ON THE BID PRICE CURVE OF INTRA-URBAN BUSINESS

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Abstract

This paper is an attempt to generalize the bid price curve of urban firms by considering the production and demand oriented theories together. By applying the powerful envelope theorem, we derive the basic properties and the shape of the bid price curve. Contrary to Alonso, Mai and Richardson, we show that the bid price curve can be straightline, convex to the origin or concave to the origin.

I. Introduction

In his highly praised book, Location and Land Use (1), W. Alonso presented a general economic theory of urban land value and location. Perhaps the most important component of Alonso's basic model is an analytical device which he called the bid price curve. There are three different types of bid price curve: agricultural, business and residential. The residential and agricultural bid price curves have received the most attention (1, 2, 3, 7, 9, 10). However, little attention has been devoted to the bid price curve of business. Recently, C. C. Mai (6) reformulated Alonso's model in terms of neoclassical production functions and reshaped the concept of business bid price curves. In this production-oriented model, Mai showed that if the output price is assumed to decline at a decreasing rate with distance, rent will decline at a decreasing rate and the bid price curve will be convex to the origin. This is contrary to Alonso's and Richardson's results that the bid price curve is a straight line. In a recent paper in this Journal, Mai (5) incorporated the demand factor into the production-oriented model and concluded that the bid price curve of an urban firm is a straight line. The purpose of this paper is to show that Mai's result would be true only under some specific conditions. In order to facilitate the analysis, we take up a general model of intra-urban location and land use presented by Mai (5) as a basic framework to reexamine the bid price curve as a vehicle for integrating the production-demand oriented factors with location theory. In this process, we derive the basic properties of the business bid price curves and show that the bid price curve can be either a straight line, convex to the origin, or concave to the origin.

The rest of this paper is divided into three sections. Section II sets forth the basic framework and incorporates the demand factors into the familiar location model. Section III conducts the comparative static analysis and examines the basic properties of the business bid price curve. The final section is a concluding remark.

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II. Basic Model

Following Mai (5), we consider a simple connected urban area. There is a simple core in which the majority of its urban activities are located including all commodity transactions. It is the only marketing center in which consumers are clustered. On the supply side, we assume that a monopolist produces a standardized product, $Q$, with the aid of labor, $N$, and land, $L$, under the standard neoclassical production. Hence, the production function of this seller can be specified as:

\[ Q = f(N, L) \]

where $f$ is a twice differentiable, quasi-concave function with the following properties:

\[ f_N > 0, f_L > 0, f_{NN} < 0, f_{LL} < 0, f_{NL} = f_{LN} > 0, \text{ and} \]

\[ J = (f_N^2 f_{LL} + f_L^2 f_{NN} - 2f_N f_L f_{NL}) < 0 \]

We assume also that the labor market is perfectly competitive and the wage rate, $w$, is constant.

In the demand side, we assume that all consumers are homogenous and population is scattered around the core-dominated city in the constant density pattern $A$. \(^1\) Therefore, the Slutsky-Hicks type of aggregate demand for output is,

\[ Q_d = Q_d(t, m, v, y, A, a, b) = A(m + tv)^a y^b \]

The partial derivatives of $Q_d$ are

\[ Q_d t = (\partial Q_d / \partial t) = Aa(m + tv)^a - 1 y^b < 0 \]

\[ Q_d m = (\partial Q_d / \partial m) = Aa(m + tv)^a - 1 y^b < 0 \]

\[ Q_d v = (\partial Q_d / \partial v) = Aa(m + tv)^a - 1 y^b < 0 \]

\[ Q_d y = (\partial Q_d / \partial y) = Ab(m + tv)^a y^b - 1 > 0 \]

\[ Q_d A = (\partial Q_d / \partial A) = (m + tv)^a y^b > 0 \]

\[ Q_d v^2 = (\partial^2 Q_d / \partial v^2) = Aa(a - 1)(m + tv)^a - 2 t y^b > 0 \]

where $m$ is the f.o.b. mill price, $t$ is the constant freight rate per unit of output and per unit of distance, $v$ is the distance between the core and the firm's factor location, and $y$ is the per capita income. We note also that $a$ and $b$ are constants and $a < 0, b > 0, a + b = 0$.

\(^1\) For simplicity, we follow Mai (5) and assume that the density pattern is constant. However, this assumption is very rigid. It would be interesting to consider the case when the density pattern is co-determined by the price pattern of urban land. I owe this point to the referee.