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## 11 Regional growth models

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(To be continued with dynamic input-output models)
Export-base theory of regional growth

The enduring theme of mercantilism

Exporting as a source of growth is almost overbearing: we can observe it so easily, and it permeates the literature on local growth. It is appropriate to start by recalling our first model to the stage.

The shortcomings of a static model

The usual economic-base study (and certainly the usual economic-base model) makes no distinction between short-run and long-run considerations. Multiplier analyses derived from economic-base models focus on short-run changes in demand. But determinants of growth, a long-run phenomenon, must include supply-based issues as well. Natural and human resources as well as available technology ultimately underlie a region's ability to grow. (Lane, 1966, 342)

Exports and long-run growth

The relationship between exports and long-run growth can be shown with a set of production-possibilities curves taken from the typical presentation in principles of economics (based on Lane, 1966, 345-7). Consider a simple local economy. With a vertical axis representing service goods and a horizontal axis representing export goods, draw a curve concave to the origin in the positive quadrant at some arbitrary position. This curve represents the full-employment output combinations of service and export goods available at this particular time, given resources and technology. Assume we are at point X, representing production of two units of service goods to one of export goods. (This position is determined by tangency with a budget line representing total income, given prices of local and export goods. Actually, it may be much more complicated than this, since export income is spent on imported goods and the prices of these goods must be taken into consideration. But this is another exercise.) What happens when we increase production of export goods? How is economic growth illustrated in this diagram?

Figure 0.1. Production possibilities in a local economy

Source (Lane 1966)

Economic growth requires two sets of factors, permissive and implemental. The permissive factors are the resources available to the economy: natural resources, human resources, technology, capital, etc. They determine the position of the curve at any particular time. The curve ab is based on a given set of permissive factors; the curve cd is based on another and larger set.
(They are concave to the origin because of the law of diminishing returns and the imperfect adaptability of resources.) Implemental factors are those which cause change to happen, which cause a shift from \( ab \) to \( cd \).

The primary implemental factor in export-base theory is export demand. Any increase in aggregate demand, whether local investment or exports, may move the economy from an unemployed state (W) to a fully employed state (say X). Any further increase in export demand (with no increase in resources) will cause a shift along the production-possibilities curve (along \( ab \)). The cost of this increase is a decrease in production of service goods as resources are shifted from one sector to the other.

The increase in factor prices (e.g. wages) now stimulates in-migration (or even commuting). Since a region has no overpowering economic boundaries, the resources available are now increased and growth occurs: the production-possibilities curve now shifts out to a new and higher level, to point Z.

As an aside, note that the export-base multiplier describes this path. The marginal multiplier value is one plus the slope of the path from one equilibrium point to another; the average multiplier is one plus the slope of a line from the origin to the particular equilibrium point \( (T/B = (B + S)/B = 1 + S/B) \). If the tradeoff ratio between local and export goods remains constant and the shift in the frontier is neutral (parallel to the previous frontier, reflecting no economies of scale in producing one good or the other), the expansion path should be a straight line and the multiplier should thus be constant. If the export goods cost more to produce (in terms of service goods) or show diseconomies of scale with expansion, then the expansion path would tend to rise at a diminishing rate and the multiplier would decline.

(This could be much more complex. What we really might compare is the tradeoff in consumption between local goods and imported goods, given prices. Then we would need to look at tradeoffs in production between local goods and export goods. Where we settle is reflected by the eventual diminution of our comparative advantage in producing the export goods relative to imported goods.)

We will come back to this important issue of factor mobility and substitutability when we look at the neoclassical model.

An interesting approach to the economic base and regional growth was taken in the early literature by Charles Leven (Leven, 1964).

The fundamental assumption underlying the economic base idea is simple and uncomplicated. Specifically, base theory assumes that the only reason for concentrating economic activities in a central location is the higher income made available to the inhabitants of the locality or region via increased returns to factors of production as a consequence of economies of scale. For many industries the achievement of such a scale, however, requires production far in excess of that demanded by the local market. This leads to regional specialization, and the institutional factor necessary to permit the exploitation of such scale economies is trade among regions.

Nonbasic industries are those whose economies of scale are exhausted within the region. Basic industries are those which require demand from outside markets to realize economies of scale.

Leven points out several shortcomings of the export-base approach to regional growth. One critical flaw is that it focuses on growth in output alone. With the assumption that basic and nonbasic activities grow in constant proportion, per capita income would not rise through export growth alone, even though incomes may differ in the two
sectors. Growth in per capita income requires a change in productivity under these conditions. In fact, Leven builds a case for change in productivity or technology as the real basis for growth with the following simple example:

Suppose three persons are living on a remote island. Suppose that two are barbers and one a masseur, and that they provide each other with personal services, otherwise living on wild nuts and berries. Under such conditions increased productivity in their primary occupations would lead to increased real income. This greater productivity initially might take the form of increased leisure for all of them. But it also might result in a sufficient increase in the price of entertainment (i.e., in the number of haircuts required for one entertainment), the price of massages (in terms of haircuts) remaining the same, to induce one of the barbers to forsake his shears for a fiddle. Or, in the absence of a lack of musical ability on the part of any of the aboriginal inhabitants, they might bid up the price of musical entertainment sufficiently high to persuade a musician to immigrate to their island. Quite clearly growth in per capita income could proceed indefinitely without external trade limited only by the productivity of the inhabitants of the island and the possible gains from the division of labor. Accompanying growth in the island’s population could also increase indefinitely without external trade, limited only by the foregoing limitations and by a continued differential of per capita real income of the islanders over levels someplace else, including full allowance for detractions to real income stemming from congestion.

But there is something else that is also likely to happen to the island’s economy. Specifically, opportunities for the division of labor are not likely to be fully realized within the island alone. Comparative advantages in production most probably would arise and trade with other regions would occur. Moreover, so long as the possibility of gains from trade are not exhausted, the absolute volume of trade would increase along with the increase in the island’s total population. Basically, then, in this example the driving force behind economic growth is rising productivity. This is hardly a very startling statement. Such increased productivity could stem from increases in the stock of physical capital, but also from increases in the stock of human capital, from discovering resources, from invention, or from a change in tastes. The increases in the volume of trade is simply an expected consequence of market adjustments to higher productivity. It is generated mainly by the proliferation rather than intensification of human wants as real income rises, and by secular changes in technology which tend to increase the technological possibilities for exploiting the division of labor.

After building his arguments regarding these two explanations of regional growth, he posits three hypotheses. The first two explain differential rates of regional growth in terms consistent with economic base theory: the "market" hypothesis and the "ignorance" hypothesis. The third hypothesis based on the productivity theory of growth may be called the "capital deficiency" hypothesis.

The "market" hypothesis says that "an area's growth rate depends upon the export demand for goods and services in which the area has a delivered cost advantage." This hypothesis leads to development policies focusing on product promotion and resource discovery. But Leven does not think these would be extremely effective. Product promotion is not necessarily place-specific, and one tends to look for specific resources wherever they may be most likely, not just for "more 'things' in Pennsylvania." He also contends that

The search for technological advance, similarly, is related to processes rather than places. Thus there is reason to be skeptical about what could be accomplished by focusing the search for resources and technology on "places" rather than on input needs or production processes.

The "ignorance" hypothesis assumes that lagging growth in a particular region mainly is a consequence of potential new firms or firms in other areas being unaware of the profit opportunities in the region. The resultant implied policy is the traditional regional promotion approach -- in its crudest form simply fatuous pronouncements about parks, churches, and playgrounds, the superior caliber of its workers, or its friendly attitude towards business; and more rationally, in terms of assembled information on
wage rates, power costs, water quality, and other information on input costs and quality and transportation facilities and rates.

Again, he is less than sanguine on the usefulness of promotion policies.

Leven prefers policies which stem from the "capital deficiency" hypothesis. This hypothesis assumes "that the major problem is plant obsolescence, the low quality of the labor force or deficiencies in social overhead capital." To stimulate regional development we must divert resources toward internal capital improvements, toward building the social infrastructure. Leven feels that this policy would have broader effectiveness than export-base policies. Unfortunately, it involves much greater risk and financial commitment.

The Harrod-Domar model of regional growth

Illustration 11.1 outlines the evolution of an export-base model of regional growth based on the "Harrod-Domar" model.

(To be continued with dynamic input-output models)
Illustration 11.1  Comparison of economic-base and Harrod-Domar regional growth models

<table>
<thead>
<tr>
<th>Simple Economic Base Model</th>
<th>Harrod-Domar Regional Growth Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System:</strong></td>
<td><strong>System:</strong></td>
</tr>
<tr>
<td>( Y = C + I - M + X )</td>
<td>( Y_t = C_t + I_t - M_t + X_t )</td>
</tr>
<tr>
<td><strong>Assumptions:</strong></td>
<td><strong>Assumptions:</strong></td>
</tr>
<tr>
<td>( C = f_c(Y) = cY )</td>
<td>( C_t = f_c(Y) = cY_t )</td>
</tr>
<tr>
<td>( I = I_t )</td>
<td>( I_t = f_l(Y) = b(Y_t - Y_{t-1}) )</td>
</tr>
<tr>
<td>( M = f_m(Y) = mY )</td>
<td>( M_t = F_m(Y) = mY_t )</td>
</tr>
<tr>
<td>( X = X_t )</td>
<td>( X_t = X_t )</td>
</tr>
<tr>
<td><strong>Solution:</strong></td>
<td><strong>Solution:</strong></td>
</tr>
<tr>
<td>( Y = cY + I_t - mY + X_t )</td>
<td>( Y_t = cY_t + b(Y_t - cY_t - mY_t + X_t )</td>
</tr>
<tr>
<td>( Y - cY + mY = I_t + X_t )</td>
<td>( b(Y_t - Y_{t-1}) = Y_t - cY_t + mY_t - X_t )</td>
</tr>
<tr>
<td>( (1 - c + m)Y = I_t + X_t )</td>
<td>( b(Y_t - Y_{t-1}) = Y_t - cY_t + mY_t - X_t )</td>
</tr>
<tr>
<td>and</td>
<td>( b(Y_t - Y_{t-1}) = Y_t(1 - c + m - \frac{X_t}{Y_t}) )</td>
</tr>
<tr>
<td>( Y = \frac{1}{1 - (c - m)}(I_t + X_t) )</td>
<td>( \frac{Y_t - Y_{t-1}}{Y_t} = \frac{(1 - c) + m - \frac{X_t}{Y_t}}{b} )</td>
</tr>
<tr>
<td></td>
<td>( = \frac{s + m - \frac{X_t}{Y_t}}{b} )</td>
</tr>
<tr>
<td>Growth rate = ( \frac{\Delta \text{Capital}}{\Delta \text{Income}} )</td>
<td>or ( \frac{\text{MPS + Net imports}}{\text{Income}} )</td>
</tr>
<tr>
<td></td>
<td>Propensity to save + Net imports</td>
</tr>
<tr>
<td></td>
<td>Capital coefficient</td>
</tr>
</tbody>
</table>
Illustration 11.1 Comparison of economic-base and Harrod-Domar regional growth models (continued)

Harrod-Domar Regional Growth Model

System:
\[ Y_t = C_t + I_t - M_t + X_t \]

Assumptions:
- Consumption: \[ C_t = f_c(Y) = cY_t \]
- Investment: \[ I_t = f_I(Y) = b(Y_t - Y_{t-1}) \]
- Imports: \[ M_t = f_m(Y) = mY_t \]
- Exports: \[ X_t = X_- \]

Solution:
\[ \frac{Y_t - Y_{t-1}}{Y_t} = \frac{(1 - c) + m - X_- / Y_t}{b} \]
\[ \frac{Y_t - Y_{t-1}}{Y_t} = \frac{s + m - X_- / Y_t}{b} \]

Growth rate = \[ \frac{\text{MPS} + \text{Imports}}{\text{Income}} \cdot \frac{\text{Exports}}{\text{Income}} \]

or
\[ \text{Growth rate} = \frac{\text{Propensity to save} + \text{Net imports}}{\text{Income}} \]

Harrod-Domar Regional Growth Model

An Alternative Approach

Drains from region:
\[ S_t + M_t = (1 - c)Y_t + mY_t \]

Savings + Imports
\[ s = \text{MPS} = \text{APS}, \quad c = \text{MPC} = \text{APC}, \quad 1 = s + c \]

Drains = \[ S_t + M_t = (1 - c)Y_t + mY_t \]
\[ = (1 - c + m)Y_t \]

Additions to region:
\[ I_t = b(Y_t - Y_{t-1}) \]
\[ E_t = E_- \]

Investments + Exports

Additions = \[ I_t + E_t = b(Y_t - Y_{t-1}) + E_- \]

Solution:
\[ S_t + M_t = I_t + E_t \]
\[ (I - c + M)Y_t = b(Y_t - Y_{t-1}) + E_- \]
\[ (I - c + m - b)Y_t = - bY_{t-1} + E_- \]
\[ Y_t = \frac{1}{1 - c + m - b} (E_- - bY_{t-1}) \]