



# Thünen and the New Economic Geography<sup>☆</sup>

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## ABSTRACT

In this paper, I explain Thünen's pioneering work on industrial agglomeration. In my opinion, Thünen's thinking on industrial agglomeration was not only amazingly advanced for his time, but in many respects remains novel even today. It is shown that if we unify Thünen's well-known theory on agricultural land use with this pioneering work on industrial agglomeration by using modern tools, then we essentially come up with a prototype of New Economic Geography model.

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## 1. Introduction

“Wherever economic theory is studied today, his ideas, his working methods, the problems he posed, have proved seminal right up to the present day—even there, where his name seems to have been forgotten, Thünen *has* worked. His work shines brighter than ever today. Much, which seems self-evident to us, goes back to him. And still not all the riches which are buried in his work are brought to light. To find them, you must without doubt read *The Isolated State* carefully and often.” (Erich Schneider, 1959, pp.27–8)<sup>1</sup>

According to Paul Samuelson in 1983 in his commemorative paper at the two-hundredth anniversary of Thünen's birth, Thünen “not only created *marginalism* and *managerial economics*, but also elaborated

one of the first models of *general equilibrium* and did so in terms of realistic *econometric* parameters.” (Samuelson, 1983, p.1468, emphases by the original author) More specifically, Samuelson asserts that “Thünen's model has in it elements of all of the following systems:

1. The Ricardo–Torrens theory of comparative advantage.
2. The Malthus–West–Ricardo theory of rent.
3. The Hecksher–Ohlin and Stolper–Samuelson theory of factors-and-goods pricing.
4. The Marx–Dimitriev–Leontief–Sraffa system of input–output.” (p.1481)

This is praise so grand that no other economist in history, except possibly Adam Smith, could possibly deserve it. As a location theorist myself, however, I would like to emphasize in this paper that from the viewpoint of location theory, Thünen's work contains more than that. In addition to the four elements cited above by Samuelson, I would like to note that in his later work, Thünen also anticipates the following theories:

5. The Marshall–Weber theory of industrial agglomeration
6. The Christaller–Lösch theory of central place system
7. The recent development of new economic geography

Before elaborating these points in the subsequent sections, let us recall that Thünen was not an ordinary armchair scholar. As is well-known, he never occupied an academic position in his life. The initial idea of the so called *Thünen rings* has evolved to a grand theory of the general equilibrium of a spatial economy while he was working on his own Tellow estate, engaging in ceaseless agricultural improvement on his land. Thünen was satisfied with his abstract model only after taking

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<sup>1</sup> This quotation is from Schneider (1959) which was written to honor Thünen's name on the 175th anniversary of his birth in 1958. The English translation quoted here is from the introduction by Peter Hall to the English translation of von Thünen (1826) by Wartenberg (1966, p.xliv).

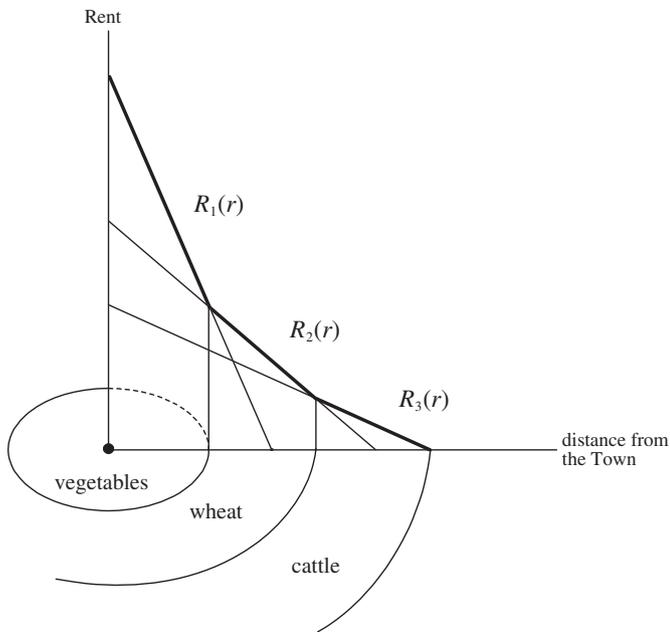


Fig. 1. The land rent profile and von Thünen rings when  $n=3$ .

laborious investigations of costs and returns on his Tellow estate over 10 years, and then confirming that the collected data fitted directly into his model. No wonder, Schumpeter (1954, p.446) called Thünen “one of the patron saints of econometrics.” In short, Thünen’s timeless model of agricultural land use and rent has been “cultivated on land” literally while he was working as a farmer. This part of his work on agricultural land use and rent was published as *The Isolated State* in 1826, later called Part I in order to separate it from later editions. Today, almost any textbook of economic geography and location theory explains the basic idea of Thünen’s theory on agricultural land use and rent, using a diagram of a monocentric economy illustrated in Fig. 1.

Later, the monocentric economy model of Thünen was developed in various forms utilizing modern analytical tools.<sup>2</sup> In particular, Alonso (1964) reinterpreted the monocentric economy model of Thünen by substituting commuters for farmers and the central business district (CBD) for the town, and generalized Thünen’s central concept of big rent curves to an urban context. This “monocentric city model” provided modern urban economics with the theoretical foundation.

For a long time, I believed that from the viewpoint of geography and location theory, this was the end of the story. Of course, even if it were so, Thünen’s story is already one of eternal scientific fascination. Then, a terrible shock came to me when I read recently Section 2 of the so-called Part II of *The Isolated State*, edited by Hermann Schumacher and published in 1863, which contains Thünen’s posthumous papers mainly dealing with the problems of spatial economy related to the original Part I.<sup>3</sup> If I borrow Schneider’s words again, my amazement was that “even there, Thünen *has worked!*” “There” means no other than New Economic Geography.

In my opinion, Thünen is indeed “the founding god” of modern economic geography,<sup>4</sup> which includes not only traditional economic

geography and location theory, but also the modern urban economics as well as the so-called New Economic Geography. As explained in the next section, Thünen was concerned not only with the working of the agricultural hinterland surrounding a single town, but also, at least in his later years, concerned with the working of the entire spatial economy including “the order and distribution of towns in the Isolated State.”<sup>5</sup>

## 2. Thünen and agglomeration economies

When we discuss the reasons for the concentration of an industry (or industries) in a specific location, or more generally, the agglomeration of people and industries in a city (or in a system of cities), it has been customary to go back as far as to Marshall (1890, 1920, Ch.x), and then to Weber (1929) and Hoover (1937), and to the central place theory of Christaller (1933) and Lösch (1940). To the best of my knowledge, there is no article in the economics literature which associates the topic of agglomeration (or distribution of cities) with Thünen.<sup>6</sup> Location theorists and economic geographers (both “traditional” and “new”) always referred to Thünen, but never in the context of agglomeration economies or city formation. Thus, it is a great surprise to realize that (using Schneider’s words again) “even there, where his name seems to have been forgotten, Thünen *has worked!*”

To see where Thünen *has worked*, it may be sufficient to glance over the following contents of Part II, Section 2 of the English translation (Wartenberg, 1966), which contain the extracts of posthumous papers on location theory written by Thünen between 1826 and 1842.<sup>7</sup>

Part Two, Section Two, ... Subsection 5 Changes in our assumptions (many towns of the same size equi-distant from each other), Subsection 6 The order and distribution of towns in the Isolated State, Subsection 7 The role of population density, Subsection 8 The dynamics of the Isolated State: are there obstacles to its expansion?

Given that I have access only to the extracts of Thünen’s work in this part, I must be careful with what I say here. Nevertheless, let me discuss my understanding of Thünen’s work with an emphasis on Subsection 6. As we all know, in Part I, Thünen assumed that the Isolated State contained only a single large town. In contrast, in Subsection 5, Thünen assumes that the plain contains many small towns of the same size located equidistant from each other, and investigates how the size of towns and the distance between them affect the pattern of agricultural production and land rent. However, in this subsection, Thünen does not discuss how the size of each city is determined nor how the distance between cities is decided, which are the main topics in the next subsection.

In Subsection 6, Thünen asks “What determines the relative position of the towns in the Isolated State in respect of size and distance from each other?” (p.285)<sup>8</sup> In studying this fundamental problem, Thünen further divides the problem into a number of more concrete questions.

<sup>2</sup> For early contributions to a systematic treatment of Thünen’s ideas in fully mathematical form, see Launhardt (1885, ch.30), Lösch (1940, ch5) and Dunn (1954). It must be noted, however, that the aspect of wage determination of farmers has been completely neglected in almost all subsequent variations of Thünen’s model except in the recent general equilibrium analyses by Samuelson (1983) and Nerlove and Sadka (1991).

<sup>3</sup> Actually, I read only extracts of Section 2 because I am unable to read German, and only extracts are available in the English translation by Carla M. Wartenberg (1966).

<sup>4</sup> Samuelson (1983, p.1468) notes that “Among geographers and location theorists, Thünen is a founding God.”

<sup>5</sup> This citation is from the title of Section 2 in Part 2 (Extract) in the English translation by Wartenberg (1966).

<sup>6</sup> This excludes the overall introduction of *The Isolated State* by Peter Hall in the English translation by Wartenberg (1966), in which Hall notes that “just before his death, he was already reaching out into general location theory, and groping towards concepts which were properly developed by others decades later.” (p.xliv)

<sup>7</sup> The titles of subsections 1 to 4 are omitted here since they are not related to the present topic of agglomeration.

<sup>8</sup> Each quotation below without the author’s name is from the English translation by Wartenberg (1966).

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