

RELOCE Lecture 3b

Regional growth - Export demand models, agglomeration and cumulative growth

23 February 2010



Aims:

- To introduce the theoretical construct of the export led growth model and explore the concept of cumulative causation.
- To examine how the balance of payments problem constrains regional growth.
- To explore alternative explanations of cumulative growth and to examine the evidence that suggests that cumulative growth is occurring

Outcomes:

- To be conversant with the methodology underlining the export led growth model and be able to describe the model's operation in detail, understand the concept of cumulative causation in general and the Kaldor - Dixon - Thirlwall model in particular.
- To be aware of how regional growth may be constrained by an adverse balance of payments situation.
- To be familiar with alternative explanations of cumulative growth and understand the links between industrial clustering and growth.

Recap from the Neo-classical models

Recap from classical model – the neo-classical school emphasises the role of labour supply, capital stock and technological progress. The emphasis is on the supply side characteristics of the growth process DEMAND ADJUSTS TO SUPPLY crucially it ignores the potential contribution of factors on the DEMAND side of the economy. A modification to the basic model allows for trade with other regions (regional exports) but this leads on to explanations that start to differ from the outcomes predicted by the neo-classical approach.

The export-base modelling approach

Early work by economic historians looked at economies that had been developed from without, rather than within. Typically capital and labour was attracted to regions rich in natural resources (e.g. US, North West) as demand expanded the necessary transport infrastructure was put in place to link these regions with world markets.

- Thus, the central underpinning of the export-base model is that the initial stimulus is traced to the exploitation of natural resources, and
- the geographic uneven distribution of resources helps to explain why regions grow at different rates.

However, if the model is to be of any use it needs to explain continuing expansion (or decline) of a region and therefore it must consider:

- Why regional specialisation occurs and,
- the circumstances under which a regional economy will continue to grow or decline.

Any explanation will therefore need to examine theories of comparative advantage (to explain regional patterns of production and export specialisation)

Heckscher-Ohlin theorem

This theorem states that regions specialise in the production and export of commodities that use their relatively abundant factors intensively (*see also lecture 4b Inter-regional trade*).

- Raw material-intensive commodities - primary and semi-processed goods
- Labour abundance - labour intensive commodities (services)
- Capital abundance - capital intensive commodities (high value added manufactures)

This is however somewhat simplified and it needs to be recognised that although it may hold relatively true for natural resources it is more tenuous for labour and capital.

Model

Once specialisation is established external demand for a region's output will have a dominating effect on its growth. But external demand depends on a number of factors:

1. Price of region's exports P_x
2. Income level of other regions and Z
3. The price of substitutes P_s

The Export demand function summarises the effect of these factors thus:

$$X^d = f(P_x, Z, P_s)$$

It should be recognised that other factors such as, quality of product and after sales service will also affect demand (although these are not specifically included in the model). Likewise the competitiveness of the export sector (in terms of world markets) will also affect the growth of the export sector through price and quality.

The main Supply side factors impacting on production cost will also impact on competitiveness (in terms of world markets). These crucially include:

Wage costs	W	Capital costs	P_k
Raw material costs	R	Intermediate input costs	C
State of technology	T		

The Export supply function summarises the effect of these factors thus:

$$X^s = f(P_x, W, P_k, R, C, T)$$

If the export supply and demand functions are "favourable" (to a region's growth) this will lead to an expansion of demand for factor supplies, thus bidding up the price for factors.

Therefore, Increased demand for exports will

- ↑ demand for factors of production, ↑ in factor prices relative to other regions,
- ↑ in-migration from other regions leading to growth disparities (between regions).

The length of time disparities persist is most likely to depend on:

- ❶ factor shortages ❷ emergence of competing regions

Thus, on the supply side, in the short-run the cost of factors is increasing relative to other regions (reducing competitiveness) and on the demand side customers may be turning to other suppliers (particularly if factor shortages are putting upward pressure on the price of the export goods).

However, a region may survive as a leader if the growth process is cumulative. This means that there is a multiplier effect on regional income and possibly an induced effect on investment. Higher factor prices can be expected to stimulate factor attraction (labour and capital). The increase in labour will increase demand for goods and services that are produced and consumed locally. Downstream industries supplying the export sector will emerge as growth continues. These will, in turn, stimulate a range of agglomeration and localised economies, which combined with economies of scale in the export sector, will stimulate reductions in production and distribution costs. Over the longer term as downstream industries continue to grow they may export in their own right as they seek to become less dependant and more diversified.

It has to be noted that the original export activity may not grow indefinitely. Low cost locations can turn into high cost locations (examples in the UK include the steel producing centres of Corby - Scunthorpe). The pattern of demand for the commodity made by the export sector may change (steel replaced by plastic) and ultimately a pattern of cumulative reversal can set in. If factors are sufficiently mobile regional exports will switch to more viable export commodities and/or loose labour and capital to more successful regions/localities.

The advantage of export-base over neo-classical theory is that it stresses the role of the demand-side without ignoring the supply-side. However, it has attracted criticism:

- In its simplified form it merely describes the development of regions dependant on raw material exports. Moreover it assumes factors do not migrate between regions (probably reasonable for raw materials but not for labour and certainly not for capital).
- It offers little insight to the dominant factors of regional growth particularly the role of local entrepreneurial activity and government development programmes.
- There is no systematic explanation of the determinants of demand for a region's exports (price, uniqueness, fashion) without which it is impossible to predict regional growth differences. In its most basic form, the model is, (according to Armstrong and Taylor, 2000) "less rigorous than the neo-classical model".

Cumulative causation - Kaldor - Thirlwall, Dixon model.

In an attempt to broaden out the basic model and to explain why some regions appear to maintain their position as economic leaders a number of economists have sought to explain the concept of cumulative causation. The Kaldor, Thirlwall and Dixon model results from the combination of the work of three notable economists in the late 1960's and mid 1970's. Their work emphasised the cumulative nature of the growth process.

Kaldor's hypothesis was that growth of per capita output is determined by the region's ability to exploit economies of scale and the type of activity in which it specialises. Thus, manufacturing reaps greater benefit gains than land-based activity because it has greater scope for productivity gains. (*In the 1990s he might argue that regions with substantial high technology bases are likely to accrue the largest gains*). More importantly the process is cumulative since the advanced regions have an in-built competitive advantage, which in turn will reinforce the region's specialisation. (See the classic article The case for Regional Policies, Kaldor N, Scottish Journal of Political Economy Vol. 17, 1970, p337).

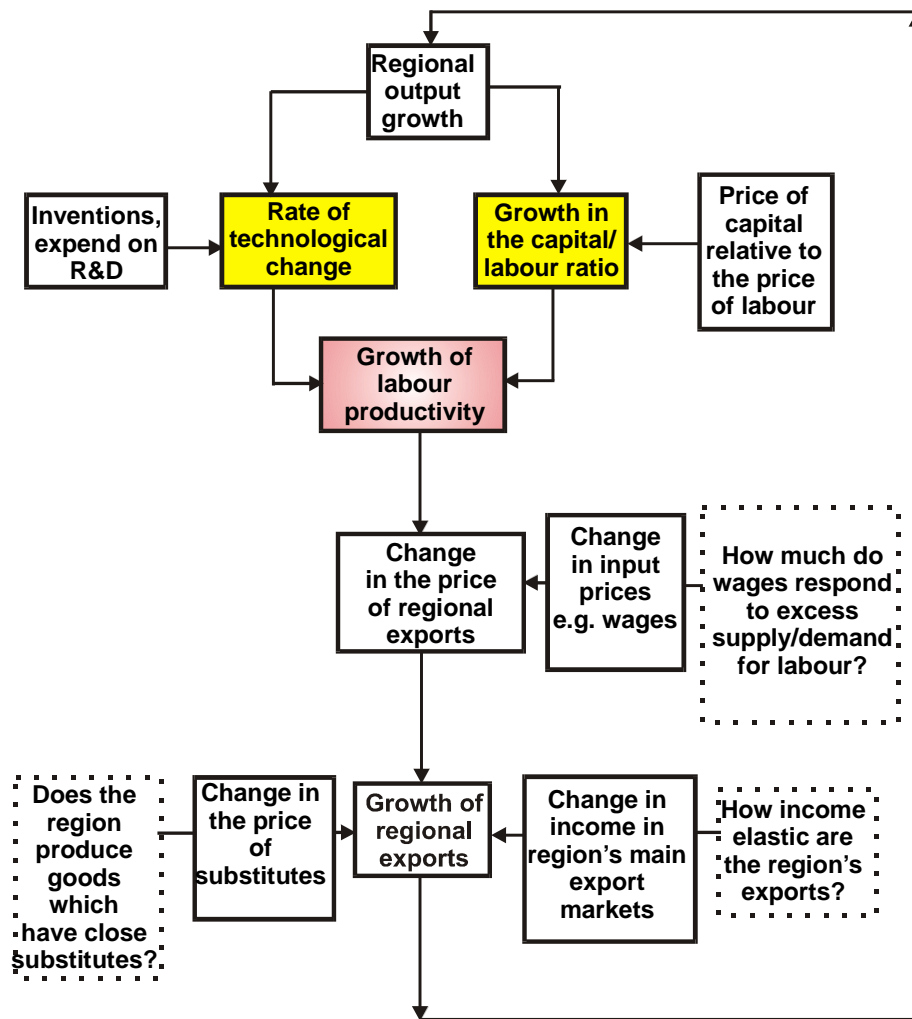
Thirlwall and Dixon sought to improve Kaldor's original model by paying particular attention to the way in which the process of cumulative causation affects a region's growth. This is achieved through the feedback effect of regional growth impacting on the competitiveness of a region's export sector. This increases output growth in the region, which further benefits productivity and competitiveness of the export sector.

Key features of the model

Focal point of the model is the growth in labour productivity (see Armstrong and Taylor, 2000, Figure 4.1).

- Factors, which determine labour productivity include, the rate of technical change and the growth in capital/labour ratio (capital deepening) - *labour productivity rises if either or both increase*.
- The rate of technical change and capital deepening are dependent on regional output growth (*to stimulate investment and R&D*).
- Output growth is in turn partially determined by export growth (*totally in the simple export-base model*).
- Export growth is dependent on the region's competitiveness relative to other areas producing substitutes and the rate of change in income of the recipient region (*for exports*).
- Finally, the price of a region's exports is partially determined by productivity gains that it is able to achieve (growth in labour productivity and rate of change in input prices i.e. wages).
- And so on.

Dixon-Thirlwall model of regional growth



The model

The model consists of four functional relationships, (these can be shown as equations).

1. The first relationship is between output and productivity growth.

$$q = \alpha + \lambda y_{-1}$$

where q = productivity growth; y = output growth;

α = autonomous (independent) productivity growth;

λ = the Verdoorn coefficient (is a constant). Verdoorn's law states that productivity is partly determined by growth in the previous period and partly by other unspecified factors (α). The faster the growth in output the faster the growth in labour productivity

2. The second relationship contends that any increase in production costs will feed through into the regions rate of inflation and productivity gains will reduce inflation.

$$p = w - q$$

where p = price inflation in the region.

and w = cost inflation in the region.

Therefore if productivity gains keep pace with costs inflation prices remain stable. Cost inflation is said to be determined outside the model (nationally rather than regionally).

3. The third element states that growth in exports (x) is determined by the region's price inflation (p); price inflation of its competitors (p_f); and growth in income (z) of the region's main export market.

$$x = -b_0 p + b_1 p_f + b_2 z$$

where b_0 and b_1 are price elasticity of demand and b_2 is the income elasticity of demand. The faster the growth in income (in the main export market) and the lower a region's inflation rate to that of its competitors the faster will be the export growth of the region.

4. The last of the equations is a simple export-base relationship, which links exports to output.

$$y = \gamma x$$

where y = output; γ responsiveness of the regions output growth to growth in its exports; and x = exports

Full model

$$q = a + \lambda y_{-1} \quad (1)$$

$$p = w - q \quad (2)$$

$$x = -b_0 p + b_1 p_f + b_2 z \quad (3)$$

$$y = \gamma x \quad (4)$$

If λ is greater than zero any output growth in the previous period will create further output growth by making the region more competitive. This increases export sales, which boosts regional output. Thus the system is cumulative and self-perpetuating.

The process

An \uparrow in the growth of world income has a positive effect on export growth, the consequential increase in a region's export growth raises regional labour productivity, which, in turn, raises the region's competitiveness by reducing regional prices relative to competitors. At this point the second round kicks in, however it should be noted that the induced effect becomes smaller with each round.

To obtain the equilibrium rate of output growth, substitute equations 1, 2, & 3 into 4.

$$y = \gamma \left[-b_0(w - a - \lambda y_{-1}) + b_1 p_f + b_2 z \right] \quad (5)$$

Rearrange terms to give

$$y = \gamma \left[-b_0(w - a) + b_1 p_f + b_2 z \right] + \gamma b_0 \lambda y_{-1}$$

This is further simplified to

$$y = \alpha_0 + \alpha_1 y_{-1} \quad (6)$$

Where

$$\alpha_0 = \gamma \left[-b_0(w - a) + b_1 p_f + b_2 z \right]$$

$$\alpha_1 = \gamma b_0 \lambda$$

In long-run equilibrium the growth rate is constant so that: $y = y_{-1}$ this then reduces equation (6)

to $y = \alpha_0 + \alpha_1 y$ solving for y gives

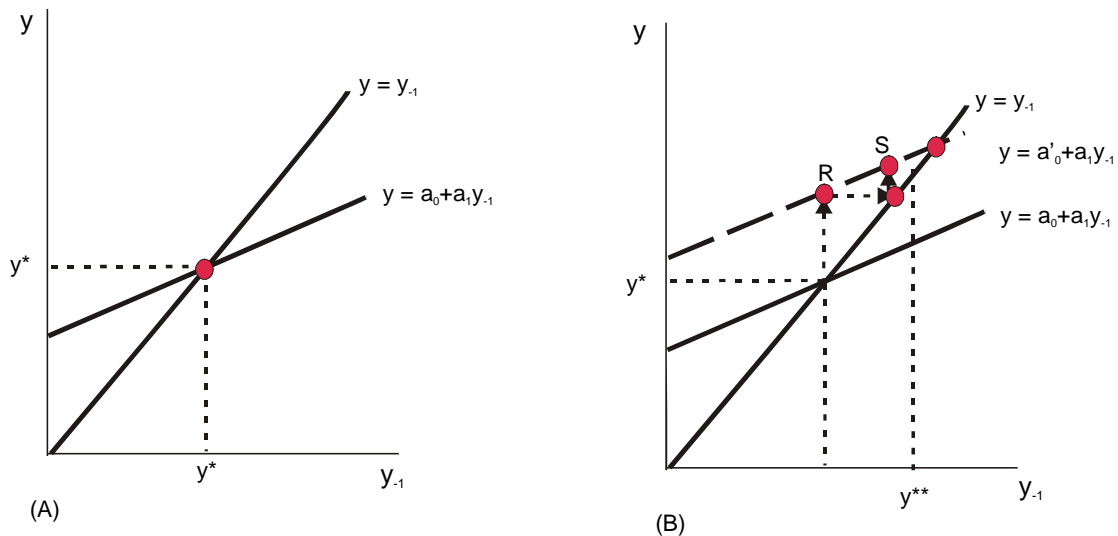
$$y = \frac{\alpha_0}{1 - \alpha_1} \quad \text{This is the equilibrium growth rate in the Dixon-Thirlwall model.}$$

From this equation it is possible to estimate a region's equilibrium growth rate provided we know the value of the coefficients (a , λ , b_0 , b_1 , b_2 & γ) and the exogenous variables (w , p_f , & z).

Note: The equation notations used in Armstrong and Taylor differ slightly from those used in the original article by Dixon and Thirlwall ("A Model of Regional Growth-Rate Differences on Kaldorian Lines", *Oxford Economic Papers* No 27, 1975, p201) and take a different starting point, but the form is essentially the same.

Armstrong and Taylor give a numerical example using the above equations to demonstrate that employment will grow if output growth exceeds labour productivity growth (assuming both are positive). Equally if labour productivity exceeds output growth employment will fall. Equation (6) also shows whether or not the equilibrium growth rate is itself stable or unstable. So far it has been assumed that α_0 is positive and α_1 is a positive fraction.

Armstrong & Taylor, 2000 (see Figure 4.3) demonstrate the relationship between output growth now (y) and output growth in the previous period (y_{-1}). The first frame of the figure shows the initial equilibrium. In the second frame, an increase in a_0 (say world income growth), shifts the output growth function upwards, the equilibrium is disturbed, the growth rate of y^* in the 1st period leads to a growth rate of R in the 2nd period. This, in turn, leads to S and onwards to the new equilibrium output growth rate of y^{**} in subsequent periods. The process is stable because it converges to the long-run equilibrium where the output growth rate is the same in each period. In theory, output growth will be unstable if the slope of the growth function (α_1) is greater than 1. In this case output growth is less than the equilibrium level and cumulative decline sets in. The other extreme is where output growth exceeds the equilibrium level and growth accelerates. Neither of these two extremes is considered feasible in the real world, which suggests that (α_1) is a positive fraction.



Problems with the model

There are a number of problems with the model:

1. It fails to explain the types of exports in which the region will specialise. The export demand equation simply shows how a given basket of export commodities will respond to changes in factors (such as world income growth). Neither does it explain how the region acquired its specialisation in the first place (*To be fair neither did Kaldor, he treated it as a given - resulting from endowments, work ethic or plain luck and Dixon and Thirlwall were at great pains to maintain his original specification*).
2. The model assumes that the export sector is the only source of regional growth. Ignoring the fact that intra-regional trade may expand (agglomeration and localised economy effects). The service sector may have a life of its own changing size independently of events in the export sector.
3. Verdoorn's Law is a complex process, the way in which regional output expansion leads to an improvement in productivity growth is not well understood. It therefore hides a number of competing processes e.g. the rate of technical progress; division of labour etc. In other words there are a number of ways that productivity growth might be achieved and these are not specified.
4. Empirical evidence to support the Verdoorn relationship is also controversial (it relies in part on the correlation between output growth and productivity found in an international cross-section study) this has subsequently been challenged on statistical grounds by Rowthorn (*Economic Journal* 85). Boulier suggests that the statistical tests of Verdoorn's law have been "unsound". On the other hand, a more recent study by McCombie and Ridder, The Verdoorn Law Controversy: Some New Empirical Evidence Using US State Data, *Oxford Economic Papers* No 36, 1984, p268 (see reading list) generally supports Verdoorn's Law (*Although Armstrong and Taylor suggest these should be treated with caution*). Similarly, studies by Fingleton & McCombie and Harris & Lau suggest that "dynamic increasing returns to scale are an important factor in determining productivity growth".
5. Armstrong and Taylor suggest that the model ignores the consequences of output growth on a region's balance of payments (*although Kaldor suggests that the balance of payments problem is not too severe for regions because of the "fiscal stabiliser"*).

Balance of payments as a constraint on regional growth.

Armstrong and Taylor review work by Thirlwall Regional Problems are "Balance of Payments Problems" *Regional Studies* (1980) to highlight the fact that regions do encounter persistent balance of payments problems. However these are disguised by the fact that regions do not have their own currency or the ability to use instruments such as currency depreciation or tariff barriers. Thirlwall argues that although a region's external trade deficit (imports outweigh exports) is partially counteracted by government transfer payments this often serves to maintain imports and does little to stimulate the regional economy. He goes on to explain that "favoured regions" will continue to prosper because they produce export goods with higher income elasticity of demand but import goods with a lower income elasticity of demand, thus stimulating more rapid output growth which feeds through into productivity gains. Other regions will find it difficult to establish a competitive foothold in these commodities.

The policy implication(s) for the lagging regions are to switch into high growth export commodities or increase the amount of import substitution. The problem is that it is difficult to switch (see Thirlwall) and because regions are very "open" and are unable to use tariffs, further, import substitution may be difficult to achieve without some form of local competitive advantage. This suggests that there may be supply-side solutions as well (reducing costs). Indeed, Armstrong and Taylor suggest that Thirlwall is wrong to ignore the supply side as increased costs and sluggish productivity growth will also effect a region's competitive position and the demand for its exports.

Alternatively Krugman, Differences in income elasticities and trends in real exchange rates, European Economic Review (1989) argues that the causal relationship is the other way round and that output growth determines export and import elasticities and an increase in factor supplies will lead to an increase in output growth. Thus, regions will be able to diversify their product range and sell to a wider market. This implies that demand for exports is endogenous. Armstrong and Taylor challenge this conclusion on two counts: ❶ he fails to explain why output growth increases assuming that growth of factor inputs = greater output (*classical model hypothesis*); ❷ he ignores the importance of demand for exports in export growth.

Alternative explanations of cumulative growth

The Verdoorn relationship incorporates a cumulative causation process into an export base model of regional growth. But the Verdoorn relationship hides a complex set of economic relationships. It picks up on the economy of scale arguments that are a feature of growth pole theory (*see Myrdal and Hirschman*).

Economies of scale and agglomeration

Internal economies of scale in a firm cause rapid growth of that firm in relationship to its competitors which leads it into a position of competitive advantage over its rivals this is usually manifest through specialising production via standardisation of product and automation (Fordism).

External economies of scale occur because of proximity to related activity. There are two types - *localised economies* - geographical concentrations of plants with input-output relationships. Nodal points of transport networks are points where transport and assembly costs can be minimised.

Examples include boarder regions such as USA, Mexico, which allows firms take advantage of cheap labour and proximity to markets. This allows greater plant specialisation reducing long-run average costs, leading to greater efficiency. Firms in the same or similar industries find it advantageous to cluster, it allows individual plants to specialise (making the part of a product for which they are best suited and most efficient).

In addition, clustering allows research and innovation to proceed because the cost of new innovation is shared. There are also spill over effects from a pool of labour with the required skills who can move between firms with advantages for both the firms and workers, or clustering of research and innovation for firms in a particular sector e.g. Silicon Valley or Silicon Fen.

It is argued that both firms and workers benefit - **Firms** have a large pool of workers with the required skills from which to draw their workers and will pay lower labour cost than if they were competing with a wider range of firms; **Workers** are more mobile between firms in the given area and are more likely to acquire industry specific skills if there is less risk to their future job prospects.

Agglomeration economies – the geographical proximity of a large number of economic activities. This further enhances competitiveness drawing together many firms who may not have direct input-output linkages but who trade with one another (through third parties) and provide all (or most of) the services required by firms. Because these large dynamic areas are centres of trade, culture and administration they tend to draw in resources from less developed regions including the most dynamic elements in the workforce. Examples include:

urban transport and commuting facilities
legal and commercial services
large diverse labour markets
service trades

cultural and recreational activities
clustering of R&D
government services

Manufacturing presents a good case of just how inter-linked sectors are and how important agglomeration is in minimising costs.

Manufacturing input-output linkages		
	Manufacturing inputs (% of total input)	Manufacturing outputs (% of total output)
Agriculture	13.0%	10.7%
Mining	6.2%	0.8%
Manufacturing	32.2%	36.8%
Utilities	5.0%	1.8%
Construction	0.0%	17.9%
Distribution and Catering	20.9%	16.7%
Transport & Comms	3.5%	6.6%
Finance & Bus. Services	16.8%	6.0%
Public Admin	0.4%	1.1%
Other Services	1.8%	1.6%

Source: Scottish input-output transaction tables 1994

Audretsch (1998), Agglomeration and the location of innovative activity Oxford Review of Economic Policy, suggests that globalisation and telecommunications has eroded the comparative advantage of traditional moderate technology industries such as machine tools and car production in Western Europe as they have faced competition from other countries mainly those with lower labour costs. He argues that a new comparative advantage is emerging based on innovative activity (which can support higher wages because demand for knowledge-based industry products is high and growing rapidly). He recognises that knowledge has spill over effects, whilst it can be retained within a firm (*via patent protection*) it is also attached to workers such as scientists and engineers (at which point it becomes mobile).

It is argued that the cost of transmitting information may be reducing but the transmission of tacit knowledge (or sticky knowledge) is still high because it is best transmitted face-to-face. He argues that tacit knowledge transmission is highest during the early stages of the industry life cycle. But he makes clear that other factors combine to create centres of excellence like Silicon Valley such as: universities, trade organisations, local business organisations, specialised consultancy, market research, and venture capitalists.

City	Patents/population	Education level
San Jose'	665	32.6
Rochester	648	22.9
Albany	350	23.6
Minneapolis	282	26.9
San Francisco	259	34.9

He found evidence of clustering around particular US city regions in terms of both the density of research centres, educational attainment and the number of patents per 100,000 residents. The main concentrations of research centres were the big cities of New York, Boston, Chicago and Los Angeles, the main centres for turning ideas into products (or patents) were San Jose', Rochester, Albany, Minneapolis.

Interregional trade ensures that capital intensive and technological advanced sectors give a significant boost to regions that host them, some of which filters down to other regions (slowly). Although it is not always implicitly stated, there may be costs as well, as less developed regions loose out as they are starved of investment and find their most efficient and enterprising workers drawn to rapid growth regions. This is known as the *backwash effect*. Over the longer-run economic benefits may be transmitted to the less developed regions but at a price (previously less efficient firms, that were protected by their isolation, may fail as they face the full effect of competition).

Trickledown theory suggests that growth will spread from growth centres to other regions over time. It is also evident that external diseconomies are likely to be encountered in the original growth poles through congestion, pollution and rising factor prices (land and labour). To some extent these twin actions help less well-developed regions to grow but government may still wish to intervene through regionally discriminating expenditure on economic development.

Trade costs, industrial clusters and regional growth

The New trade theory approach draws on cumulative causation mechanisms. This suggests that it is the interaction between internal scale economies, market access and agglomeration, which determines inter-regional trade flows. New trade theory is based on three propositions:

- The existence of scale economies encourages firms to choose a single location (*i.e. greenfield sites next to motorway*)
- Barriers to trade encourage firms to locate near their markets (*travel costs*)
- Agglomeration economies encourage firms to cluster in certain locations (*supply chains*)

If trade barriers initially exist then trade is restricted and the regions do not export, once the barriers are withdrawn there is an opportunity to trade. If one region decides to specialise in manufacturing (it increases output and exports and through scale economies it gains a competitive advantage. These internal scale economies are reinforced if there is a high degree of vertical integration in the region (clustering allows cost reductions).

Which region grows and which declines depends on a number of factors:

1. Cost of transport (inputs) {optimal location midway between suppliers and customers}
2. Cost of transport (outputs) { }
3. Low labour costs {Labour intensive industries}
4. Degree of agglomeration (concentration of economic activity)
5. Congestion & land costs

For evidence see Amiti (1998) New trade Theories and Industry Location in the EU, Oxford Review of Economic Policy

Evidence of the economic benefits of industrial agglomeration

The important question is whether or not firms in the same industry cluster to take advantage of external economies of scale or whether or not this is due to factor endowments e.g. efficient transport links, cheap labour or land. Armstrong and Taylor use two studies: the location of US manufacturing plants in the border region of Mexico and Japanese manufacturing plants in the US and UK to demonstrate.

Hanson (1998), North American economic integration and industry location, Oxford Review of Economic Policy, suggests that three specific location factors played a crucial part.

1. US firms took advantage of low-cost Mexican labour
2. Access to US markets was a primary consideration (particularly the South and West) as transport costs are minimised.
3. Backward linkages to suppliers in the US have also been a deciding factor.

In terms of further shifts in the location of production in the Americas he suggests that there will be an expansion of *maquiladoras* type firms specialising in the import of intermediate input and the export of goods such as clothing and electronics.

This is driven by the comparative advantage most central and Latin American countries have in low-skilled assembly over the US (labour costs). Finally, he looks to the future, suggesting that the Americas may develop a number of manufacturing hubs these are most likely to be in the country with the dominant economy with other countries trading through the hub rather than directly with each other.

Research by Head suggests that Japanese manufacturing plants located in the US have been attracted to locations where:

- There are already an existing concentration of plants in the same industry
- The pull of areas which already have Japanese firms in the same industry is even stronger.

He suggests that the reason for this is the long-term relationship they have with suppliers and "just in time" production methods. Thus suppliers tend to follow buyers. A similar finding occurs in the UK with data from the Invest in Britain Bureau confirming significant clusters of Japanese owned firms in the motor industry (particularly Tyneside) and the electronics industry (Wales and the borders)

Spatial concentrations of the financial sector:

Armstrong and Taylor also review the issue of the concentration of the financial sector in core regions and the effect this has on the distribution of investment to depressed regions. They concluded that there are a number of reasons why peripheral regions lose out to the core:

1. Lower income levels (high demand for liquid assets which are provided by national rather than local institutions. Savings flow to regions with high demand for investment capital.
2. Financial institutions have efficient networks for attracting savings from low wealth to high wealth regions.
3. Few investment opportunities in low-growth regions more in high-growth core regions.
4. Venture capital invests in SMEs (high growth potential) who are located in the core region.
 - i) higher SME growth rates in core
 - ii) distance between investor and borrower is important (investor risk aversion).
5. Induced effect from the centralised location of financial institutions (jobs and income).
6. Further economic and monetary integration will lead to greater spatial concentration to the disadvantage of the periphery.

Empirical studies of the cumulative growth process

There have been significantly fewer studies of the regional cumulative growth process than those investigating the neo-classical growth model. Research into cumulative causation concentrates on the medium-term rather than the long-run, usually looking at period of 10 - 20 years.

The first of two studies reviewed by Armstrong and Taylor is by Cheshire et al (1996). This examines the difference in per capita GDP growth between major cities in the EU. Cheshire used Functional Urban Regions (city core and its functional labour market). Initially he identified a number of potential determinates of regional growth:

- Industry mix (*likely to have effect as some have greater growth potential*)
- National factors (*If a country has a faster growth rate than its neighbours then this is likely to be reflected in its' regions*)
- The location of the region in relation to market potential (*those located close to the main population centres have a distinct advantage in terms of transport and market size*)
- Agglomeration economies and diseconomies (*large regions benefit from agglomeration economies but as they get bigger diseconomies set in with congestion and higher costs due to excess demand*)
- Endogenous growth through technology innovation (*High concentrations of R&D workers are expected to generate further regional growth*)
- Spill over effects (*Regions in close proximity may benefit from trading relationships with the growth rubbing off on neighbouring regions*)

The variables that he found to be significant were:

- The growth rate of the national economy in which the region is located
- The growth of neighbouring regions
- Population of the region
- Number of R&D establishments per capita
- Historic influence of agriculture, resource based industries and port areas (less rapid growth)

This implies that the growth process is cumulative, that there are scale economies and that there are spill over effects, the R&D association suggests endogenous growth is important. Finally, Cheshire suggests that interventionist regional policy is required if gains from integration are to be spread more widely these include transport networks, start-up capital and innovation exchange.

Armstrong and Taylor quote the work of Sun et al to demonstrate the gap in regional output growth in post Maoist China between the East and West. Although Eastern China has always had better external trade relations than the West because of its proximity to international trade routes gap has widened substantially in the last two decades (see Armstrong & Taylor, 2000 Table 4.5).

The factors leading to the disparities include:

- A more favourable mix of industries in the eastern region - less dependence on agriculture.
- Easier access to international trade
- Easier to attract FDI
- Higher rates of domestic investment
- Promotion of specific growth zones by Government.

The Chinese government has recognised the growth potential of the eastern region (because of its proximity to established trade centres/routes) and encouraged investment to create growth poles to use as the springboard for further growth.

This suggests that they believe that growth is a cumulative process and they have deliberately concentrated resources to exploit internal and external economies of scale. The government has adopted a sub-optimal regional strategy, which has widened disparities in the short-run in order to kick-start the economy. Sun suggests that although there may be some spill over effects, in the longer term action will be required to prevent economic and social problems in the west and congestion in the east. This could be achieved through better economic linkages, integrating the east and west through improved transport linkages which would allow investors to take advantage of the relatively cheaper labour costs in the west and increased infrastructure investment. Without such a policy Sun suggests that the economic gap between the regions will continue to widen.

Conclusion

Although there is no universal agreement between economists about the causes of regional growth disparities there are a number of main (conflicting) theories/models:

Neo-classical models stress the supply-side influences on growth;

Keyensian models stress the importance of demand for export commodities in the growth process

Cumulative causation models stress the self-perpetuating nature of the growth process.

There is clearly more to come in trying to unravel the causes of regional growth (or lack of it) and more empirical work is emerging all the time, particularly in the EU as economic integration has implications for regional disparities. Growth policy is on the agenda for policy makers as they realise that regional policy has a part to play in spreading economic growth outwards from national and international growth centres.

Next week: Industrial location theory