Neo-thunian Analysis - A tool for spatial understanding

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"Progress in science is often brought about after a growing awareness of discrepancies between observed facts and the possibilities of explaining them on the basis of existing theories has led to *a new way of looking at these 'facts'* or even to the introduction of a new paradigm."

(E. von Boventer, Papers, Regional Science Assn., Vol. 42, 1979).

INTRODUCTION

The mark of a good theory is its application to a wider spectrum of problems than to smaller particularities — wider literally in its spatial applications and wider in terms of the time dimension. One important criterion of the utility of a theory or hypothesis is its use by scholars many years after it was first articulated. Theories in Sociology and Economics easily spring to mind. In Geography, similarly, recent years have witnessed a thrust into the theoretic with the exhumation or revitalising of certain pivotal contributions to space understanding. In the human aspects of geography certainly the most used theories are the location theories of Alfred Weber (1909), Johann H. von Thünen (1826) and Walter Christaller (1933). With the swing after 1964 in the halls of geographic academia from the study of the unique to the search for the general, geographers, quite rightly, are striving to create concepts which apply widely in space concepts which can give insights into the humanised structure of the earth at the macro-level.

Geographers were late on the scene in terms of the application of theoretical thinking to their studies. The pre-occupation with the unique went on for hundreds of years. But then, some would argue, this was necessary simply because the mere gathering of the facts of the real world is a long and tedious affair and it is a part of the geographic job which

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must be done before any attempt is made to see order and system. Those opposed to this view would insist that a mere gazetteer approach to geography is futile and intellectually pointless unless one is armed with a theory around which the facts naturally fall into place. Better late than never, for a theory without a fact is like a ship without a rudder and a fact without a theory is like a chinese painting which is simply pendant. The truth is, the reality of human behaviour is too complex to be studied in place. The becomes, therefore, more urgent for organising concepts which can help in the understanding of artificial macro-space. To be sure, geography has not lost its interest, even its consuming passion, in the real world. Geographers are still deeply interested in the study of "the earth as the home of man." But the search has deepened for laws, principles, guidelines. One should, in truth, say that the search has been *revived* because even in the middle of the last century path-breakers like Humboldt and Ritter were looking, even if implicitly, for nature to reveal her order. It is probably true that scholars, not only geographers, carry as a touchstone of belief, the hunch that 'behind it all' there is some reason, some rational explanations for things terrestrial. Sure a good many phenomena must be randomly arranged. But what about those patterns which recur again and again in vastly different parts of the earth? What about those patterns which even from the most casual of observations could never have taken form just 'by chance'?

One of the thrusts towards a more theoretical geography, of course came before the 1960s in the form of macro-geography which was pioneered by a small core of scholars including William Warntz. To Warntz, "Macroanalysis is aimed at a more meaningful level of abstraction so as to make possible the understanding of the whole economic system and to provide a conceptual framework into which to put the micro-descriptions"[1]. One wonders why Warntz did not say "the whole economic *and spatial* system." Warntz continues in this train elsewhere taking to task the many geographers who insist that no laws of geography are possible. Looking at the larger entity of spatial life, Warntz insists that "aggregate behaviour viewed macroscopically is determined and generalisations about it can be made, once the proper dimensions are isolated and recognized"[2]. Maybe there is far more than a grain of truth in the dictum that 'it is better to think like a geographer than to know a lot about geography.' Indeed, one may well take sides with Wayne Davies who avers that "The major scientific advances in knowledge are made, not by more precise observations, but by the development of *new ways of looking at old things*"[3].

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[1] W. Warntz, "Contributions towards a macro-economic Geography," *Geographical Review*, 57, 3 (Jul. 1967): 421-422.
[2] Ibid. "Geography at mid-twentieth century," *World Politics* 11, no. 1 (April 1969): 442-454.
[3] W.K. Davies (Ed.) *The Conceptual Revolution in Geography* (London: Univ. of London Press, 1972),

(my emphasis). In fact, as Michael Chisholm puts it, "Geography is not distinguished from other subjects by the *class* of phenomena studied or by the methods of analysis employed. It is distinguished by the class of problems that is examined — namely the identification and description and measurement of processes operating in a spatial context"[4].

A plea for the macro-view of the world of human and economic geography is *not* a denial of the unique. But uniqueness does not preclude similarity because from similarities 'relationships can be elicited to provide the basis for scientific generalisations.' Indeed, to a certain extent, one may even be on the side of the old descriptive school of 'unique geography'. Who can deny that statements about the general can only come after the real world has been thoroughly studied and after certain patterns repeat themselves over and over in a wide range of areas? It is probably true that what is required more than geography is the correct *mental* approach. Ernst Nagel pleads with scholars to "continue the search for laws as a belief that laws cannot be found will certainly ensure that they never are discovered — *even if they actually exist*"[5]. Wayne Davies is thus absolutely correct when he urges geographers always to keep concepts ever in view. "Conceptualisation" he asserts, "is the means by which knowledge is more easily codified. Without a body of concepts to act as a checklist of current problems, the geographic viewpoint can easily degenerate into an encyclopaedic list of facts and regularities"[6]. Indeed, it does not even seem as if geographers have a choice. "Without theory we cannot hope for controlled, consistent and rational explanation of events. Without theory we can scarcely claim to know our own identity. Theory constructed on a broad and imaginative scale must be our first priority"[7].

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Walter Isard, himself the douen of modern regional scientists and the scholar who has done by far the most to advance the concept of the 'aggregate space economy' reserves for von Thünen a place at the top of the hierarchy of location theorists. To him, "Thünen, who was far in advance of his time, laid the basic methodology in analysis of specific as well as general locational problems"[8]. Indeed, Peter Haggett reminds us that the value of Thünen's analysis lies *not in its absolute findings* so much as in its *illustrations of the kinds of locational problems*"[9]. That

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[4] M. Chisholm, *Research in Human Geography* (London: Heinemann, 1971).
[5] Re-quoted from L. Guelke, "Problems of Scientific Explanation in Geography", *Canadian Geographer*, 15 (1971), 38-53.
[6] W.K. Davies, op. cit.
[7] D. Harvey, *Explanation in Geography* (London: Arnold, 1969).
[8] W. Isard, *Location and the Space Economy* (Cambridge, Mass. 1956).
[9] P. Haggett, *Location analysis in Human Geog.* (London: Arnold, 1965).

is, if one stays with an appreciation of the Thünian theory at the level of the small isolated state, useful as that may be, then the whole purpose of the theory would be lost and the place of Thünen at the top of the hierarchy as the pan-locationist would not be appreciated. How often Thünen himself was at pains to plead with readers not to reject him simply because his conditions do not conform to reality. His purpose was to illustrate the workings of certain key forces, the reflections of which are to be seen in the landscape, whether vaguely or with some close semblance to the theoretical model *. Michael Chisholm, the scholar most synonymous with the theory of von Thünen through his seminal work *Rural Settlement and land use* (1962) almost in a plea for neo-thünianism, quite categorically states that "the ideas developed and expounded by von Thünen do not constitute a theory of location. They amount to a method of analysis which *may be applied to any situation in any time or place*... the methods developed by von Thünen are still applicable and allow considerable extension..." (my emphasis) [10] It is about time that scholars make some advance on the simplistic *Isolierte Staat* for the greatest dis-service that can be done to such an all-embracing vision of the forces at work on the surface of the earth would be to remain apron-stringed to the original conditions, the original findings and the original diagrams which are repeated *ad nauseam* in our university level textbooks. Walter Isard wrote "The seeds for developing the basic methodology in analysis of specific as well as general locational problems can be found in von Thünen's work [11]. If, then, as Isard says, the *seeds* even for 'general locational problems' were laid over one hundred and fifty-five years ago, how is it that very little attempt has been made by scholars to broaden the scope and applicability to the understanding of the macro-patterns on the face of the earth?

How many have seen the Thünen model in terms of a system in which interlocking devices strengthen each other and force a system in the same direction? Richard Peet is therefore right when he implores us to see that "The advantages of using a von Thünen model to interpret the fairly well-known changes in settlement and agricultural geography... is that it allows a *logically-connected system of forces to* be advanced as the economic structure underlying the events portrayed" [12]. (my emphasis). The von Thünen model, Peet continues, "does provide the necessary general connecting mechanism between the causal factor of the Industrial Revo-

lution in Western Europe and the consequential invasion of the great continental interiors by commercial farmers" [13]. Peet is specific here. His idea of a 'Thünen World City' is, of course, a far cry from the *state* of Thünen's original model which was a few miles in diameter.

David Harvey concurs. He writes, "The von Thünen model, containing, as it does explicit notions of behaviour at the margin... has some applicability to the advance and movement of frontiers of agricultural activity in newly-developing countries. There is a broad analogy between the idea of the frontier of settlement sweeping across a country and a dynamic von Thünen model where, for example, the seaboard region is regarded as the central market. In countries such as Argentina, Brazil, Australia and the United States in the nineteenth century, a dynamic von Thünen model may be an appropriate generalisation for a very complicated process of settlement expansion" [14].

Otherwise put, there is a good case for using the original theory to explain broad sweeps of movements even on a continental scale. This attempet to carve out a neo-Thünian ideology even of history would find favour with other modern exponents of old theories. David M. Smith some years ago in a defence of Alfred Weber's theory warned against 'throwing out the baby with the bathwater' [15]. This is exactly the line we are taking in this paper. While it is true that we must lock away some of the 19th century artifacts in museum showcases, 20th century arrogance must be tempered so that in the exhumation process we discard what must be discarded and use what is everlasting.

How interesting it is to see trans-oceanic colonialism, the expansion of the colonial ecumene, the agriculturisation of the peripheries, the economic upliftment of dependent space and a whole host of 'well-known' facts in a Thünian guise! Who would have thought that one can explain growth poles or diminishing returns in Thünian terms? Not far-fetched, but one can even explain peripheral urbanisation à la von Thünen. Rural-urban migration patterns, the abandonment of the countryside, rationalisation of sugar factories and a host of other questions can be 'resolved' with Thünian analysis, not to mention the untapped field of spatial engineering. West Indian economic geography students are now getting new excitement from Thünian interpretations of the age-old history of West Indian colonisation, West Indian export agriculture, the waxing and waning of West Indian crops, the building of railways, urbanisation and many other phenomena [16].

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* The original model of von Thünen is not explained in this paper as it is assumed that readers will all be familiar with the broad framework. Any university-level text on economic geography would give the basics and only the basics.

[10] M. Chisholm, "The relevance of von Thünen," *Annals. Amer. Assn. of Geogrs.* 58, 4 (Dec. 1968): 401.

[11] W. Isard, op. cit.

[12] J.R. Peet, "The Spatial Expansion of Commercial agriculture in the 19th Century: a von Thünen interpretation," *Economic Geography* 45, No. 4 (October 1969): 283-301.

[13] Ibid. p. 301.

[14] D. Harvey, Review Article: "Theoretical concepts and the analysis of agricultural land-use patterns in Geography," *Annals, Assoc. of Amer. Geogrs.* 56, no. 2 (June 1966): 361-374.

[15] D.M. Smith, "On throwing out Weber with the bathwater: a note on industrial location and linkage," *Area* 1 (March 1970): 15-18.

[16] V.C. Mulchansingh, "A Thünian overview of the macro land use patterns of Trinidad, West Indies", *Nigerian Geog. Journal* 18, no. 2 (June 1975): 135-156.

That prophet of neo-thünianism, John Schlebecker put the focus quite simply. "Human events take place in time and space..." he wrote. "All who live within a certain given zone around the metropolis have at least one common experience: they are all some specified distance from the metropolis... What farmers grow and where they grow it is determined by the economic distance of the farm from the metropolis... For several centuries political thinkers have been telling mankind that this is one world... and so it is. So much so that a world metropolis can be identified. *Von Thünen's isolated state is the world.* Regardless of its size, every metropolis has been ringed by zones of agricultural specialisation... In the nineteenth century the American seaboard joined this metropolis (S.E. England/Netherlands/N. France/Hansa) to form an Atlantic or world metropolis. London and New York formed the axis of this metropolis. Around this world metropolis spread the isolated world of ours with its sub-metropoles and zones of agricultural activity"[17]. Schlebecker continues in his Thünian statements: "Railroads mostly encouraged an expansion of the wheat and grazing belts. The increase in the size of the outer zones had a profound influence on the metropoles. By steamship and rail American food was sped to the metropoles where prices were driven down and European peasants were ruined. They were forced to migrate. Many went to the metropole, European or American, where they swelled the labour force, and indirectly speeded industrialisation... Many were deposited on Western soil where they increased the flow of food to Western Europe, ruined more peasants, and accelerated the whole process. One result was a series of worldwide agricultural depressions, made even more severe by technological advances which reduced the cost of producing food and increased the total amount of food at the same time"[18].

The simplicity of the Thünian mechanisms can be summoned to explain better and thus in a more lasting way all the processes of the famed 'Atlantic economy'[19].

How apt, therefore, is Peter Haggett's observation that all spatial macro-patterns bear relations to common nodalism. He writes, "We can see the familiar theme of centre and periphery, accessibility and remoteness running through human spatial organisation all the way from the small farmsteads right up to the world level. Different geographers in different periods have chosen to emphasise one part of the sequence. But the study of land values in a city, workloads on a farm, land use competition in Thünen's isolated state or the world core and the Third World are each part of a common theme of nodal organisation"[20]

[17] J.T. Schlebecker, "The world Metropolis and the history of American Agriculture", *Jour. of Economic History* 20, no. 2 (June 1960): 187-208).
[18] Ibid., p. 202.
[19] B. Thomas, *Migration and Urban Development* (London: Methuen 1972) especially Chapter 4 'The Atlantic Economy: The Process of Interaction'.
[20] P. Haggett, *Geography — a modern Synthesis* (New York: Harper and Row, 1972), p. 274.

Richard Peet, likewise, in another paper, is surprised that although "the von Thünen model and the centre-periphery model obviously refer to the same geographical forces, the two remain surprisingly distinct in the minds location theorists"[21]. Peet went on to offer a hint to scholars and teachers. "Simple modifications... make it (the model) applicable to the explanations of zones of resource exploitation of all types around demand cores." It is the task of the neo-geographer to consider thoroughly what Peet means by speaking of 'geographical forces', 'simple modifications', 'resource exploitation', and 'demand cores'. It is the task of this writer to offer some suggestions. But at this stage one could start by asking the Human geographer to search for Thünian explanations for the following problems. For each of the conditions posed readers must attempt to show with *graphs* and *head-on* diagrams what the statements mean. Show and shew, therefore, the following:

(1) The effects of differential pole growth on the Thünian landscape.
(2) How distant producers may compete with close-by producers for a given market.
(3) The effects of tapering rates as opposed to linear rates on land use or ecumene in-filling.
(4) The effects of subsidies to marginal, pene-marginal or extra-marginal producers.
(5) The effects of punitive taxation on producers nearer a given market than those further out in the periphery.
(6) The effects of pole-multiplication on ecumene development.
(7) The folly and disadvantage to the consumer when the principle of spatial comparative advantage is not adhered to.
(8) Why the West Indian cocoa industry, once flourishing economically and spatially, was all but destroyed with the onslaught of competition from West Africa.
(9) Why in an era of primitive transportation sugar factories proliferate (e.g. 330 factories in Trinidad in 1830 while in a modern era four or five do the same or better job).
(10) Why some sugar factories remain small or even decay while others grow larger and larger.
(11) The effects on the landscape of a legislative decision to subsidise diesel fuel or the customer cost of trucks transporting agricultural produce.
(12) The cost effects and spatial effects of diminishing returns at the pene-margin of production.
(13) The effect of protection given a local producer for a good as compared with a foreign lower cost producer who is however subjected to punitive tariff.

[21] J. R. Peet "Influences of the British Market on agriculture and related economic development in Europe before 1860", *Trans. Inst. of Brit. Geogrs.* (April, 1972).

(14) The spatial and social effects of a legislative decision to pay to peripheral producers a bonus above that of the market price.

Those few puzzles given above were intended only to stimulate the reader. They were intended merely to open the eyes of the reader to the tremendous possibilities of using a thünian framework to discuss a wide range of academic and planning questions. But more anon.

SOME COMPLICATIONS — SINGLE PRODUCT ASSUMED

What kinds of relationships may one deduce from certain inputs in the thünian scheme? Consider Figure 1. The price in the market for a given unit of a given product, agricultural or otherwise, is $90.00 while the cost of production for all producers is $10.00. The transport *rate* for every producer is $2.00 per unit load per mile. The producer at M, for all practical purposes has no transport cost and thus his profit or locational rent is $80.00. The producer at d has to pay $80.00 in transport *cost* so that he is at the margin. a's rent is $60.00, b's is $40.00 and so on. The line Xd has two meanings:

(a) It is the *rent decline line* so that reading vertically from the location of any producer one can tell the rent or profit or net take accruing to each producer.

(b) It is also the *Transport curve of the LAST PRODUCER*. Its slope indicates transport rate. Thus in the diagram the rate of transport is $\dfrac{XM}{Md}$. But, that aside, the steeper the slope of that line the higher the rate of transport. If we assume that all producers have the same rate of transport, then for each producer we simply draw in lines parallel to Xd to show the individual transport curves.

The area under economic production for the good in question is therefore $\pi \,(Md)^2$ at that point in time. What is patently clear is that distance confers disadvantages on places and producers in the periphery. Polarity exists. Producers between M and a, for example have more profits *per acre,* can plough back more in capital equipment, can acquire more of the appurtenances of modern living, in short can be far more affluent than say producers between c and d.

Figure 1, let us repeat is a snapshot of a condition at a given time. The facts as they are may be static for a given period of time. Conditions *will* change, positively or negatively. But change there will be.

Factors may change one at a time or they may all change together. If they change together they may all be positive changes or they may be a mix of positive and negative changes, in which case the system may in the end remain the same despite the ferment. For simplicity, however, let us start assuming singular changes.
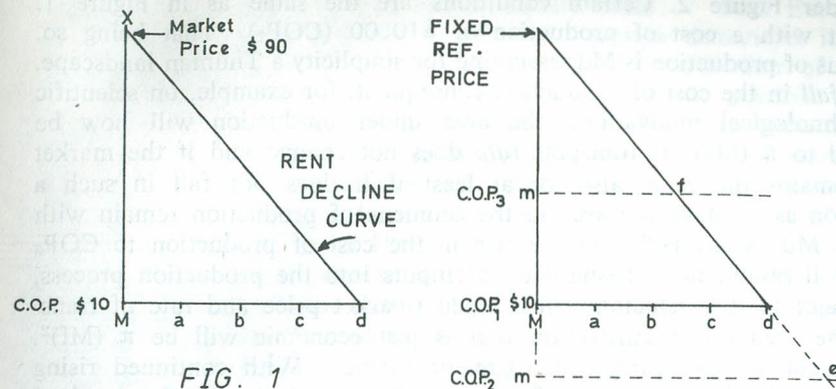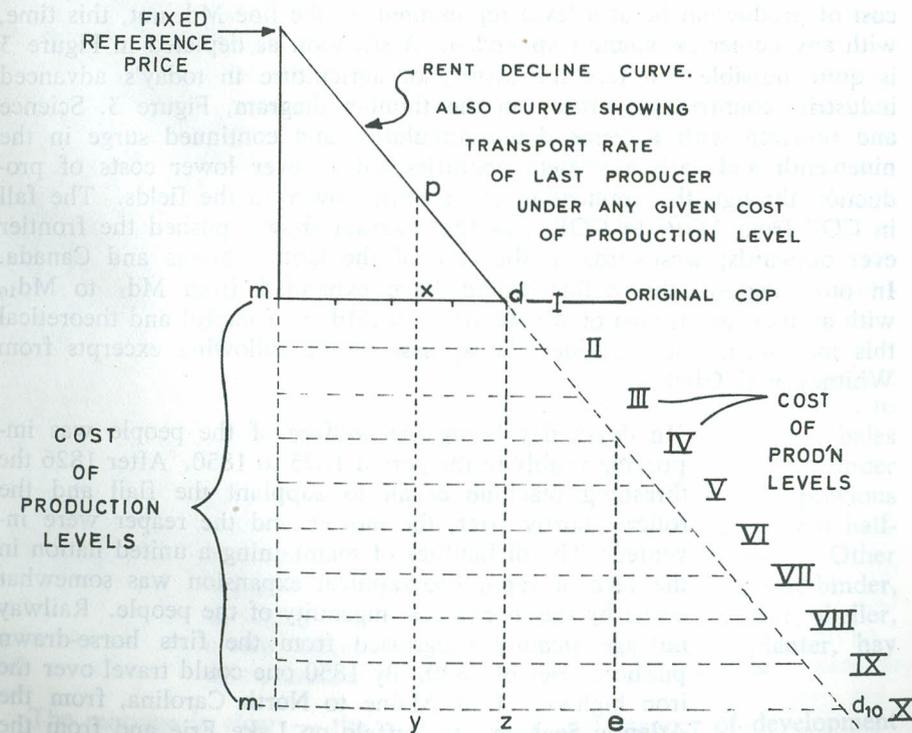

FIG. 1

FIG. 2

FIG. 3

Consider Figure 2. Certain conditions are the same as in Figure 1. We start with a cost of production of $10.00 (COP$_1$). That being so, the radius of production is Md, assuming for simplicity a Thünian landscape. With a *fall* in the cost of production consequent, for example, on scientific and technological innovations, the area under production will now be extended to π (Me)^2 if transport *rate* does not change and if the market price remains the same also, or at least if it does not fall in such a proportion as to make the area in the ecumene of production remain with a radius Md. Conversely, with a rise in the cost of production to COP$_3$ due to soil failure or to rising costs of inputs into the production process, other major factors remaining unchanged (market price and rate of transport), the area under cultivation that is just economic will be π (Mf)^2. One, of course, can carry the argument further. With continued rising costs of production, *ceteris paribus*, the COP could rise to the level of X, the market price so that the end effect is that no production of the good in question, agricultural or mineral, will be effected. The reverse also holds. Keep market price steady and transport rate unchanging. Let cost of production be at a level represented by the line Md, not, this time, with any numerical amount appended. A situation as depicted in Figure 3 is quite possible. In fact the history of agriculture in today's advanced industrial countries is written in the thünian diagram, Figure 3. Science and research with a tremendous, cumulative and continued surge in the nineteenth and early twentieth centuries led to ever lower costs of production through the application of machine power to the fields. The fall in COP from COP$_1$ to COP$_{10}$, as the diagram shows, pushed the frontier ever outwards, westwards in the case of the United States and Canada. In our diagram, the radius would have expanded from Md$_1$ to Md$_{10}$ with an increase in area of π (Md$_{10}$)^2 — π (Md$_1$)^2. Fanciful and theoretical this may seem. But consider the aptness of the following excerpts from Whitney and Glick:

"In day-to-day living the welfare of the people was improving visibly in the period 1825 to 1850. After 1826 the threshing machine began to supplant the flail and the roller; shortly after, the mower and the reaper were invented. The difficulties of maintaining a united nation in the face of rapid geographical expansion was somewhat eased by the mechanical ingenuity of the people. Railway mileage steadily progressed from the firts horse-drawn public carrier of 1830. By 1850 one could travel over the iron highways from Maine to North Carolina, from the Atlantic Seaboard to Buffalo on Lake Erie and from the Western end of Lake Erie to Chicago or Cincinnatti. In 1812 the population of the U.S.A. was 7.25 million. In 1852 it was 23.0 million. The land available for settlement during these years grew from 1.7 million square miles to 3.00 million square miles... Both Europe and the older settled parts of America demanded its (midwest) wheat and meat. Rapid introduction of labour-saving devices, at the same time, made possible an unexampled increase in production. The most important new devices were the McCormick reapers. Five hundred were in use in 1848 and 100,000 in 1860. The wheat crops increased from 100 million bushels in 1850 to 173 million bushels in 1860. An important stimulus to western prosperity was the great improvement in transportation facilities for from 1850 to 1857 the Appalachian Mountains barrier was pierced by five railway trunk lines. These iron bonds uniting the north and the west gave rise to mutually profitable trade. ...the frontier had vanished... Great factories and steel mills, transcontinental railroad lines, flourishing cities, vast agricultural holdings marked the land... The 36,000 patents granted before 1860 were but a pale forerunner of the flood of inventions to follow. From 1860 to 1890 some 444,000 patents were issued and from 1900 to 1925 this number reached to 1,000,000. ...the Homestead Act of 1862 granted free farms of 160 acres to citizens who would occupy and improve the land. By 1880 some 56,000,000 acres had been passed into private hands... ...agriculture was undergoing a revolution. This involved a shift from husbandry to machine farming and from subsistence to commercial farming. In the fifty years from 1860 to 1910 the number of farms in the U.S. trebled from 2.0 million to 6.0 million. The area doubled from 400 million acres to 880 million acres. Wheat production rose from 173 million bushels to 635 million bushels, corn from 838 million bushels to 2,886 million bushels and cotton from 3.8 million bales to 11.7 million bales. More land was brought under cultivation in the years 1860-1890 than in all previous history in the U.S. The farmer in 1800 could cut half-an-acre a day. In 1840 he could cut 6 acres... Other inventions coming in rapid succession were the wire binder, threshing machine, corn planters, cutters, husker, sheller, cream separator, manure spreader, potato planter, hay drier, incubator and hundreds of others..."[22]

The message is clear — the use in a sustained manner of development technologies had the very important effect, over many decades, of pushing back the frontier of the American *raum*. If that alone were the end

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[22] F. Whitney and N. Glick, *An Outline of American History* (1970).

effects that would be spectacular enough. We have not, of course, built in the effects of price rise. Even without it, notice in the diagram, (Fig. 3) how economic wealth (net) has grown. x's location rent has increased from px to py, D's from nil to dz and even producer e now gets in net profit what in earlier times the best located producer at the market M derived.

In all this, however, the phenomenon of polarity and the disadvantage of distance from the centre remains always to the fore. Must places further away from the centre always suffer simply from being far from the reference point? What do we as geographers have to say about this? In a general way, Brian Berry gives the answer by asserting that "As professional geographers we share in a common task, that of creating future geographies... for to be self-respecting professionals deserving the respect of others we must help shape processes of anticipatory evolution that will form the future environments in which we live and work..." [23] About thirty years ago, also, August Lösch hinted at the corrective role of geography or space science when he insisted that the role of theory was a normative one. He wrote, "The real duty of the economist is not to explain our sorry reality, but to improve it. The question of the best location is far more dignified than determination of the actual one" [24]. Likewise, Abler, Gould and Adams call for a more relevant geography. Geographers are space (terrestrial) scientists. "We call upon scientists to perform diagnoses, to prescribe remedies, and to provide us with the means of avoiding problems which we think might arise in the future. Scientists have been rather successful in performing these tasks for the societies which support them... *Geographers are expected to rectify existing spatial incongruities and to take preventive action against possible spatial incompatibility in the future* [25]. (my emphasis.)

So what does all the last paragraph have to do with a neothünian view of space? Quite a lot, in fact. Still on the question of the role and importance of the cost of production (COP) on net profit, economic rent, locational rent, net welfare — call it what we will — how can we engineer this factor in a prescriptive way? Let us revert, for a start, to Figure 2 in a situation where original cost of production is COP_1. Assuming equal fertility of land and the usual *ceteris paribus*, the major reason why a producer at c is worse off than a producer at M is the fact that c is further away from the market.

How, therefore, can one engineer the system so that disparities can, at least be lessened? Consider Figure 4. In Fig. 4a the situation is

[23] B.J.L. Berry, "Creating Future Geographies", *Annals, Assn. of Amer. Geogrs.* 70, 4 (December 1980): 449-548.
[24] A. Lösrh, *The Economics of Location* (English Edition, New Haven: Yale Univ. Press, 1954).
[25] R. Abler et al, *Spatial Organisation: The Geographer's view of the world*, (New Jersey: Prentice-Hall, 1971).

one in which rent disparities over the radius of operations Md become progressively worse away from the centre. One may think of a kind of spatial engineering not unlike income tax engineering. In income tax, those receiving higher salaries pay more tax than those receiving low wages. The policy is couched in terms of taking from those who can most afford and sharing with those who most need. As per Fig. 4b, one may decide that since those between M and a are best off and since those producers between c and d are worst off then, for a start, those are the two 'groups' of producers to which attention could be directed. So, the cost of production for the farmers between c and d could be lowered to a new artificial level we can call $ArCOP_1$. In this way c's net rent would be increased from ec to en and d with no previous rent would receive rent do. Similarly, one might decide that producers in the region Ma are doing far too well in their endeavours and that à la Robin Hood, a tax should be effected. Whatever it is called, a tax equivalent to Mh effected over the space Ma radius would have the effect of lowering every producer's net take in the region. Thus instead of a rent of af, producer a now gets rent fg. Instead of a rent of MX, producer M now gets rent Xh.

In point of fact, the socio/spatial engineering can be neater and more equitable if another approach is taken. Consider Fig. 4c. The starting point is one in which M at the market has a rent of XM and the last man gaining any rent is at a distance Md. This is the typical punishment people get for being further and further away from centres. The system could be so engineered by constructing line ho in the Figure so that in typical 'socialist' fashion and in amounts that are directly related to ability and needs, the most 'tax' is taken from those who can best afford it and the most given to those who mast need it. Thus M's rent is reduced from XM to Xh and a's from af to fg. b's rent remains unchanged. But c's goes from ce to en and d's from just about nil to do.

We may now consider another of the simple dynamic elements which lends logic to the Thünian scheme. Consider the question of higher demand. Styles may change, the population may rise, there may be an influx of population, urbanism may take a spurt, urban industrialisation may suddenly have a boom and a host of other factors acting separately or in concert may produce a situation in which short run and even long run demand cause a price rise. In Figure 5 the starting situation is one in which the market price for a good is $90 per unit weight and the transport rate per unit of product $2.25 per ton-mile. Other costs are held constant. It is obvious that the last producer who can produce for the market M will be located at d and the ecumene of production, the agland, will be described by an area πMd^2. Figure 5b indicates the repercussions of a demand and price rise. The price at the market now for the same unit of good is $135. The rate of transport and the other factors remaining unchanged, it is easy to see that the last producer who is able to produce for the market and just make a profit will be at f,

FIG. 4a

ORIGINAL RENT
DECLINE CURVE

M   a   b   c   d

FIG. 4b

ArCOP

RENT TAKEN
FROM
PRODUCERS
IN AREA
M to a

ORIGINAL RENT
DECLINE CURVE

COP₁

Ar COP

RENT ADDED
FOR PRODUCERS
OVER AREA c—d

FIG. 4c

NEW RENT LINE
From m to d

RENT TAKEN
FROM
PRODUCERS
IN AREA m to b

RENT ADDED
FOR PRODUCERS
OVER AREA b to d

FIG. 5a.

ORIGINAL
RENT
DECLINE
CURVE

ECON·
RENT

$90

0   m   a   b   c   d
        10   20   30   40 mls.

FIG. 5b

$135

$90

ADDITION TO a'S RENT

ECON·
RENT

NEW RENT DECLINE
CURVE

ADDITION TO
c'S RENT

$0

a   b   c   d   e   f
10   20   30   40   50   60 mls

FIG. 6

$135

$90

ORIGINAL RENT DECLINE CURVE   I

RDC AFTER TRANSP RATE INCREASED
TO TAKE ADVANTAGE OF GREATER MARKET
PRICE III

ECON·
RENT

RDC AFTER MARKET PRICE RISE
TRANSP. RATE BEING AS
BEFORE II

$0

M   a   b   c   d   e   f
     10   20   30   40   50   60 mls.

located at a distance of $135 \div 2.25$ or 60 miles away. The area under the ecumene has increased from 5028.6 square miles to 11314.3 square miles. Not only that. Each producer along the line from the margin to the market is better off. Each is better off by $45 per unit weight, in fact. The expansion of the ecumene may be *good political geography*. The extra production coming from the additional area of 6285.7 square miles may well be needed not only at local market M but also for export. This may be a golden opportunity for the society to populate the hitherto empty lands. This may be the final *raison d'etre* needed by planners for the extension of roads and rail beyond d. For a host of reasons, spatial expansion is the expected result of the price rise at the market. But there may well be good reasons why production will not go beyond distance d. There may not be any transport or, even if there were, producers may not be willing to 'swallow the bait'. The government may decide that whatever the price there must not be any real expansion of the land under the crop in question. Farmers themselves may think it unwise to expand areally. They may decide that their best chance for the future lies in *not* floodi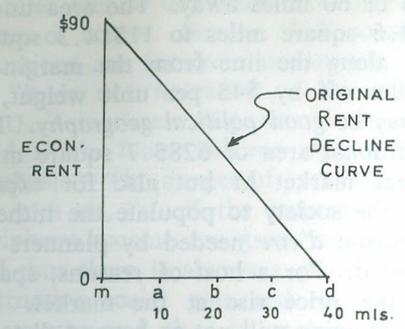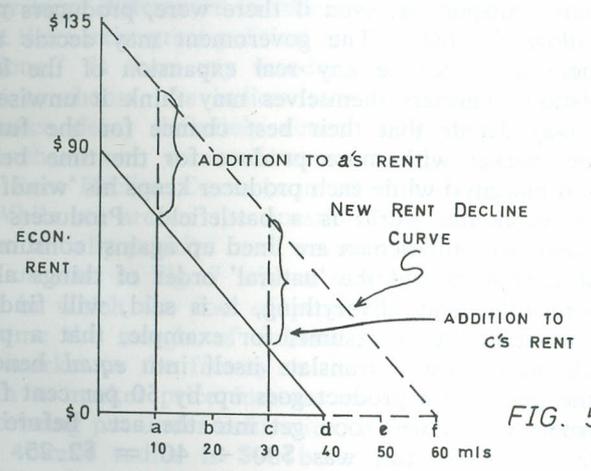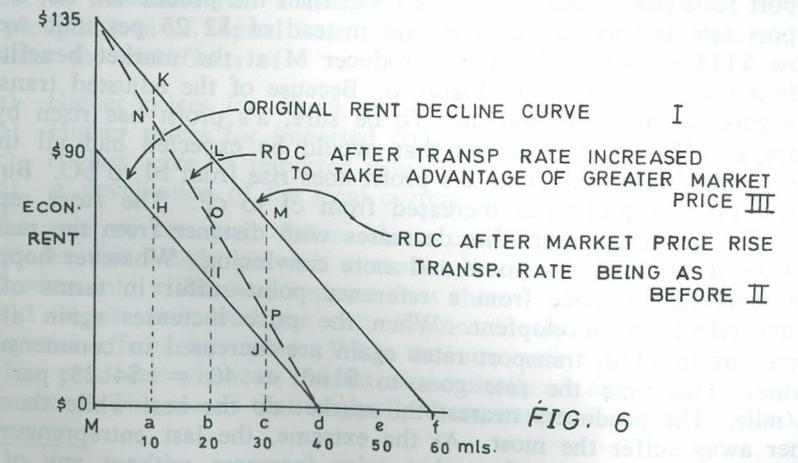ng the market with more produce for the time being. So, production remains at margin d while each producer keeps his 'windfall'.

In some respects the economic world is a battlefield. Producers are lined up against middlemen and middlemen are lined up against consumers. In the market place of capitalism and the 'natural' order of things all is left to a process of auto-adjustment. Everything, it is said, will find its own level. So, one must not always assume, for example, that a price rise at the market will automatically translate itself into *equal* benefits for *all* producers. If the price for a product goes up by 50 per cent from $90 to $135 the transport middlemen soon get into the act. Before the rise the transport rate on a unit load was $90 \div 40 = \$2.25$. But transport feels that it must benefit no less than the producers. So, a new transport rate is announced. The rate instead of $2.25 per unit weight is now $135 \div 40 = \$3.375$. Producer M at the market benefits to the limit regardless. But, see Figure 6. Because of the adjusted transport rate a gets not ak profit but an. To be sure, a's profit has risen by an amount aN-aH. But this is less than would be expected had all things moved in the 'right' direction. b's profit does rise from bI to bO. But he has lost Lo. c's profit has increased from cJ to cP. The story repeats itself. The increment of profits decreases with distance from the market. The laws of space become more and more convincing. Whatever happens, those removed by space from a reference point suffer in terms of the residual effects of developfent. When the price increases again at the market, say to $180, transport rates again are increased in commensurate measure. This time the rate goes to $180 \div 40 = \$4.25$ per unit load/mile. The producers nearest the market do the best while the ones further away suffer the most. At the extreme, the last entrepreneur (d) sees rounds and rounds of market price increases without any of the benefits accruing to him. No wonder the people at the periphery sooner

or later feel so depressed that they abandon the land. Something can be done, of course. But we shall come to that later. The truth is that such situations are far from uncommon. To be sure, as von Boventer [26] puts it, "it is not necessary... for all regions to be equal in income... (but)... moderate disparities in average regional incomes are easier to defend *if the lower income regions offer environmental advantages*". (my emphasis.) The danger of spatial disadvantage is stressed by von Boventer. He goes on, "...if the income differentials between the centre and the periphery become too great the periphery gets more and more frustrated and thus there is always a growing tendency for the periphery to develop alternative social gols and to try to overthrow the political system at the centre and thus to replace the old value system with a new one. Very large differences in incomes and standard of living in general imply that there exist great political and cultural differences between the different regions." Is there any wonder that for any development index one may care to choose, the indices run higher nearer the 'poles'? Alliteratively, distance decay definitely deters development and delineates districts of disenchantment, demoralisation and dereliction. Is it any wonder, that the Rent Decline Curve is in effect the Development Decline Curve?

While we are on the question of negative responses to changes which were initially positive ones we may turn to an even more serious scenario. Let us start in Fig. 7 with a situation in which the Market price is $90 and in which the cost of production for all producers is held constant. Assume the margin of cultivation is at a distance 40 miles, Md from the market or the factory or the receival plant, even the railway station. With a market price increase of 100 per cent and with no more new land being put under cultivation, it is easy to see that each producer within the 40-mile radius is $90 better off per unit of product. One would expect in the short run a massive series of improvements in terms of the ploughing in of capital improvements in the productive process. But, consider the mal-effects of

(a) Higher prices for diesel oil
(b) Higher prices for imported trucks
(c) Higher taxes on imported vehicles
(d) A devaluation of the local currency.

The rate of transport before these conditions came into being was $2.25 per unit weight per unit distance. If any or all of the conditions a to d come into effect and suppose that there is a new rate of transport of $12.00 per unit load per unit distance in the later period, then the mal-spatial effects are clear. With the new rate of transport in effect the last producer who can market economically at M will be located 15 miles away. This means that originally there was an ecumene of production

[26] E. von Boventer, "Development in space: Historical processes, Aspirations, Potentialities and Inequalities", *Papers, Regional Science Assn.*, 42 (1979): 29-38.
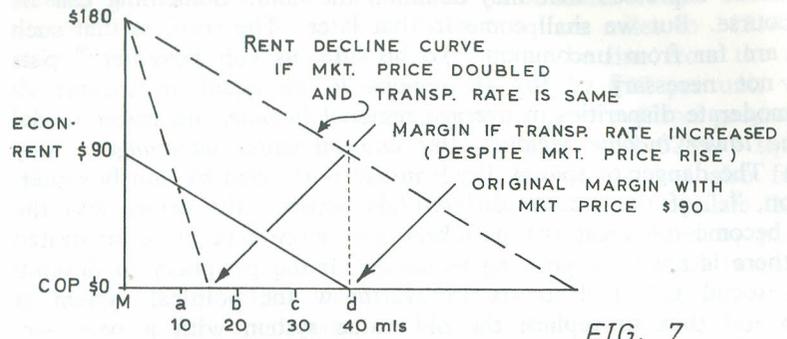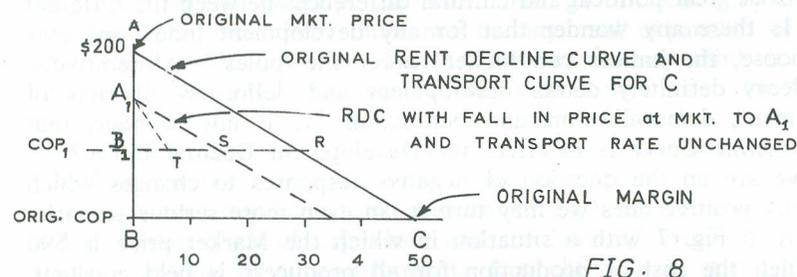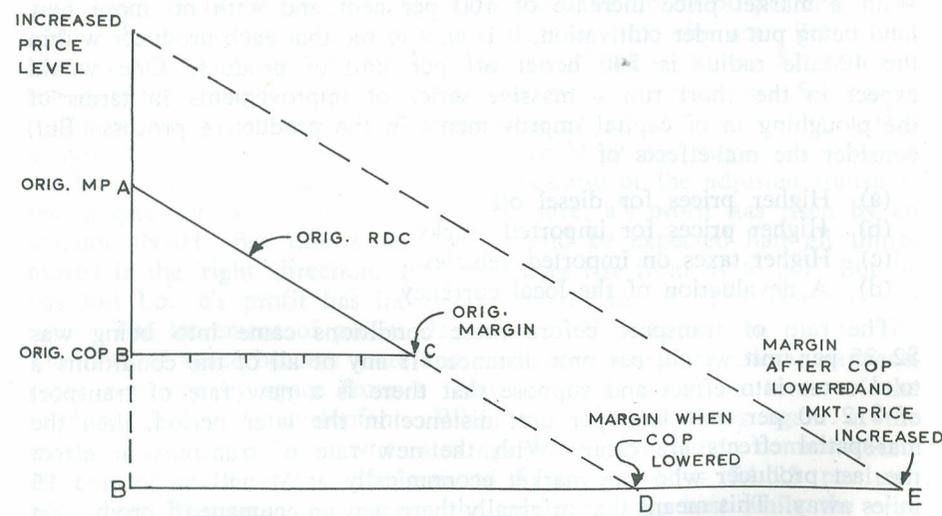
FIG. 7

FIG. 8

FIG. 9

totalling some 5029 square miles. Now there are only 707 square miles under production of the good in question. There has been a *loss of land in production* amounting to some 4322 square miles. This phenomenon of *recoil of margin* is not unknown in the West Indies, for example, where the waxing and waning of prices for sugar, tobacco, bananas and other crops have been perennial features of these economies. But in our example, let us imagine that 200 people per square mile are supported by the land. The effect of higher transport rates, ceteris paribus would be to put 864,400 people out of a *raison d'existence*. Worse than that, the 1 million people who had a living by reference to the Market or factory M now may have to crowd into an area which is a mere 707 square miles in area. That would give us a density, not of 200 per square mile but one of 1414 per square mile. The Figure also points out that the effect of this transport cost rise in putting land out of economic production and recoiling it from a radius of 40 miles to one of 15 miles is the same as if, transport remaining unchanged, the offered price at the market for the good had been reduced from $90 to $40, in which case the mal-spatial and the mal-social effects would be the same. One can carry the argument on and on. This being an export crop, say, the foreign exchange reserves would suffer, the ability of the country to purchase overseas goods would diminish, the standard of living of people would fall, other producers of goods and services would have smaller markets, unemployment would escalate, crime would increase exponentially and the whole social order would collapse. Maybe events would not follow in such dramatic turns as one is wont to describe in a theoretical example. Nevertheless, in varying degrees such a progression of events, such spatial changes, such a social evolution come face to face with us as we read into the geography and history of countries advanced and underdeveloped. Is it any wonder when we look at the spatial patterns existing in large countries that people either vacate the peripheries and crowd nearer to cores or at least leave very few people with larger acreages in the peripheries? The geography text books refer to such phenomena as intensive living and intensive farming nearer cores and extensive living and extensive farming the further and further out one gets from centres. Of course it stands to reason. If the rent (profit net) per acre near a pole (market) is say 100 and the rent near the margin is 5, then to expect the man in the periphery to stay there and be happy he has to be given 20 acres while leaving the farmer near the core with the one acre. That way, *cet. par.* each will be equally well-off and the second will not be penalised for his distance. To be sure, the farmer in the periphery *will* have additional costs for his additional acreage. But, for the moment we may ignore other complications.

Spatial developments are often too complicated to reduce them to a set of positive actions taking place at one time and a set of negative factors all taking place at the same time. For academic clarification we often do separate out these effects however. We do so again. Consider finally

in this section, therefore, what the effects would be of all negative actions on space. Figure 8 illustrates. The Figure ABC is the starting position. Consider an increased cost of production. A COP_1, *cet. par.* automatically leads to new margin at R instead of C. Add to that a fall of market price to A_1. With transport rate unchanged, the margin is now at distance S. Now with the transport rate more costly added to the two preceding factors, the last producer is now located at a distance $B_1 T$ from B. Properly translated in terms of areas, this means that an ecumene has shrunk from an area of 7857 square miles to 79 square miles. The decay has untold ramifications. Vice versa, start with the same as in Fig. 8. The cost of production is lowered. Automatically production *can expand* areally to a radius of BD (Fig. 9). Increase the price of the good at the market by 100 per cent of the original and the ecumene *can expand* to a radius BE. Lower, next, the rate of transport and the ecumene can expand even far beyond BE. In terms of figures, this means that from an original area under a crop of 7857 square miles the region under economic use is now near to 71,000 square miles. But that is easier said than done. For an area to be under economic use there are important inputs that have to be made to space. To a few thoughts on this issue we now turn.

FILLING UP THÜNIAN SPACE

The logic of the von Thünen theory or more strictly the neo-Thünian theory is a simple one of cause and effect, sometimes of sustained, cumulative cause and long run effects. What is sure, however, is that critical spatial changes, especially those involving very costly inputs of infrastructure are lasting, if even on their landscape impact. Take some simple facts of economic history. Larger populations in the eastern cities of the U.S.A. demanded more food. To the west the land was available. But more food for the cities and the growing industrialisation of the 19th/20th Century meant that such food had to be transported over long distances. The demand being sustained, this evoked a response from entrepreneurs to the extent that the railroads, among other things came into being. "Railroads", Fogel writes, "emerge as the most important innovation in the period 1840 to 1900. They were the *sine qua non* of American economic growth, the prime force behind the Westward movement of agriculture, the rise of the corporation the rapid growth of modern manufacturing industries, the regional location of industry, the patterns of urbanism and the structure of international trade"[27]. It is sometimes difficult to resolve the "chicken and egg" syndrome. However, once built, the railroads played an important role in future spatial patterns. The very fact that transport became available and became cheap meant that poles could thrive on

very large supply aeras for certain raw materials. They could gain scale economies, could thus produce goods at cheaper rates and sell at lower costs. They could pay more for the raw materials and so the symbiosis thrived. The poles and the large peripheries grew together. As Rostow states, "The railroad was historically the most powerful single initiator of take-off. It performed the Smithian function of widening the market, was a prerequisite to the development of major new and expanding export industries and led to the development of modern coal, iron and engineering industries"[28]

Both of the statements by Jenks and Rostow are similar. And both are explainable in the simple logic of Thünen. While Thünen wrote in particular terms of a small-scale situation, a neo-Thünian view must interpret *the very forces* at different levels of spatial history so that processes can be better understood. The shifting of the gaze from Thünen's town in the middle of 'der isolierte staat' to a more global dimension has not been a favourite concern of academics. But it is necessary. Consider Palma's pithy appraisal:

> "Railway networks and shipping lanes merged into an interlocking transport system with the nucleus in Western Europe but reaching into all parts of the world. Europeans were increasingly fed from the American Mid-West, the Argentines or the Steppes of South Russia all of which were developed and brought into the world market by the rails and the steamship"[29].

Much of what has come before in this paper can 'explain' a lot of what the economic historians tell us. Certainly some of the neo-Thünian writings do this and certainly some of the neo-Thünian diagrams go a far way in explaining the conquest of space, the expansion of the ecumene and the aggrandisement of certain points on the earth.

One point of departure in neo-Thünian thinking is the leapfrogging of the ocean. One can possibly see the logic of spatial conquest (Fig. 9) say on land. But when it comes to transcending the ocean some may be inclined to be sceptical. Let us be reminded that even in the 19th century the 'one-world', global village idea was taking root. Brinley Thomas reminds us of this. "Not only do cycles in different countries systematically affect each other so much as that *the history of hardly any one of these can be written without reference to simultaneous cyclical phases in other countries*"[30]. (my emphasis). And Habbakuk speaks of the 'Atlantic Economy'." The Atlantic Economy he writes, "developed in the nineteenth century. Economic relations between the U.S.A. and Britain were dis-

[27] R.W. Fogel, "Railways in American Economic Growth", *Jour. of Economic History*, 22 (1962), 163.

[28] W.W. Rostow, *The Stages of Economic Growth* (Cambridge, 1960).
[29] R. Palma, *Atlas of World History* (New York: Rand McNally, 1965): 105.
[30] B. Thomas, *Migration and Urban Development* (London: Methuen, 1972).

tinctive because of the reciprocal movement of investment and growth in these two areas. The rapid growth and intensive use of resources in the two economies were inversely related to each other because there was a common stock of resources"[31]. With the world passing from Toffler's First Wave to the Second, the impulses of demand were felt far beyond the bounds of the village, the Duchy, the City-State or the nation. We refer again to Alfred Marshall's analogy of the pair of scissors. Which blade cuts the piece of paper?

Our trans-oceanic view of spatial development can now be shown diagrammatically. In Fig. 10 we place Great Britain at the centre because in Britain the industrial revolution was born and from Britain went out tentacles to all the world to find markets, to carry philanthropy, to secure raw materials and to enlarge the political raum. In 1913 Britain was the world's leading creditor nation with 41 per cent of gross credits to the world. British Overseas investments in publicly-issued securities stood at £3.8 billion of which 41 per cent were in railways, 5 per cent in utilities, 16 per cent in industry. Not only were investments made in her colonies, for in 1913, Latin America had absorbed 20 per cent of these investments, Europe 6 per cent and other countries 7 per cent. United States of America took 20 per cent. In our neo-Thünian diagram (Fig. 10) the ecumene or the orbit from which produce would be brought in early times (Stage I) was very small indeed. As Peet has so ably shown, the average radius from which Britain drew imports in 1830s was 1800 miles. With the development of trans-oceanic shipping in the middle of the 19th century everything could be imported from a wider ambit (Stages II and III). With the double effect of trans-oceanic shipping and trans-continental railways the world literally became one large backyard. As Peet shows, in a matter of two or three decades Britain could draw produce from as far as 10,000 miles[32]. In our diagram there are two key characteristics. The urban/industrial demand hence market price in the United Kingdom was increasing. Simultaneously transport *rates* were falling (flatter transport curves). And transport lines and media were becoming available. The oceans were transcended, the continents were pierced and Thünen's state changed from an 'isolated' state to an 'all-encompassed state'. The effects are the same whether we are thinking of the U.K./U.S.A. bond or the U.K./Colonial bond. The economic bond was a transport bond and the economic/transport bond, in some cases, meant also a political bond.

ON MANIPULATING THÜNEN FOR CORRECTIVE PURPOSES

The obvious question that scholars and students ask is 'So far, so good. But of what use is the theory?' This is a valid unease and must be

[31] H. Habbakuk, quoted in B. Thomas, ref. 30.
[32] R. Peet, Loc. Cit.

U.S.A., CANADA   U.K.   W. EUROPE / EUROPE
S. AMERICA
S. AMERICA   1 ~ STAGE 1 LOW MKT. PRICE, HIGH TRANSP. RATE,
S. AFRICA   SMALL ECUMENE, LAST SUPPLIER NEARBY
W. AFRICA
THE WEST INDIES 2 ~ MKT. PRICE INCREASED, TRANSP. RATE LOWERED,
AUSTRALIA   'FIELD' OF SUPPLY WIDENED.
INDIA ETC.   3 ~ MKT. PRICE HIGH, TRANSP. RATE LOWERED.
               EVEN MORE (TRANSOCEANIC SHIPPING e.g)
            4 ~ INTERIORS OF NEW CONTINENTS INVADED
               VIA THE RAILWAY, ROADS, VEHICLES, TELEGRAPH.

FIG. 10

REAL WELFARE LINE
PRIMA FACIE RDC
APPARENT MARGIN OF ECUMENE
EFFECTIVE MARGIN OF ECUMENE

FIG. 11

answered in a convincing manner by those who are the purveyors of theories. This goes not only for Thünen or Weber or Christaller. It goes to the very root of all education. Everyone is all concerned today about relevance. We shall thus attempt to point out a few only of the ways in which basic Thünen can be used in a corrective, prescriptive manner.

To most scholars the Thünen theory, Myrdal's Cumulative Causation, Perroux's Growth Poles and Friedmann's Core and Periphery are distinct theories. In fact they are not. They are all different ways of stating a global and perennial problem — that of the division of the world, of countries, of districts within countries into *points* and *areas related to those points*. The purist may object to the use of the word 'points'. But everyone knows what we mean. There are very few scholars who think of points in their dual roles. To most scholars, a Thünian centre is a point *to which* produce is brought to a buying organisation. This destination may be a factory, a warehouse, a middleman, a supermarket or just a fresh food market. Such producers of goods are located at varying distances from the point and as such, bearing in mind that market price is fixed, and taking costs of production as the same for all producers, then the net profit accruing to producers will show a decline from the market. The Rent Decline Curve then becomes the key fact and the key 'tool' of the Thünen theory.

Very few writers, at the same time, however, highlight the fact that a Thünian point is one *from which* goods, mainly finished and processed products are distributed to consumers who are at varying distances from the reference point. Now, this adds some complication. Fig. 11 is similar in one respect to diagrams such as Fig. 1. The Rent Decline Curve AC tells us the rate at which farmers, say, find their net profit declining depending on distance from the market. The line may be a RDC for for one product, say sugar cane. The line may just as well be an aggregate RDC for all the products which people *take to* the city, the town, the market. The line may be very flat in which case the transport rates are low. Or, the line may be very steep in which case the transport rates are very high. But, to say that the margin of the ecumene is at C is really only partly true. To read off any vertical line such as cx and say that this represents the quantity of wealth accruing to a person located at c is only *part of* the truth. The fact is that goods are distributed from B to the periphery. This very distribution of goods incurs a transport cost. The rate, singly or in the aggregate, may be low with a flat curve or high with a steep curve. But any movement from B to the periphery costs money. A truck-load of brincks made in B and sold in B may cost $x. The c.i.f. price at a will be higher, $1.3x say. At c the delivered price will be still higher, $1.8x perhaps. So, in building in this Thünian fact in the opposite direction we have to construct a delivery cost line BD. We can see just what this does to give the true picture of welfare geography. People at B are well-off whatever the circumstance. But consider a. His

welfare is not av as the ordinary Thunian RDC would lead us to conclude at first glance. In fact, a's welfare is vm because he pays an additional penalty for living at a. The good in question or the totality of all goods coming from B costs him $am more than it costs those at B. c's welfare is not xc as the Thünian RDC alone would have led uns to conclude *prima facie*. Because he pays a penalty of oc on manufactured goods delivered to him, his net welfare is only ox. The true welfare line is therefore AE.

The question of being disadvantaged merely by being located far from reference points thus raises interesting questions. The friction of distance, we have over and over stressed is some thing that has to be accepted. *But*, that being so, society has to find ways of ameliorating bad situations. We have shown in past diagrams how changes in market price, transport rate, cost of production and other factors can *evolve* in a positive way to lessen the problem of locational disadvantage. But are we to wait for things to *evolve*? Sometimes, but not always.

Take the problem of pole and periphery. Whether we take the Thünian RDC *minus* the delivery cost increase curve (DCIC) there comes a point when, even with the best will and the best wit in the world, the ecumene ends. There is a certain distance from the destination/origin point beyond which it is impossible to ship anything to the central point and make a profit. On a flat plain in which transport costs are the same in all directions from the centre, the ecumene will be circular. In Fig. 12, with the market price for a good produced in the periphery being $80.00, no farmer beyond a distance Md can ship his goods to M and still be economic. If farmer e therefore wished to send his products to the market at M at that price and at a transport rate of $80 ÷ Md, then he will arrive at the market at a loss of $20.00 instead. If the price were $100.00 that would suit him fine. This would suggest a kind of *engineering* that agricultural planners, economic planners and others coul effectuate. For the farmers beyond d who wish to remain in these areas 'beyond the pale' the government could *artificially* jack up the receival price. Or, another form of *spatial engineering* could come by way of manipulating the transport rates for the farmers outside the ecumene. Thus, one could so subsidise e's transport rate that over the distance ce his rate of transport will be cf ÷ ce and then for the remainder of the distance to market e would pay a rate of Ag ÷ Mc. In that way e would have his product arriving in the market at the same cost as it would for farmer d.

But a good planner may see a golden opportunity for more extensive spatial engineering. The chance may be taken to establish a new pole. That pole may be a receiving point for produce. It may be a factory. It may be more. It may be a town with all the services and backward and forward linkages set up in an organised complexity. That last may well be the aim in the ideal. The main thing is that a new reference point is conceived. Assuming the same price at the market of $80.00 per unit
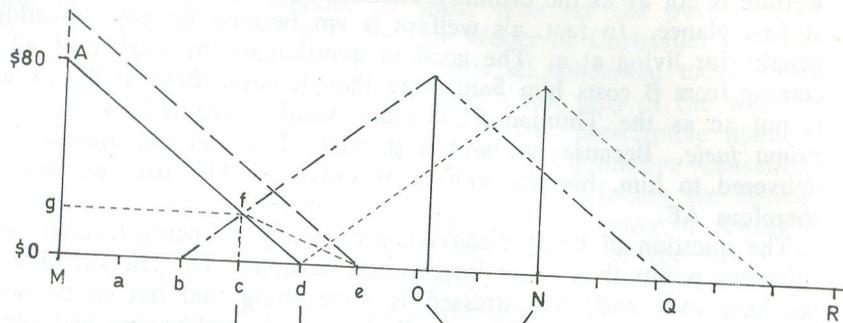
POINT OF INDIFF.
with new pole
at O and with mkt.
Price and transp. rate
remaining unchanged

NEW POLES
POINT OF INDIFFERENCE with new
POLE at N, MKT Price and transport
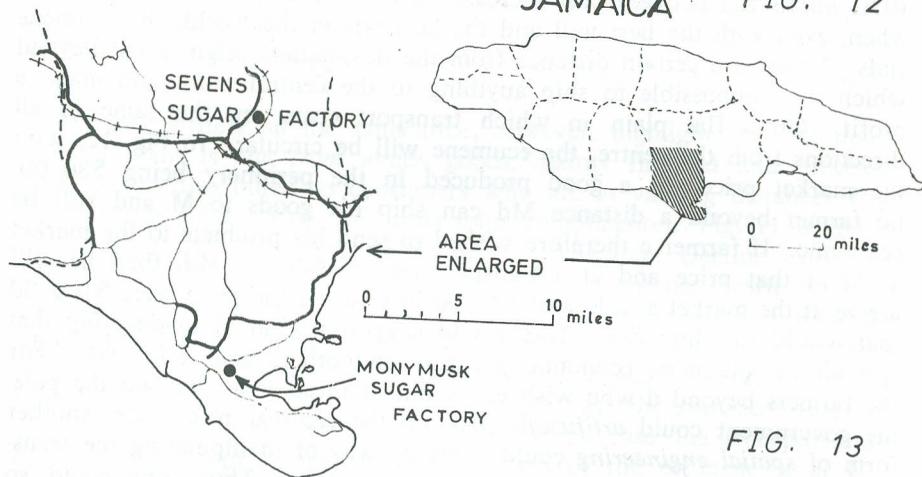rate remaining unchanged.

JAMAICA   FIG. 12

SEVENS
SUGAR • FACTORY

AREA
ENLARGED

0   20 miles

0   5   10 miles

MONYMUSK
SUGAR
FACTORY

FIG. 13

RDCs
for sugar prod'n
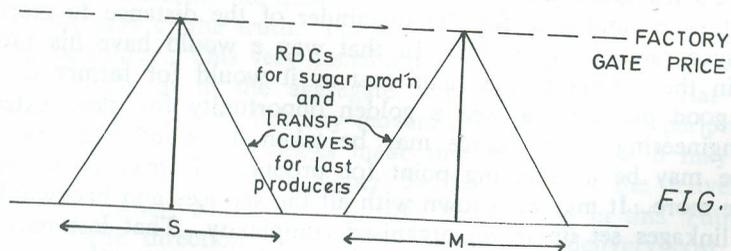and
TRANSP
CURVES
for last
producers

FACTORY
GATE PRICE

FIG. 14

of produce, a new centre at N would mean that all space is being used. The point of indifference is d. Farmer d can indifferently take his goods to M or to N. But one will notice that e who before had no rent can now get a rent of $20.00. Obviously all the farmers in the band dN can now for the first time find a living by producing the good in question, the assumption being made all along that the society or the broader overseas markets have the absorbtive capacity. Better still, from some points of view if the new town/factory/market were set up at 0. In that way the point of indifference shifts to c and all the farmers in the band cd are better off kith market 0 than they were before with market M. d, instead of being merely a peripheral producer just eking out an existence would have a rent of $40.00 per unit weight. e who had no possibility of being an economic producer for M before now has a rent $60.00 and o which might have been totally devoid of commercial beings before now would attract a large population because location there earns for the good in question the full $80.00 per unit weight. The stage is set for spatial development. Imagine that M was a seaport with the land area of the country stretching well beyond to R. Then only the narrow band near to the coast would be populated. The system would be self-perpetuating (like Guyana, Venezuela, Brazil). *New-core* developments (such as N and o) eventually aiming to be substantial central places could only be a wise economic strategy. Staying with the new location at O, we can see that the diameter even of O's control would be 2(OQ). In such a case, beyond Q would be 'beyond the pale' which in fact would be a pointer to the establishment of a *new pole* at R. And so the look at space continues. Thus we find that *Thünian thinking can be a tremendous force for positive spatial designs*.

One may be tempted to think simply of the beautiful logic and geometricity of what we have just described. But the implications of all this 'engineering' are greater. The following are in summary only *some* of the repercussions in the short and in the long run:

(a)   A new system of central places takes root.

(b)   The mass crypto-urbanisation characteristic of areas around M is lessened.

(c)   People in the periphery get financial satisfaction from producing goods in formerly peripheral areas for new collection centres.

(d)   With a greater and better spread of people and towns in the hinterland the political purpose of ecumene-filling is achieved.

(e)   With larger and larger areas being 'filled in' areal specialisation becomes possible so that efficient use is made of the land.

(f)   With the waves of 'infilling' taking place more and more employment is created. People are usefully employed in the former periphery rather than being idle in the slums of the pseudo-urban centre.

(g) The need arises for more and more transportation (roads, vehicles, telephones, etc.) to link the new centres so that scale economies arise in the production of these factors of transport.

(h) With more and more population in formerly destitute regions, the society comes to find out more and more about their natural resources so that greater and greater use is made of indigenous resources.

What we have just described can be couched by different writers in a variety of languages and postulates. But, one may go along with Richardson and term this process 'polarisation reversal' [33]. Richardson defines PR as "the turning point when spatial polarisation trends in the national economy *give way* to processes of spatial dispersion out of the core region into other regions of the system." Our point of view in this paper is a little stronger. We are suggesting that *the process has to be interfered with* rather than be left to take place at its own pace. And this is khere the force of the thünian mechanism comes in. If planning is aberrant thinking, then any aberrant thinking is suspect, certainly in the minds of the people who hold the purse strings in a society. Convincing arguments must be 'proved'. The Thünian argument, we think, is a critical prop.

We may turn now to a real example of the way Thünian thinking can help in arguing a case for corrective action. Sevens and Mony-musk (Fig. 13) are two sugar factories in the southern part of Jamaica, located about 15 miles apart. In 1974 Sevens was closed after a few years of declining sugar production, from 120,000 tons of sugar in the 1960's to 70,000 tons in the 1970's. Sevens, like any pole, had its *field* from which it drew its sustenance. With both factories offering the same 'gate' price per ton of sugar cane the ideal supply situation would be as represented in Figure 14. We assume in our diagram a level plain and the same transport rates in all directions. The field would be circular in each case, identical in area, in fact. The closure of one factory, Sevens in this case, obviously has spatial repercussions, not to mention repercussions on people, settlement patterns, urban vibrancy among others. With the Sevens suppliers left on their own, we can see their plight. As Fig. 15 points out, with the rate of transport remaining the same, farmers A, S and B will find their canes arriving at the new reference point, Monymusk, at prices MG, H and MI respectively. None of these prices will be any good, for the price on offer at the market is MU. Our Thünian tool allows us to *see* the inequity. It allows us to see clearly the fate of all farmers in the area π SB^2. They will never be able to sell to Monymusk. The Thünian diagram also allows us to see what the possible solution may be. The problem was in fact seen for what it was by the decision-makers. Soon

[33] H.W. Richardson, "Polarisation Reversal in Developing Countries", *Papers, Regional Science Assn.*, XLV, (1980): 67-85.

after the farmers were throwing up their hands in horror, the authorities declared that the 'problem was a transport one'. The plain fact is that a farmer at B requires a transport subsidy of IU, one at S needs one of HU per unit load and a farmer a distance of AM from the factory M needs a subsidy of transport amounting to GU per unit weight.

We turn now to another real condition. Take the problem of feeder roads in Jamaica. There are very many headlines like the one in July 25, 1974, which read "NEW ROAD ENHANCES GROWTH". In part the article in the Jamaican daily newspaper read, "A new Blue Mountain-Coffee Grove Road was declared open. The road is one mile and connects Bellefield and Williamsfield withney and Porus. Some 8,000 people are affected in these areas and 95 per cent are farmers... Since the construction of the road, the farmers have shown deep interest and had begun planting more crops... Trucks can now go to any point to pick up farmers' produce..." Note the dimensions of the example. A road *merely a mile* has an impact on 8,000 people and probably 16,000 in 1985. That's 8,000 people who might have left the area altogether for the slums of Kingston had not that road, that "artery" brought in fresh life, fresh blood to enable the people to survive. A road a mere mile in length having an impact on a region roughly a mile square must constitute in the Third World at least one of the conditions of development so beloved of Walt Rostow.

What has all this to do with von Thünen, anyway? The short answer is 'a lot'. Thünen can come to the aid of the planner, the agriculturist, the backbencher in Cabinet, the teacher in the nearby Secondary School, in fact anyone who wants to understand more clearly and wants others to comprehend more lucidly. Figure 16, illustrates. M is the reference point, the market, say. Pq is the rent decline curve up to the point X, which is, says, a point on the main road to which the intended feeder road would relate. At X rent bearing land ends. XZ, however, is an area which is *potentially* rich for production of the good in question. But the region beyond X, for all practical purposes, does not exist. Now, with the extension of a feeder road heyond X it is now *possible* for goods to be transported out to Market M, provided M can absorb the additional produce. As the diagram shows, the *ecumene* now extends from a radius of MX to MZ. The region covered by the distance XZ for the first time 'comes to life'. Areas which hitherto had no relationship to a market and cash crop system now become enmeshed in the life of a greater area. In the *newly related* region land gains value, people find that they can make a living and, as we have remarked, the disincentive to remain in the area on the land is gone, or at least it is lessened. Wealth is created in the area. Taxes can be paid and services now become feasible. The income of farmers creates need for services. Shops spring up and a wide range of services now have a *raison d' etre*. The system is cumulative. In the second and third rounds conditions improve. In the long run, *ceteris*
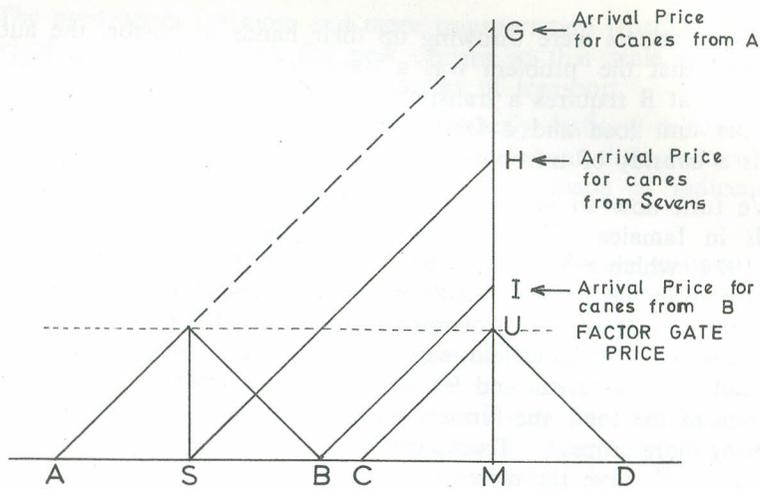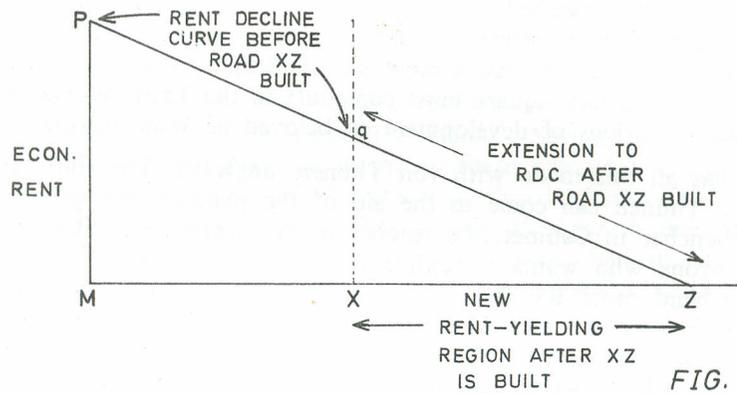
FIG. 15

G ← Arrival Price for Canes from A

H ← Arrival Price for canes from Sevens

I ← Arrival Price for canes from B

U — FACTOR GATE PRICE

A   S   B   C   M   D

FIG. 15

FIG. 16

P ← RENT DECLINE CURVE BEFORE ROAD XZ BUILT

ECON. RENT

q

EXTENSION TO RDC AFTER ROAD XZ BUILT

M   X   NEW   Z

← RENT—YIELDING REGION AFTER XZ IS BUILT →

FIG. 16

FIG. 17

h   x

MKT → g
PR.

gt =
RDC from
M to N   y   t

TRANSP
CURVE
for N

TRANSPORT CURVE FOR O

U   v

o

Pt and gt = TRANSP. CURVE FOR P

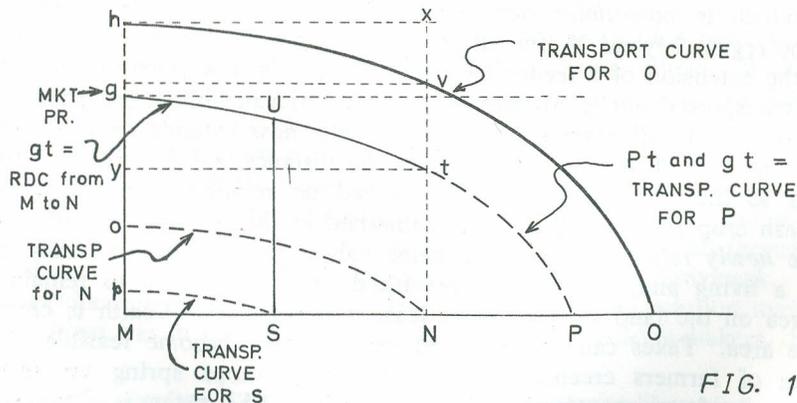M   S   N   P   O

TRANSP. CURVE FOR S

FIG. 17

paribus, the Thünian extension of the ecumene through the input of transport has kept at bay the decay of space.

The *Transport and Communications Bulletin of Asia and the Far East* (Vol. 48, 1972) puts the impacts best:

> "The development of a well-planned rural road system is one of the basic factors contributing directly to rural development as a whole. Such a system facilitates farm mechanisation, effective utilisation and mobilisation of manpower and resources and access to land. It makes rural areas accessible to newly-developing industries, encourages the dispersal of industries, increases employment opportunities and promotes regional development. Rural development reverses migration trends and reduces the pressure on cities. It spreads industrial capital to rural areas and reverses migration to over-crowded urban areas or at least encourages people to remain in the rural areas.
>
> The velopment of rural transport which is a basic requirement for rural development and social welfare, will increase employment opportunities and facilitate the provision of education, health, recreation and other services, once again encouraging the farm people to remain in the rural areas.
>
> The development of rural roads will contribute to the national economy by extending the market and providing mobility for people, products and natural resources. It will also make it possible for Governments to provide social services and strengthen the political unity of the country."

There could be little doubt that one of the nagging and cumulative problems of the Third World is the condition of spatial disparity. This is a global phenomenon more marked and disastrous in the Third World countries, but not in any kay absent even in rich advanced, industrial countries. There can be little doubt that the Thünian model offers an explanatory tool which can *show how* infrastructural changes and administrative manipulations can 'save' a situation. "Who can deny", as Walter Isard asked, "the spatial aspect of economic development: that all economic processes exist in space as well as over time?"[34]

Take another examples of those headlines which appear every few weeks in the newspaper. A news item in the Jamaica *Daily News* of August 16, 1980, read *ROAD WOES WORRY*. The report went on to say *inter alia*, "Feeder roads are in such a sorry state that only 37 per cent of the canes cut in Eastern St. Thomas reach the factory because

[34] Walter Isard, "The General Theory of Location and Space Economy" *Quarterly Journal of Economics,* 63 (1949): 476-506.

vehicles cannot travel on the roads." To most people this can just be a simple news item. To be sure, some may comprehend the *gravity* of the news. But to 99 per cent of those not involved, this is just another few square inches of ink on paper. But what about those who care? What about the planner who wants to explain the plight to his superiors? What about the scholar who wants to convince a Planning Seminar about a negative *process* which is operating and which, unattended, will lead to space decay and spatial underdevelopment? Here again von Thünen comes to our craving for explanation. Figure 17 addresses itself to this problem. M is the factory or other reference point. N is the outlet from the feeder road to the main road. From N to M transport is so low that a man at N pays Mo in transport cost to the factory leaving him with a rent of Nt. S has a transport cost of Mp so that his rent or net profit is SU. M, of course has no transport cost so that his rent is Mg. The rent decline curve for the distance MN is therefore gt. O has, on a bad road, a high transport rate to the main road point N. After paying Nv in transport cost to N he still has a long way to the factory despite the low rate of movement from N to M. Proceeding from N to M his transport cost is vX. His total transport cost is thus NX, which is \$NX-Mg above the going market payment price at the factory. P takes his goods to N at a cost of Nt and then carries on to factory at M by paying the additional cost yg. P can just make it. He is the last economic producer under existing conditions. The total rent decline curve is thus as shown by the line gUtP. By this time it should be an easy matter for the Thünian scholar to see how best the transport cost situation could be manipulated in favour of the region No so that producers in the region PO can take their produce to the market and still make a profit.

IN REAL TERMS — THÜNIAN SPATIAL UPLIFTMENT

Lest one be accused of a non-pragmatic approach to this question of space understanding, let us hasten to state again that the whole purpose of spatial theorising and spatial engineering is to maximise the efficiency of spatial use and the maximal infilling of space. Many of our theoretical, diagrammatic examples have, if we observe carefully, an over-riding theme, that of lifting the economic health of areas far from centres. As we have shown in our examples, the simplest conclusion we can come to is that once the periphery is affected by a lowered transport rate, a higher market price, a subsidised cost of production, subsidiary reference points, or whatever means of lessening the burden of distance, so will a whole train of events be set in motion.

The train of events may be conceptualised in terms of a RURAL-URBAN, POLE-PERIPHERY, CENTRE-PERIPHERY, CORE-PERIPHERY relationship. Someone many years ago coined the term 'RURBANISATION SYMBIOSIS'. And an apt term it is. Consider Figure 18a-18c. In very

brief the following are some only of the highlights of spatial development under rurbanisation.

STAGE 1

For all practical purposes, the urban modernised centre is a world apart. So is the rural sector. The former is upwardly mobile while the latter is being downwardly degraded. In the urban area, life goes on as it would anywhere in a metropolitan setting in the advanced world, while in the rural area the practices differ little from village neolithic life. In the former, things become cumulatively better. In the latter area everything becomes cumulatively worse. In the latter regions there are hardly any appurtenances of modernity. Negativism and fatalism are the order of the day and a persistent characteristic is outmigration of capital, skill, the youth, the teachers, the entrepreneurs, in fact every attribute of the region which would otherwise be of positive benefit to the economy and the *space* economy. The situation can be described as *HYPER-CEPHALIC* with neither sector achieving the fullness of mutuality that is possible.

STAGE 2

In this stage of proto-symbiosis the former condition of pure subsistence in the Rural Sector is 'disrupted' by an incipient 'relation' with the crypto-urban sector. The farmers now produce for the urban workers. Some formerly imported food is replaced by locally-produced crops. Money flows from *urbs* to *rure*. Less people are inclined to abandon the rural for the urban parts. There is more money circulating in the rural areas. The success of the measure induces the government to make critical connections between the two spatial sectors — via road, rail, telephones, electrification. The urban industries can now sell more to the rural folk. So the Factories gain better economies of scale and plainly increase their sales. A symbiotic relationship is incipient.

STAGE 3

Stage 2 innovations are strengthened. More farm produce and other raw materials are consigned for the urban sector from the rural periphery. More money flows from the urban areas to the periphery and, in turn, money from the hands of farmers and others is used in greater quantities for the purchase of urban goods. Urban factories gain better scale economies as a result. The urban areas are now consuming more local pro-
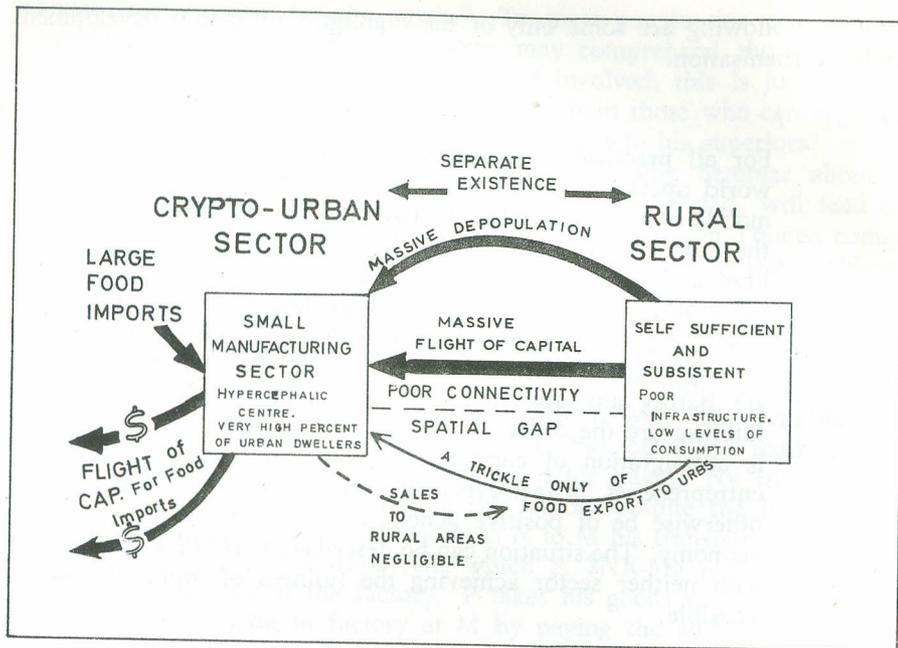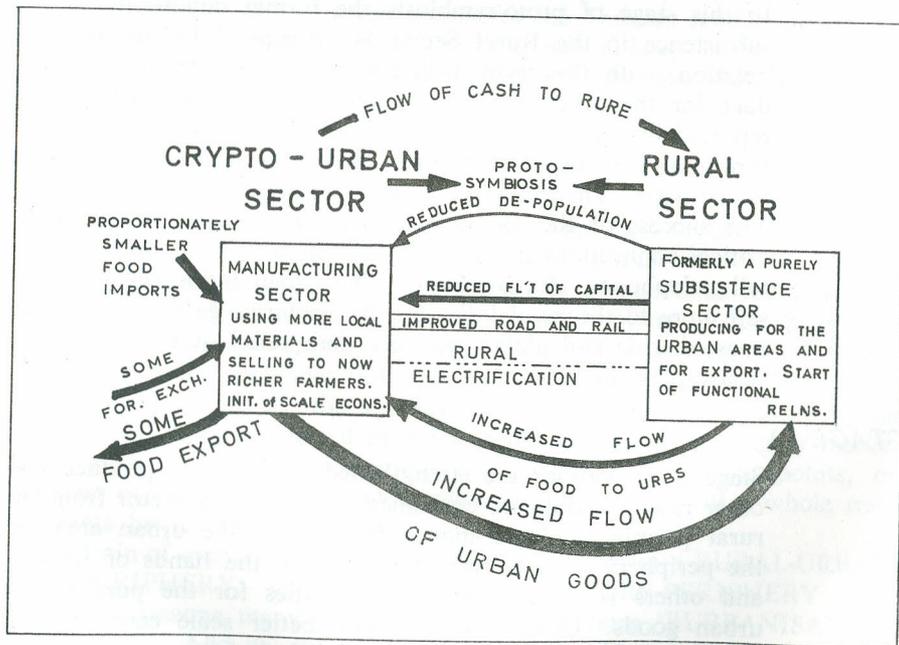
FIG. 18a

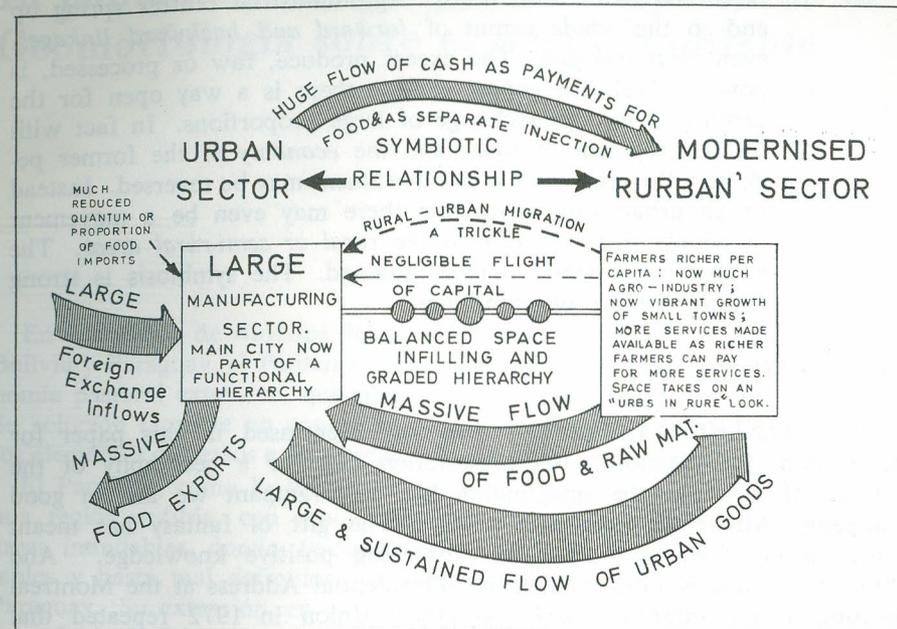CRYPTO-URBAN SECTOR ←SEPARATE EXISTENCE→ RURAL SECTOR

MASSIVE DEPOPULATION

LARGE FOOD IMPORTS

SMALL MANUFACTURING SECTOR — HYPERCEPHALIC CENTRE. VERY HIGH PERCENT OF URBAN DWELLERS

MASSIVE FLIGHT OF CAPITAL

POOR CONNECTIVITY

SPATIAL GAP

A TRICKLE ONLY OF FOOD EXPORT TO URBS

SELF SUFFICIENT AND SUBSISTENT — Poor INFRASTRUCTURE. LOW LEVELS OF CONSUMPTION

FLIGHT of CAP. For Food Imports $

SALES TO RURAL AREAS NEGLIGIBLE

FIG. 18b

CRYPTO-URBAN SECTOR → PROTO-SYMBIOSIS ← RURAL SECTOR

FLOW OF CASH TO RURE

REDUCED DE-POPULATION

PROPORTIONATELY SMALLER FOOD IMPORTS

MANUFACTURING SECTOR — USING MORE LOCAL MATERIALS AND SELLING TO NOW RICHER FARMERS. INIT. of SCALE ECONS.

REDUCED FL'T OF CAPITAL

IMPROVED ROAD AND RAIL

RURAL ELECTRIFICATION

FORMERLY A PURELY SUBSISTENCE SECTOR PRODUCING FOR THE URBAN AREAS AND FOR EXPORT. START OF FUNCTIONAL RELNS.

SOME FOR. EXCH.

SOME FOOD EXPORT

INCREASED FLOW OF FOOD TO URBS

INCREASED FLOW OF URBAN GOODS

FIG. 18c

HUGE FLOW OF CASH AS PAYMENTS FOR FOOD & AS SEPARATE INJECTION

URBAN SECTOR ← SYMBIOTIC RELATIONSHIP → MODERNISED 'RURBAN' SECTOR

MUCH REDUCED QUANTUM OR PROPORTION OF FOOD IMPORTS

RURAL-URBAN MIGRATION A TRICKLE

NEGLIGIBLE FLIGHT OF CAPITAL

LARGE Foreign Exchange Inflows

LARGE MANUFACTURING SECTOR. MAIN CITY NOW PART OF A FUNCTIONAL HIERARCHY

BALANCED SPACE INFILLING AND GRADED HIERARCHY

FARMERS RICHER PER CAPITA : NOW MUCH AGRO-INDUSTRY ; NOW VIBRANT GROWTH OF SMALL TOWNS ; MORE SERVICES MADE AVAILABLE AS RICHER FARMERS CAN PAY FOR MORE SERVICES. SPACE TAKES ON AN "URBS IN RURE" LOOK.

MASSIVE FOOD EXPORTS

MASSIVE FLOW OF FOOD & RAW MAT.

LARGE & SUSTAINED FLOW OF URBAN GOODS

duce and are importing less foreign produce with a consequent large saving in foreign ex-change. With more cash available for disposal *in the rural periphery,* the way is open for the growth and development of *services* and service centres. The stage is set for the development of a *hierarchy* of settlements to take root.

The triggers initiated in Stage 2 are strengthened in Stage 3. A deep symbiosis now exists. There is a stronger urban sector which suffers less from the in-migration of hoards of rural people fleeing the land. Farmers are now much and are therefore able to *plough back* substantial amounts of their earnings into farm machinery, insecticides, pesticides, irrigation and many of the *accoutrements* of modernisation. Small towns flourish in the erstwhile periphery. Farmers being richer can pay more taxes. And, because so many more people remain in the rural areas, it is now economic for the government to inject sizeable capital inputs into the region in the form of public utilities, infrastructure of many types and so on. With the application of science to farming and with the application of modern methods

in all their manifastations, food produced in the periphery is far in excess of local needs. Agro-industrial centres spring up and so the whole gamut of *forward and backward linkages,* even *joint linkages.* The excess produce, raw or processed, is now available for export so that there is a way open for the earning of foreign exchange of large proportions. In fact with the development of *space* and the *economy* of the former periphery the process of social movement may be reversed. Instead of an urban-ward movement there may even be a movement of people *from the city to the rural or semi-rural areas.* The *mutual* upliftment has been attained. The symbiosis is strong and so the process continues.

CONCLUSION

The *NEO-THÜNIAN* analysis thus has been used in this paper for description, for diagnosis, for prescription and for a geography of the future. If at times the imagination has run rampant we are in good company. Albert Einstein once stated, "The gift of fantasy has meant more to me than my talent for absorbing positive knowledge." And Professor Stanislaw Leszczycki in his Presidential Address at the Montreal meeting of the International Geographical Union in 1972 repeated that geographical research "should fulfil four or five basic functions: (1) Informative and diagnostic; (2) Theoretical and explanatory; (3) Prognostic; (4) Planning and decision making; and (5) Co-ordinative." Berry himself in his Presidential Address to the Association of American Geographers in 1980 advised that, "From time to time it therefore becomes necessary to assess the status of our field, to imagine what it might become, and to map alternative routes for getting there" [35] He went on to quote Kenneth Boulding who wrote, *inter alia,* "The human brain has as enormous 'autopoietic' potential for mutation of images... The images which it creates need not have any correspondence to structures in the real world. The principal business of the human mind, indeed, is fantasy... science is the product of organised fantasy about the real world..." [36]

Finally, as a teaching mechanism the neo-thünian theory just outlined can be rewarding at least in terms of its diagrammatic logic. The lecturer can devise his own graded set of Thünian exercises. The present writer is offering such a set and interested readers are invited to make their requests to the address shown.

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[35] See reference 22, p. 449.
[36] Ibid., p. 453.