. point C in figure 1.5d).

This analysis suggests that policies designed to increase income in low-income regions need to focus on increasing a region's export competitiveness, otherwise

persistent trade deficits will lead to a continuous outflow of assets. If low-income regions are not to rely indefinitely on government income transfers, the supply side of the regional economy will have to be addressed. The range of supply-side policies available to policy makers will be discussed at length in part II of this book.

An example of a chronic regional trade deficit: eastern Germany

An excellent example of a regional balance of payments problem is provided by the recent experience of eastern Germany. In the immediate aftermath of the reunification of Germany in 1990, the output of the former East Germany fell by 45 per cent. Job losses were consequently severe and this resulted in substantial migration from east to west as people moved in search of a job and a higher standard of living. To stem this east–west migration, the German government had to prop up the economy of the depressed eastern regions through massive fiscal transfers, in the form of unemployment benefit and subsidies to state-owned industries, in order to prevent a catastrophic economic collapse. These massive fiscal transfers have been a major cause of Germany's economic problems in the 1990s.

In addition to the fiscal transfers to the eastern regions, private sector investors have been seeking out investment opportunities through mergers and acquisitions of former state-owned companies. Together with the fiscal transfers, the flow of investment funds has helped to plug the huge balance of trade deficit of the regions of eastern Germany.

Not surprisingly, this process has caused balance of payments problems for Germany as a whole. The way in which these regional transfers have caused problems for Germany's balance of trade as a whole can be explained most easily by considering the economy's expenditure and income identities. These are defined as follows:

$$\text{expenditure} = C + I + G + X - M$$

$$\text{income} = C + S + T$$

where C is consumption, I is investment, G is government expenditure, X is exports, M is imports, S is saving and T is taxation.

In equilibrium, expenditure and income must be equal, and so

$$C + I + G + X - M = C + S + T$$

On rearranging this equation, we obtain

$$(I - S) + (G - T) + (X - M) = 0$$

Thus, if the economy starts initially from a situation where $I = S$ and $G = T$, then X and M must also be equal. An increase in investment relative to saving ($I > S$)

and an increase in the fiscal deficit ($G > T$) will inevitably result in an increase in imports relative to exports ($M > X$). This must be the case since the equality has to hold. The direct consequence of unification has therefore been a worsening in Germany's trade balance.

The ultimate intention of these fiscal transfers into the regions of eastern Germany, accompanied by inflows of private capital, is to improve industrial efficiency so that these depressed regions can compete in world markets. The alternative is mass migration from a jobless and derelict east to a prosperous and growing west, causing severe social and political problems as a consequence. These problems can only be averted if the German government continues with its policy of regenerating the eastern regions. Substantial fiscal transfers into eastern Germany will be required for years to come since the eastern regions will continue to run a chronic balance of trade deficit until they are able to compete effectively in both domestic and overseas markets. Massive capital transfers from west to east will be required to reduce the competitiveness gap.

1.6 Further developments in the economic modelling of regions

Regional multiplier models have proved to be a useful device for predicting the effects of investment projects on the aggregate income and employment levels of local and regional economies. A major weakness, however, is that they fail to take into account the effect of feedback effects emanating in the region's labour market. This is because the regional multiplier model assumes a perfectly elastic supply of labour (and indeed a perfectly elastic supply of all other factors of production). The factor markets are completely ignored. Any increase in the demand for labour, for example, is assumed to be met by a corresponding increase in supply at current wages.

More ambitious approaches to modelling regional economies deliberately take these feedback effects in the labour and other factor markets into account explicitly. We are interested not simply in estimating the effect of imports on aggregate income and employment but also on other key regional economic variables such as unemployment, net migration, participation rates and factor prices. How will the investment in new productive capacity in a region affect the job market? How will the closure of an existing plant affect the local unemployment rate and net outward migration from the region? What effect would a labour subsidy have on employment levels in the region? These are the sorts of questions that regional economic models are designed to address.

Regional models vary tremendously in detail and complexity. They range from very aggregative, demand-driven explanations based upon simplistic interpretations of the Keynesian macro-model to more sophisticated approaches which allow for the supply side to respond to changes in capital and labour markets. It is useful to provide an outline of these two approaches before discussing them in more detail.

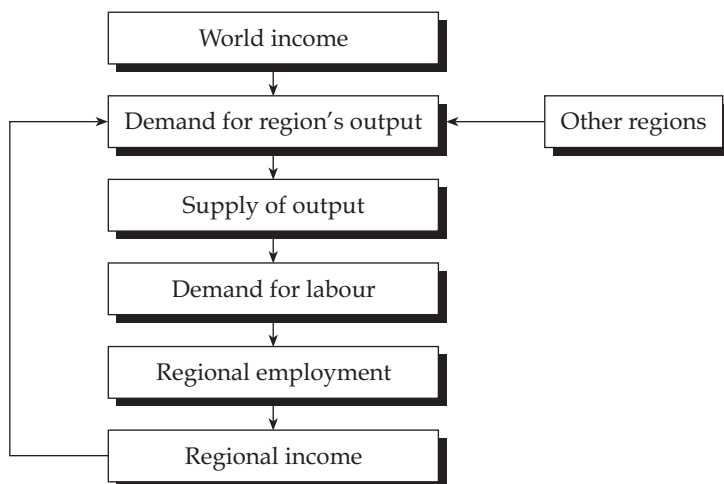


Figure 1.6 A simple demand-based model of regional income and employment determination.

Features of the model

- 1 Output and employment respond positively to an external demand 'shock' (e.g. an increase in the demand for the region's exports).
- 2 There are no capacity constraints on output or employment. The labour supply is perfectly elastic (e.g. the regional economy has high unemployment and a lot of excess capacity).
- 3 The wage rate is exogenously determined, i.e. it is determined by national wage setting arrangements.

Demand-based models

Models of the regional economy based on the simplest versions of the Keynesian model were developed to answer the question: 'What are the effects of demand shocks on regional economic activity?' The usual assumptions are made:

- 1 The supply of labour is perfectly elastic at the current market wage.
- 2 There is plenty of spare productive capacity in the economy so that output can be increased without affecting prices.
- 3 Regions are price-takers.

This approach is referred to as demand-based since it is assumed that the supply of factor inputs responds to increases in demand without this leading to any price effects either in factor markets or in product markets. Supply is entirely 'endogenous'. It is always available when needed and it is available without having to offer higher prices to purchase greater quantities of it.

How would a demand shock affect the regional economy according to the demand-based model? The answer is provided in figure 1.6. An injection of demand (e.g. either from other regions in the same country or from other countries) will lead to

increased output and a higher demand for labour. Since the wage is not determined within the region (by assumption), the increased demand for labour has no effect in the labour market apart from creating more jobs, thereby reducing unemployment. Higher employment levels lead to an increase in regional income (notice that the regional wage is exogenously determined and is given by the national wage), and this increase in income leads to further increases in the demand for regional output by way of the Keynesian multiplier.

The weakness of the demand-based model of regional economic activity is clear: it ignores the fact that the impact of an increase in the demand for a region's output is likely to affect the price of factor inputs. An increase in the demand for labour, for example, may be expected to affect regional wage levels unless there is an abundance of unemployed workers looking for jobs at the going wage. Under normal circumstances, an increase in the demand for labour will lead to wage increases, which in turn will lead to price increases and a consequent fall in competitiveness. Regional wage levels may be strongly influenced by national wage setting arrangements but they are unlikely to be entirely exogenous. Local demand and supply conditions are likely to have some effect. Furthermore, an increase in wages relative to other regions will have effects on net migration flows and on the participation rate of the region's workforce. These potential effects on the supply side of the regional economy suggest a need to construct a more comprehensive model than is offered by the demand-based approach.

Incorporating the supply side into the model

A more realistic approach to modelling the regional economy needs to allow for the supply side to be active and responsive to regional demand shocks. An extended model is sketched out in figure 1.7. This shows that a demand injection can be expected to have secondary effects in the labour market. An increase in employment, for example, will reduce unemployment which in turn will raise the regional wage. This induces an increase in net inward migration and an increase in the region's participation rate, both of which will raise the supply of labour and dampen the upward pressure on wages. As wages rise, however, the region will lose some of its competitiveness, which in turn will lead to a decline in the demand for the region's output (as prices rise relative to the price of competing products). As in the demand-based approach, the combined effect of an increase in employment and wages will stimulate the local demand for the region's output.

This response from the supply side of the labour market to increased labour demand means that an increase in employment will not be matched by an equal reduction in unemployment. Net outward migration will fall as more jobs become available and the participation rate will rise as more non-workers are induced into the job market. The combined effect of these two responses will be that employment will increase by more than the reduction in unemployment since the unemployed have to compete with others for the new jobs being created.

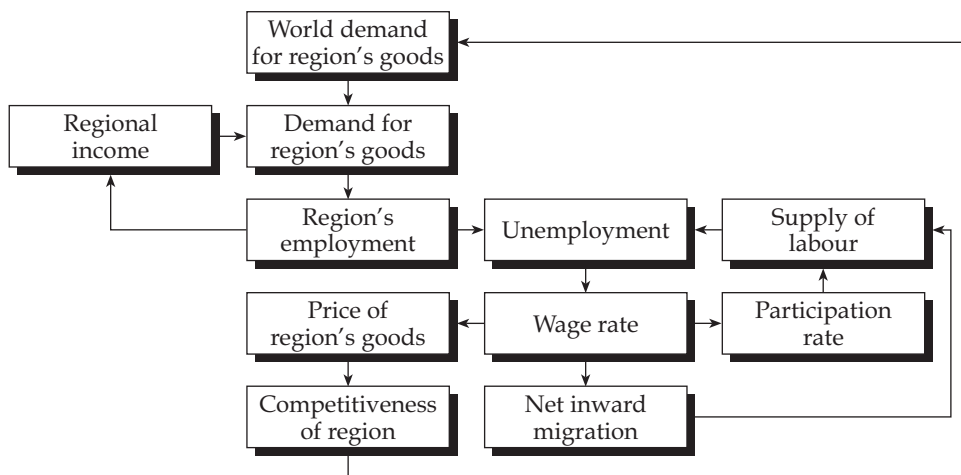


Figure 1.7 Regional income and employment determination assuming an active supply side.

Features of the model

- 1 The supply side is endogenous since an increase in the demand for the region's output will have effects in the labour market, which in turn will affect the supply of output.
- 2 The region's wage rate is determined within the region (by the excess demand for labour).
- 3 An increase in the regional wage will lead to an increase in the labour supply through: (a) inducing an increase in net inward migration; (b) inducing an increase in the region's participation rate.
- 4 An increase in the regional wage will reduce competitiveness by raising production costs.

1.7 Regional econometric models

Regional multiplier models are useful for providing estimates of the effects of expenditure changes on total regional income and employment. There is a need to construct models capable of providing more detailed predictions, however, if economic development policies are to be efficient and effective. Such models must be capable of providing forecasts for a wide range of economic variables so that the consequences of alternative policy strategies can be evaluated. If detailed forecasts of the likely consequences of any given policy action (such as changing the pattern or level of public expenditure) are provided, the policy maker will be able to select the policy with the most favourable outcome. It is the purpose of regional econometric models to assist the policy maker to achieve this objective by producing quantitative forecasts of a range of economic variables.

To be useful for planning purposes, regional models must possess several characteristics. First, the model must be sufficiently detailed so that relevant government departments at both national and local level (e.g. education, health, housing, industrial development, social services) can be provided with the sort of

data needed to carry out their functions efficiently. A detailed industrial breakdown of output and employment forecasts is required, for example, if local or regional authorities are to construct effective industrial development plans. A detailed age and gender breakdown of population forecasts is also needed if local authorities are to plan their public services efficiently. School enrolment rates, for example, have implications for staffing levels in schools and for school buildings, and a detailed occupational breakdown of workforce forecasts is needed if establishments of further education are to develop appropriate training programmes.

Second, regional models must be constructed for geographical areas which correspond to administrative authorities if they are to be useful for planning purposes. Furthermore, it may be necessary to disaggregate the model spatially if the administrative area for which the model is being constructed has functions that are undertaken at different spatial levels. Educational planning, for instance, requires detailed demographic forecasts at district level. A further problem arises when different administrative functions require different levels of disaggregation. In such cases, it is necessary to construct the model such that it can be aggregated up into the set of spatial units that are required for planning each administrative function.

Third, it is essential that the model is internally consistent. This means that the region must be treated as a set of interdependent elements. Whenever one part of the regional economic system is affected by an exogenous shock (e.g. a sudden change in demand), this will have reverberations throughout the regional economy. The model must be capable of predicting the 'full system effects' of any such shocks.

Regional econometric models vary tremendously in detail and size. They vary for a number of reasons. First, different models are constructed for different purposes. Some models, for example, are constructed for the purpose of estimating the impact of alternative fiscal policies on employment and output in each main sector of the regional economy. Other models are more concerned with providing forecasts of the main economic and demographic variables.

A second and very important reason why regional econometric models differ from each other is that the models actually constructed by researchers are largely determined by data availability. It may not be possible to construct what the researcher believes to be the 'true' model simply because such a model may require data that do not exist.

Finally, modellers are often reduced to *ad hoc* devices in order to make their models work. According to economic theory, for example, private investment spending is determined, at least in part, by the rate of interest. But if the researcher finds that this determinant does not help to explain variations in the level of investments in practice, there is no alternative but to discard it from the investment function. The equations of econometric models do not always correspond with *a priori* theorizing.

A simple hypothetical model

Regional econometric models consist of a set of equations. Each equation determines the numerical value of one of the region's economic variables. The determinants on the right-hand side of each equation may include exogenous variables

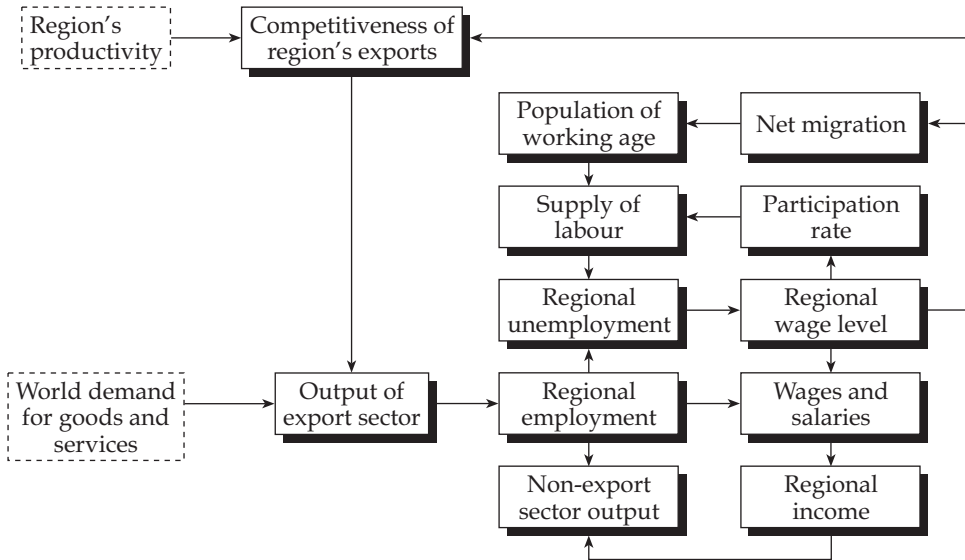


Figure 1.8 Illustration of the structure of an econometric model.

(such as national output, the national wage rate, autonomous government expenditure and taxation, and demographic variables such as birth rates and death rates) or endogenous variables (which are the variables determined by the model itself).

Such models attempt to measure the economic linkages that exist (1) within the region, and (2) between the region and the outside world. The link between each element of the model is estimated by econometric methods and is represented by an equation in the final model used for prediction purposes. The potential importance of such linkages is illustrated in figure 1.8. It can be most easily understood by considering the effect of an exogenous shock.

Suppose world income increases. This will lead to increased output in the region's export sector (assuming there exists spare capacity). Export sector employment will consequently increase and this will increase the wage bill on the one hand and reduce unemployment on the other. The fall in unemployment will exert pressure on the local labour market and push up the regional wage rate. Wages and salaries will therefore increase because employment increases and the wage rate increases. Gross income will increase, thus raising disposable income which in turn leads to an increase in the demand for the output of the non-export sector. The process just described is then reinforced by further feedback effects as the non-export sector employs more labour.

The increase in the regional wage can also be expected to have longer-term effects through inducing more in-migration, which will occur whenever the regional wage rises relative to the national wage. Tracing the effect of this through the labour market, we see that the inflow of workers from other regions will increase the labour supply and so raise the level of unemployment. This in turn

will ease the pressure on the regional wage rate. The net inward migration therefore acts as a safety valve by helping to satisfy the excess demand for labour which originated in an increased demand for the region's exports. Higher wages in the region will also induce an increase in the labour supply by raising the labour force participation rate. Working in the opposite direction is the adverse effect of increased wages on the competitiveness of the region's exports, thus deflating demand in this sector.

The model could be made more realistic in numerous ways:

- 1 Transfer payments into the region will fall since any reduction in unemployment will automatically reduce the unemployment benefit flowing into the region.
- 2 Taxes could be made to depend partly on wages and salaries since tax revenue automatically increases as income increases.
- 3 The export sector could be disaggregated into several sectors, each of which may respond quite differently to changes in world income (and also to changes in their competitive position in world markets).
- 4 Other parts of the model besides the export sector could be disaggregated in order to provide more detailed forecasts. These might include: population change by age and gender, and employment by industry and occupation. No two regional models are therefore likely to be the same. Different models serve different purposes and their construction is very heavily influenced by data availability.

1.8 Conclusion

The primary concern of this first chapter has been to explain how regional income and employment are determined. Much of the discussion has been about how the simplest version of the Keynesian model of income determination has been adapted for application at regional level. Understanding how regional income and employment are determined is an essential prerequisite not only for estimating the impact of exogenous shocks on the regional economy, but also for predicting the consequences of policy action aimed at reducing regional disparities in economic performance. Predictions about the likely consequences of policies designed to improve the economic performance of regions are likely to be more reliable if these are made within the context of a coherent theoretical model of the regional economy. We need to know how the regional economy 'works' before we can start to predict policy impacts.

A major aim of this chapter has therefore been to explain how a regional version of the Keynesian multiplier model can be used to estimate the effect of expenditure injections on local and regional economies. Lying at the very heart of this approach to estimating regional impacts is the income multiplier itself, which has been used extensively by economists to predict the impact of expenditure injections on local and regional economies. The basic elements of regional multiplier analysis have been explained and its potential usefulness has been illustrated by

reference to particular applications. The critical feature of regional multipliers is the extent to which expenditure injections leak out of a region and special attention has therefore been paid to identifying the nature of these leakages. Not surprisingly, the marginal propensity to spend on locally produced goods plays a prominent role in determining the regional multiplier effects resulting from an expenditure injection.

The critical test of the value of regional multiplier analysis is whether it provides policy makers with useful information. The rapid growth in the use of regional multipliers to estimate the impact of a wide variety of different types of economic impact provides considerable support for the view that this technique has some value. One of the most important developments over recent years in the application of regional multiplier analysis is the calculation of several multipliers for the same region, where each multiplier refers to a specific type of expenditure injection. This is important because the multiplier consequences of an expenditure injection are very sensitive to leakages in the initial expenditure injection itself (i.e. leakages in the multiplicand).

Regional multiplier analysis has undoubtedly proved to be of substantial value, not only in impact analysis but also in providing an explanation of how regional economies actually function. But it does nevertheless have its weaknesses, one of the primary ones being that it does not provide sufficient detail of the economic effects of expenditure injections. The response to this criticism has been to construct regional econometric models, which provide far greater detail than regional multiplier models. Needless to say, regional econometric modelling also faces serious drawbacks since the data requirements are very demanding. Progress is, however, being made in this direction as more data become available. It seems inevitable that regional econometric modelling will become increasingly commonplace in the near future.

One type of regional economic model which has not been discussed in this chapter is the regional input–output model. This has been extensively used in local and regional planning, particularly in the United States. Local and regional applications of input–output models are the subject matter of the next chapter.

Further reading

Archibald (1967); Brownrigg (1971; 1973); Sinclair and Sutcliffe (1978; 1984); McGuire (1983); Dow (1986; 1987); Glasson et al. (1988); Love and McNicoll (1988); Armstrong (1988; 1993); Bayoumi and Rose (1993); Felsenstein (1996); Dow and Rodriguez-Fuentes (1997).