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ASSET FIXITY, ASSET SPECIFICITY AND REGIONAL ECONOMIC CHANGE: HYPOTHESIS AND IMPLICATIONS

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Abstract - That asset specificity and asset fixity are impediments to economic adjustment is well understood in the literatures of industrial organization and agricultural economics. In this paper, we show that spatial factors can plausibly be expected to be arguments in functions that define asset fixity and specificity and, hence, asset fixity may be systematically related to space. The implications with regard to differences across space in rates of adjustment to market signals suggest that the short run is longer in remote than in less remote places, which may prove useful in explaining the behavior of a spatial economic system during times of rapid technological change.

I. Introduction

The concept of asset fixity as an impediment to economic adjustment has been well understood by agricultural economists for more than a generation (Galbraith and Black, 1938; Johnson, 1958; Edwards, 1959) and there are some scattered references to the concept in economic development literature (Schultz, 1964; Robinson, 1965; di Tella, 1982; Ward 1993). The related concept of asset specificity as a factor affecting transaction cost was introduced by Williamson (1979; 1989) in reworking the theory of industrial organization. In this paper, we propose to explore the relationship between asset fixity and asset specificity and expand both concepts by introducing space into the analysis.

II. Asset Fixity and Asset Specificity

The fundamental concept of asset fixity is central to our analysis, and so we must take some time to review that concept for readers who may not be familiar with it.

Johnson defines the firm's expansion path, contraction path, and asset fixity according to the following set of inequalities:

Expansion Path: V>A>S

Contraction Path: A>S>V

Asset Fixity: A>V>S

where: A = the acquisition cost of an asset,
(1)
V = the use value of the asset, and
(2)
S = the salvage value of the asset.
(3)

A, S, and V are to be interpreted as representing the "best" among a set of alternative sources (A) of assets, alternative resales (S) of assets, and alternative uses (V) of the assets inside the firm.

In the context of Johnson's analysis, firms expand when use value (V) is greater than acquisition cost (A) of assets; firms contract when salvage value (S) is greater than use value (V); and firms produce with existing assets so long as marginal revenue exceeds variable costs when there is asset fixity. Asset fixity, therefore, has been a way to explain why there is surplus agricultural production in times of falling product prices.

The concept of asset specificity, on the other hand, has to do with the ability to substitute assets in production (e.g., between use in producing widgets or gadgets). It arises from custom-designed assets intended for very specific use or uses. But asset specificity, too, can be used to explain why production might continue during a time of falling prices for the product that the assets are used to produce.

Thus asset fixity, as described by Johnson, and asset specificity, as described by Williamson, are not precisely the same thing. But they are closely related concepts. Both describe certain impediments to adjustment to changing market signals. Consider a case in which demand for textiles shifts from double knits to cotton broadcloth. A textile mill with fixed assets in the form of knitting machines may continue production of double knits in the short-to-intermediate run even as the price of double knit fabrics falls and that of broadcloth rises because: a) the double knit fabrics continue to command a positive price greater than variable costs, b) the knitting machines can not be used to make broadcloth, and c)there is a diminishing secondary market in which the knitting machines can be sold. Similarly, even as the real acquisition cost of labor falls relative to the real acquisition cost of new capital, labor may only slowly be substituted for capital because capital cost is sunk in the form of existing, specific assets with a limited secondary market. In times of transition, the relevant cost of the capital for a declining product will be the opportunity cost implied by the salvage value.

From this brief analysis, a simple taxonomy of fixity begins to emerge. The asset fixity defined by Johnson has to do with continuation of current production, abstracted from specific use. Hence we will refer to asset fixity as defined by Johnson as "General Fixity." Asset specificity may well be a subset of this General Fixity and refers to the difficulty of switching an asset from one use to another, either in the present location or in some other location.

III. Fixity and Space

In this section, we show that there is another subset of the General Fixity problem which we will define as spatial fixity. Production takes place at points in space. As the concepts of asset fixity and specificity were originally developed, however, space was not explicitly considered. Yet the introduction of space into the analysis creates some interesting new insights into the interactions between time and space in economic activities.

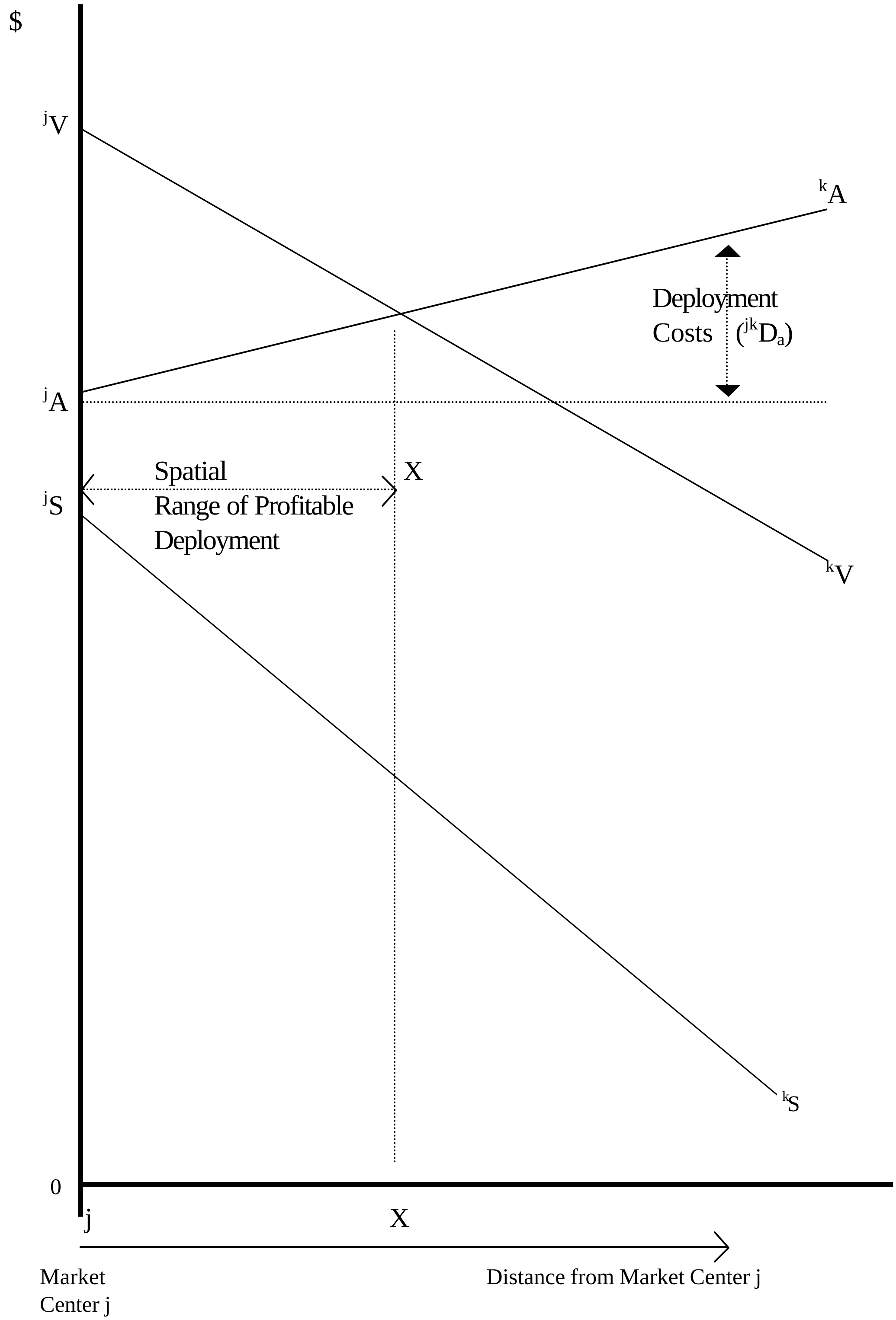
As a reference point, let us assume a simple Thunen plain. In order to simplify what would otherwise be very complex analysis, let us also assume that the single isolated city is both the center of consumption and of distribution on the plain. Thus it is the place where both the assets used in production and the output resulting from the use of those assets is traded. Having stipulated such assumptions, let us now return to the three values in equations 1-3 and examine how space might effect them.

Acquisition Cost: The firm-gate acquisition cost (${}^{k}A_{a}$) of an asset (a) at any given location (k) will be dependent upon its supply price (${}^{j}P_{a}$) and its deployment costs (${}^{jk}D_{a}$) -- i.e., those costs associated with moving it from the central city where the asset is produced (j) to the place (k) where it is installed and put into production.

The supply price of the fixed asset(${}^{j}P_{a}$) is, in the first instance, dependent upon the marginal costs of producing the asset itself (C_a). C_a, however, is dependent upon whatever scale economies (including external scale economies) may exist in producing the asset and the quantity of assets produced at j. There are also certain transaction costs associated with making a market for the asset and whatever markups the sellers can command over direct costs to be considered in determining ${}^{j}P_{a}$. But for our purposes here we will assume that ${}^{j}P_{a}$ is constant and represented by O^{j}A on Figure 1.

That assumption makes deployment cost (${}^{jk}D_{a}$) the chief variable of interest here in establishing acquisition cost to the point in space at which the fixed asset will be deployed. The extent to which distance between j and k determines deployment costs may be less

Figure 1. Expansion Path and Distance from Market Center - Basic Model



than in the past, and indeed, it may be of less importance today than weight, mass, and handling (e.g. loading/unloading) costs. Yet distance still must be a variable that cannot be ignored. For instance, installation of complex and sophisticated equipment at very distant and remote locations may require that specialized technicians be brought in from afar and reimbursed for travel and living expenses. Hence:

$$^{jk}D_a = f(^{jk}d,\ x_1,\ x_2,\ \ldots.,x_n) \qquad (4)$$

where: jkd = distance from j to k, and
x_1, x_2, ...,x_n = other unspecified variables.

Thus: $$^{k}A_a = {}^{j}P_a + {}^{jk}D_a \qquad (5)$$

and acquisition costs, shown as line $^{j}A^{k}A$, rise as distance increases between j and k. Although, for purposes of simplicity of presentation, a linear form for Equation 4 is assumed in Figure 1, the reasoning is not changed if a non-linear form is introduced.

Use Value: The use value ($^{k}V_a$) of a single asset in question is taken to mean the capitalized value of its marginal product when employed at k in the primary use for which it was intended at purchase, and as the capitalized value of producer’s surplus in the case of whole plants. Clearly the use value depends upon the production function in use at k and the “expected” (accounting for rational expectations) realized product price at k.

Using the Thunen model, we know that the expected realized product price (net of shipping costs) is affected by location and that, as distance increases from markets, the realized product price declines. Thus:

$$ {}^{k}G^{*} = f({}^{jk}d) \quad (6) $$

where: ${}^{k}G_{a}^{*}$ = the expected realized product price at k of the additional output achieved using asset a.

If we assume that markets are also geographically concentrated at j, then:

$$ {}^{k}V_{a} = f({}^{k}G^{*}) \quad (7) $$

And substituting Equation 6 into Equation 7, we get:

$$ {}^{k}V_{a} = f({}^{jk}d) \quad (8) $$

As per Thunen, the function is an inverse one. Hence, in Figure 1, use value is depicted as line ${}^{j}V{}^{k}V$. Again we assume a linear form for simplicity of presentation. The important point is that the use value of the asset (line ${}^{j}V{}^{k}V$) declines with distance, and the acquisition cost (line ${}^{j}A{}^{k}A$) rises with distance. Hence, at some point in space (X) more or less remote from j the two lines intersect, and the distance OX is the maximum radius around Thunen’s metropolis where the new asset will be acquired and installed.

Salvage Value: Salvage value (${}^{ki}S_a$) refers to the net proceeds from sale (or, in the case of intrafirm transfers to another use, the present value of its marginal product in another use) realized by the current owner of asset (a) when it is transferred from k to some other point (i) which need not necessarily be Thunen’s metropolis.

The demand price (${}_{\cdot}G_{\cdot}$) in the salvage market is driven by the present values of the marginal product from employing an asset in alternative uses (${}^{k}G^{\#}$) or at alternative places (${}^{i}G^{*}$) or, possibly both in a different use at a different place (${}^{i}G^{\#}$). This demand price, however, must be adjusted for any costs of transferring the asset to the alternative use (${}^{ki}T_a$). Thus, in the first instance, we might write:

$$ {}^{ki}S_a = {}_{\cdot}G_{\cdot} - {}^{ki}T_a $$
(9)

Since the value of ${}^{ki}T_a$ has an important effect upon the salvage value, some reflection upon the factors affecting the asset transfer cost is in order. These transfer costs will be affected by four primary factors: asset mobility (${}^{ki}M_a$), asset conversion cost (E_a), buyer uncertainty (B), and information and communications costs between k and I (${}^{ki}I$). Consequently:

$$^{ki}T_a = f\ (^{ki}M_a,\ E_a,\ B,\ ^{ki}I) \quad (10)$$

and we can rewrite equation 9 as follows:

$$^{ki}S_a = \cdot G \cdot - f(^{ki}M_a,\ E_a,\ B,\ ^{ki}I) \quad (11)$$

Both the first and last of these four factors have superscripts indicating that they are location-specific and hence affected by spatial considerations. Moreover, assuming the simple Thunen model, whatever is produced with the asset after it moves through the salvage market must eventually be traded in the metropolis at j, it is safe to assume that the demand price for an asset in the salvage market is adversely affected by distance from j in the same fashion, to a greater or lesser degree, as use-value of a new asset in its originally intended use. Thus, in general:

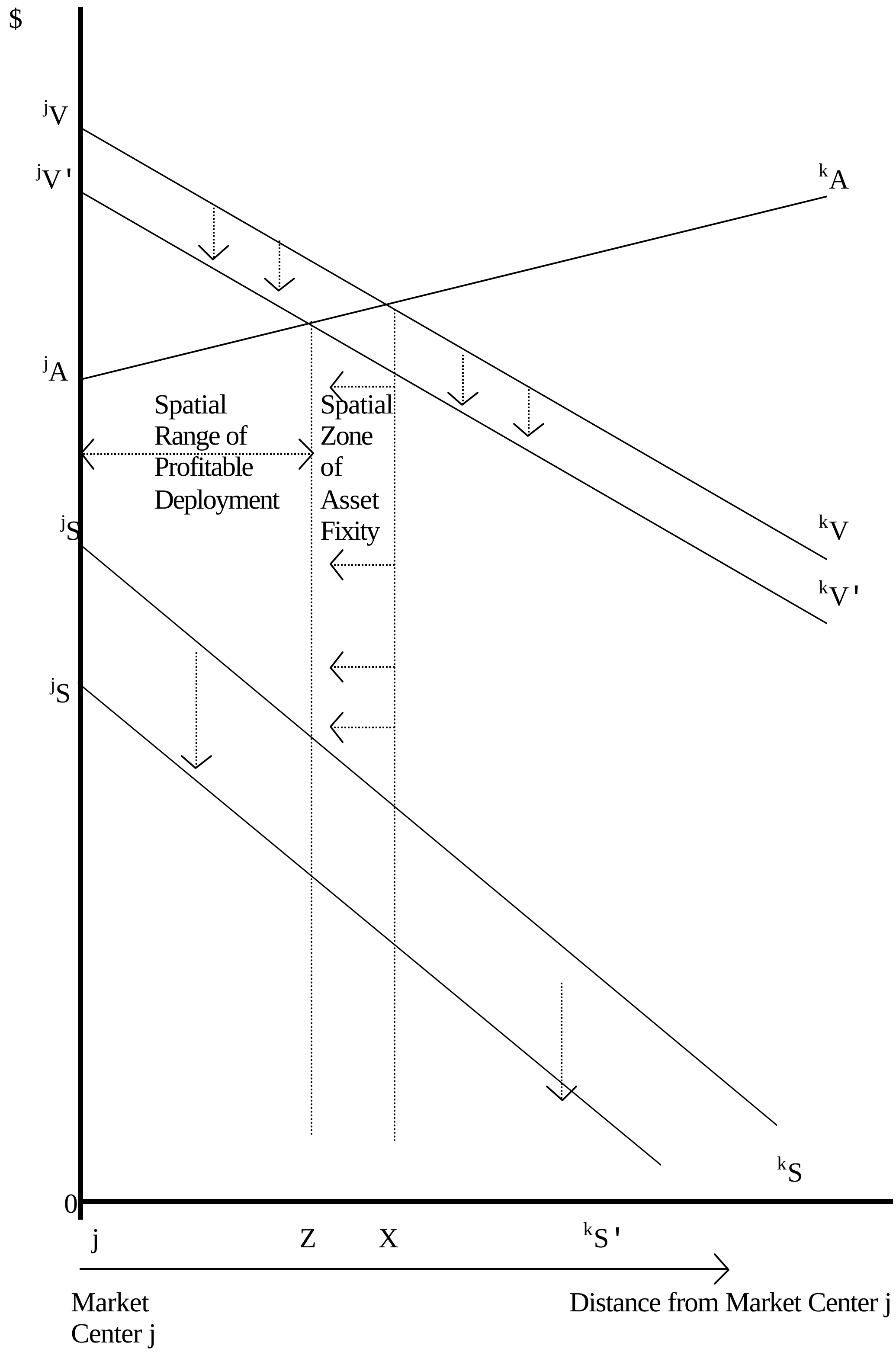
$$^{ki}S_a = f(^{kj}d) \quad (12)$$

Since the function described in equation 12 is an inverse one, we draw it as shown by line $^{j}S^{k}S$ in Figure 1. But we know nothing from theory about the relative slope of $^{j}S^{k}S$. It may be relatively flat compared to the $^{j}V^{k}V$ line, in which case at some remote distance, salvage value exceeds use value and contraction is occurring. But it is also possible that salvage valve is more adversely affected by distance than use value, in which case the slope of $^{j}S^{k}S$ is steeper than that of $^{j}V^{k}V$. There is no *a priori* reason to choose a flat salvage value curve over a steeper one, or *vice versa*. Either situation may, in reality, obtain.

But what are the implications with regard to spatial fixity? To see that space can cause asset fixity, let us now direct our attention to Figure 2. Assume that the initial situation involved acquisition costs as depicted by ${}^{j}A{}^{k}A$ and use value as depicted by ${}^{j}V{}^{k}V$. But let us further assume that there has been an unexpected decline in the price of the product that asset (a) is used to produce, and use value declines to the new line depicted as ${}^{j}V'{}^{k}V'$. Given the new lower use-value, it makes no economic sense to acquire the asset in question at any distance greater than OZ from Thunen's metropolis. But because in an earlier time it made sense to acquire to asset over a larger area with a radius of OX, those producers located in a band between Z and X meet Johnson's test of asset fixity -- i.e., use value is less than acquisition cost but greater than salvage value. Moreover, that condition is solely the result of spatial factors. Hence it is clear that asset fixity, at least potentially, has a spatial dimension.

Spatial fixity arises because of the cost of moving the assets used in production. Since some things are more portable than others, we can think of degrees of spatial fixity between zero and unity. Land has a spatial fixity of unity, buildings of, say, 0.90 to 0.99, and office equipment of, say, 0.01 to 0.5. But not only is the portability of an asset a factor, the distance which is must be moved to be redeployed is also a factor.

Figure 2. Asset Fixity and Distance from Market Center - Reduction in Value of Output and Onset of Asset Fixity



Use specificity can also be a factor. A hydropower plant has a spatial fixity of about unity as well as a similar use specificity, whereas a gas turbine generator which can be moved and substituted in non-electrical applications has much lower degree of both spatial fixity and use specificity. Iowa farmland has a spatial fixity of 1.0 but crop use specificity somewhat less than unity, since it can be used for producing other crops. Farmland in the urban fringe of the northeastern United States also has a spatial fixity of unity but a lower use specificity since it can be used for crops and there may be viable non-agricultural uses for residential subdivisions or commercial facilities. A mobile housing unit has a moderate spatial fixity degree and a moderate use specificity degree because it can be moved to another site where it can serve either residential purposes or perhaps be used as an office on a construction site. Of all the “capital” assets, working capital tends to have the lowest spatial fixity and use specificity, with “cash” having fixity and specificity coefficients approaching zero, while goods-in-process inventories typically show the greatest use specificity and spatial fixity among the elements of working capital -- factors which are related in the following section to financing implications over space.

IV. Implications

If asset fixity is systematically associated with space, there are major implications for regional economic development. Let us consider two of the most important.

Spatial Diffusion of Innovations: There is an extensive body of literature dealing with the spatial diffusion of innovations (Berry, 1972; Brown and Cox, 1971; Hagerstrand, 1967; Pred, 1977). The models, some borrowed from epidemiology, used in this literature generally are mechanisms geared to reflect the spread of knowledge about innovations and give only scant attention to the underlying economics. Yet the results of empirical study of the spatial diffusion of innovation show that innovations diffuse outward from urban centers toward remote places. The existence of spatial fixity can provide an alternative explanation for observed patterns of spatial diffusion of innovation.

Consider the implications of such fixity for risks in financing investment. Salvage value affects the collateral value of assets used to secure loans for financing fixed asset acquisition. In principle, debt/equity ratios for asset purchase should reflect the dynamic nature of salvage value over both time (i.e., the decay rate, or depreciation, of the salvage value over time) and space (i.e., the transfer cost of deploying an asset from its present to a new location). Rational lending policy relates loan principal and repayment schedules so that:

$$ {}^{k}S_{at} > N_{at} \tag{13} $$

where: ${}^{k}S_{at}$ = the salvage value of asset (a) at time t,and

N_{at} = the principal outstanding at time t.

Consistent with the analysis above, salvage value is adversely affected by remoteness and by the specificity of the asset. Hence, the more remote k, the place of the initial and primary use of the asset, the less its collateral value. Since acquisition costs also rise with remoteness, an asset placed in service at a remote location would presumably require a larger down payment from equity than one placed in service at a less remote site. Thus, one impediment to adoption of new innovation in remote places is the difficulty of obtaining debt financing. The more remote a place, other things constant, the more difficult financing the asset acquisition that may be required to adopt a new innovation, and the slower the rate of adoption.

Income Convergence/Divergence: Innovation, of course, is fundamental to economic development (Flammang, 1979; 1980). When Schumpeterian innovation unsettles markets and creates new economic equilibria, the adjustments required by economic actors are not marginal, but structural. Spatial fixity and use specificity are significant impediments to such adjustment and may be factors in the process of interregional income convergence/divergence.

Neoclassical theory suggests that real per capita incomes across an open economy should tend toward convergence (Borts and Stein, 1964). Taking a long view, there is empirical evidence that supports the theory (Barro and Sala-i-Martin, 1991; Cashin, 1995). But periods of divergence have occurred, most recently in the mid-to-late 1970s and throughout the 1980s in the United States and Australia. This divergence has given birth to a small cottage industry trying to figure out what is happening (Amos, 1986; 1989; 1990;; Caughlin and Maudelbaum, 1988; Garnick, 1990; Maxwell and Hite, 1992; Ray and Rittenore, 1987; Rowley, Redman and Angle, 1991).

The theory of convergence requires either factor mobility or factor price equalization across space. But if factors are fixed longer in some parts of space than in others, as the hypothesis presented here suggests, one or both of these requirements is threatened. In effect, the spatial fixity hypothesis suggests that the short run (the period over which at least some factors are fixed) is longer in remote than in less remote places. Hence, during a time of major Schumpeterian innovation, remote regions can be expected to suffer relative declines in real per capita income compared to less remote places able to make adjustments more quickly.

That divergence might be associated with stages of long economic waves has been suggested by Amos (1988). Amos, however, suggests a connection with the latter stages of a wave. The spatial fixity hypothesis offered here suggests that it is rather more likely to be associated with the early stages of a new wave set off by a major Schumpeterian innovation. Given the innovations associated with new computer and telecommunications technology that began in the 1970s, spatial fixity may well offer one, or possibly several, explanations for this most recent period of divergence.

Rowley, Redman and Angle (1992), Barff and Knight (1988), and Lampe (1988) found that the divergence in the United States is explained primarily by east and west coast states where per capita income grew very rapidly. Maxwell and Hite (1992) observed much the same pattern in Australia. If the two coasts of the United States are taken as the less remote parts of the country, those findings are generally consistent with the spatial fixity hypothesis. But further careful analysis is needed before reaching any firm conclusions.

V. Conclusions

We want to be very careful in offering strong conclusions from this analysis. Yet, at least within the context of the simple Thunen model, we should expect that the more remote a place, the greater the problems arising from both use specificity and spatial fixity.

We are cautious, however, because the simple Thunen model requires some very unrealistic assumptions about the spatial concentration of consumption and distribution at a single point across all economic sectors. The loci of the markets for producers’ assets are not always the loci of markets for consumer goods, and the loci of the markets for some producer assets are the same as the loci for other producer assets. Spatial fixity, as an empirical phenomenon can be expected to be dampened in a polycentric spatial economy.

Empirical tests of the asset fixity/specificity hypothesis requires some definition for remoteness, and that is not a conceptually easy undertaking. But there is some empirical evidence from the innovation diffusion and income divergence/convergence literature that seem consistent with both the asset fixity/specificity hypothesis and the ordinary understanding that remoteness in the modern world has to do with distance from such world cities as Los Angeles, London, New York and Tokyo.

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