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Alternative Models of Rent Control

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Discussion Paper 002

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RESEARCH PROGRAM: IMPACT OF THE PUBLIC SECTOR ON LOCAL ECONOMIES

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1. Introduction

In the typical textbook treatment, the effect of rent control on the price and quantity of housing is analyzed geometrically using a conventional supply-and-demand diagram under the assumptions that (a) rent control imposes a ceiling on the rent of a dwelling unit and (b) the level of housing services yielded by a given dwelling unit (i.e., "quality") is not variable.[1] Because assumption (b) is unrealistic, these textbook treatments are deficient in two respects. First, their predictions that effective rent control imposes losses on landlords and leads to excess demand for housing could be incorrect. Second, their analyses of the effect of rent control on quality are verbal and ad hoc, rather than based on an explicit model of the housing market.[2] One purpose of this paper is to present a geometric model of the housing market which can be used to analyze quality adjustments, and to demonstrate that under effective rent control landlords could earn profits and quality adjustments could eliminate excess demand.

Another purpose of this paper is to distinguish between two forms of rent control which have recently been confused:[3] (i) rent control that imposes a ceiling on the rent or price (p) per unit of housing service (q)[4] and (ii) rent control that imposes a ceiling on the rent (R) of a dwelling unit. In the second form rent control puts a ceiling on revenue ($R = p \cdot q$) for a dwelling unit but not on the price per unit of housing service.

This distinction is important because the two forms of rent control

could have substantially different short run effects on the housing market. Under both forms one predicts a reduction in the quantity of housing services if rent control is imposed below the initial equilibrium level on previously uncontrolled housing. However, under the first form one predicts a reduction in the price per unit of housing services while under the second form one predicts an increase. Under the first form one predicts excess demand for housing services and nonprice rationing, while under the second form there would not necessarily be excess demand because equilibrium might be re-established through adjustment of the quality of the housing stock. Also, if there is an increase in demand while rent control is in effect, under the first form one would predict that only the extent of excess demand would change while under the second form one would predict a decline in the quality of the housing stock. If there is an increase in variable costs while rent control is in effect, under the first form one would predict a decline in the quality of the housing stock while under the second form there would not necessarily be any change in the price or output of housing services. Finally, one would predict that the first form of rent control would impose losses on existing landlords while the second form of rent control might be profitable to landlords.

2. Conventional Supply-and-Demand Model

The model of the rental housing market used in the typical textbook analysis of rent control includes the following assumptions: (a) dwelling units are homogeneous, or the level of housing services yielded by a dwelling unit is not variable; (b) the rental market for dwelling units is perfectly competitive; (c) the market demand curve for dwelling units (DD in Figure 1) slopes down; and (d) the market supply curve for dwelling

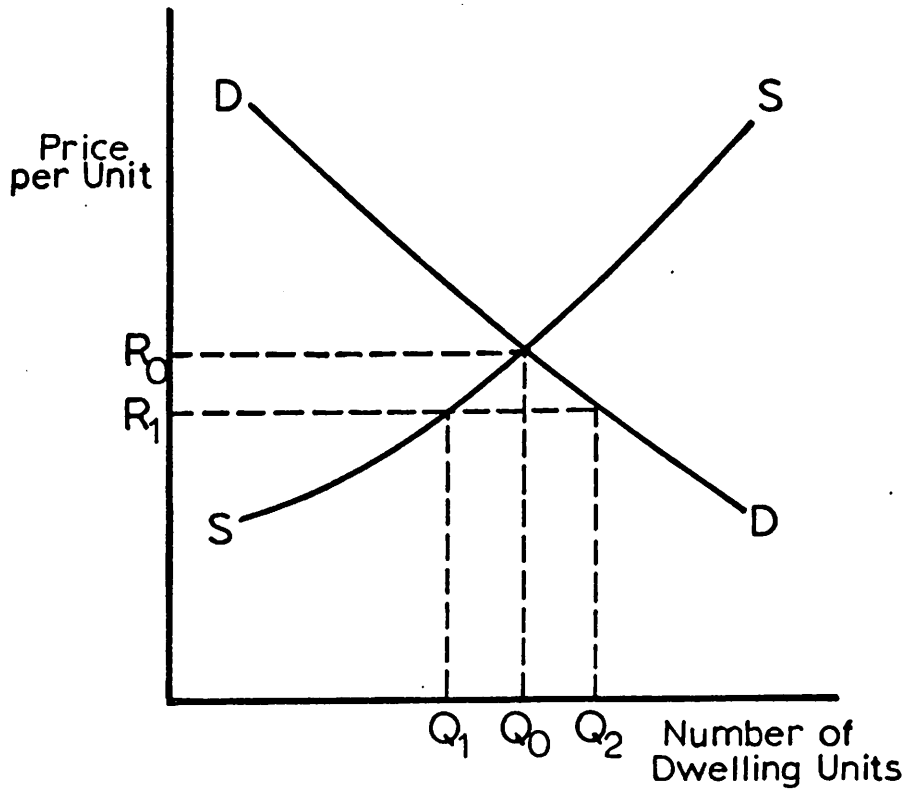

FIGURE 1: Model of Market for Rental Dwelling Units with Application to Rent Control

units (SS in Figure 1) slopes up. In the typical statement of the model the supply curve is not derived from an explicit model of the firm which supplies dwelling units, and it is not clear whether the model is intended to apply in the short run or the long run.[5] It is assumed that prior to the introduction of rent control the housing market is in equilibrium with Q_0 dwelling units and a rent of R_0 each.

It is then assumed that rent control places a ceiling $R_1 < R_0$ on the rent of all dwelling units.[6] The model yields the following predictions concerning the effects of rent control: (i) the number of dwelling units will decline from Q_0 to Q_1; (ii) the rent per dwelling unit will decline from R_0 to R_1; (iii) there will be an excess demand for $Q_2 - Q_1$ dwelling units and nonprice rationing; and (iv) under rent control an increase in demand would lead to an increase in the extent of excess demand but would not affect the number of dwelling units or the rent level. Although there is not an explicit model of the firm, this supply-and-demand model would also be consistent with the following two predictions; (v) under rent control an increase in variable costs would lead to an upward shift in the supply curve and hence to a reduction in the number of dwelling units; and (vi) rent control will impose losses on existing landlords.

Since the preceding model does not admit changes in the quality of dwelling units, the typical textbook analysis of the effect of rent control on quality is ad hoc rather than based on an explicit model of the housing market.

3. Model with Quality Variable

In this section we present a geometric model of the housing market which can be used to analyze quality adjustments. The major conceptual

difference between this model and the preceding one is that in this one homogeneous housing services yielded by dwelling units, rather than the services of homogeneous dwelling units, are the goods traded in the perfectly competitive rental housing market. In addition, unlike the preceding model, this one incorporates an explicit model of the firm. Each firm corresponds to an apartment house which produces homogeneous housing services. Finally, this model distinguishes between the short run and the long run.

We assume that the market demand curve for housing services (DD in Figure 3) slopes down and that the long run market supply curve ($S'S_{LR}$ in Figure 3) is perfectly elastic.[7] We also assume that the market for housing services is initially in long run equilibrium, so that Q_0 units of housing services are traded at a price of p_0 per unit.

The long run average cost (LRAC) curve and the corresponding long run equilibrium for a representative profit-maximizing firm are depicted in Figure 2. The firm produces q_0 units of housing service and operates with zero profits.

We define the short run period for the analysis as a period short enough that some of the costs of existing firms are fixed and new firms cannot enter the industry but long enough that the marginal cost for existing firms is not zero at any positive level of output. Thus, in the short run the stock of rental dwelling units cannot be expanded but the quality of the existing stock can be changed. The short run average cost (SRAC), average variable cost (AVC), and marginal cost (SRMC) curves for the firm at its long run equilibrium output q_0 are shown in Figure 2. The short run profit-maximizing firm's short run supply curve is the segment of the SRMC curve above the AVC curve. The short run market supply curve ($S''S_{SR1}$ in Figure 3) corresponding to the long run equilibrium output

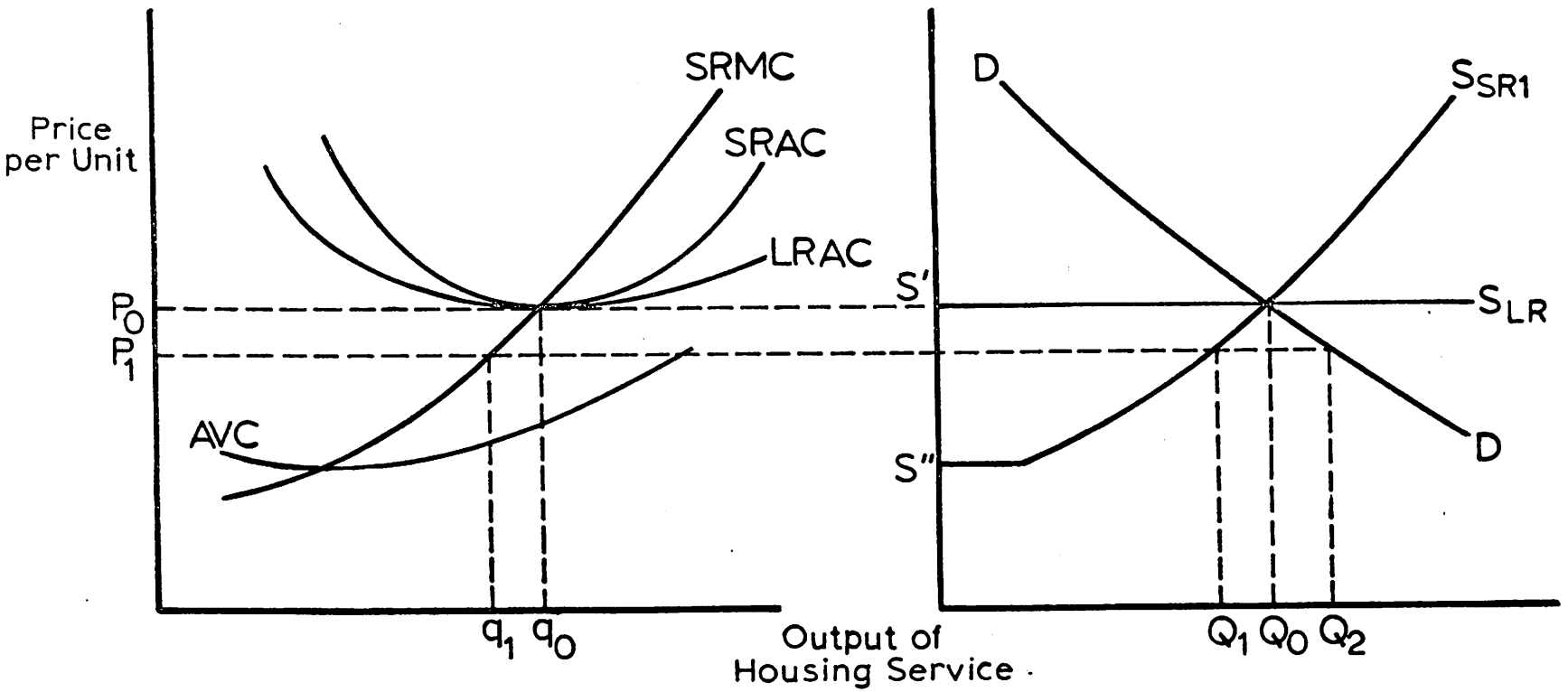

FIGURE 2: Model of Firm Supplying Rental Housing Services with Application to Rent Control as a Price Constraint

FIGURE 3: Model of Market for Rental Housing Services with Application to Rent Control as a Price Constraint

Q_0 is the horizontal summation of the short run firm supply curves.

4. Analysis of Rent Control as a Price Constraint

One hypothetical form of rent control would impose a ceiling $p_1 < p_0$ in Figure 2 on the price per unit of housing service on all existing firms in the industry.[8] The model presented in section 3 yields the following predictions concerning the short run effects of rent control of this type: (i) The aggregate output of housing services will decline from Q_0 to Q_1 in Figure 3. The representative firm in Figure 2 will allow its dwelling units to deteriorate until the flow of housing services declines from q_0 to q_1. (ii) The price per unit of housing services will decline from p_0 to p_1, and the rent per dwelling unit will decline because both the number of units of housing services per dwelling unit and the price per unit of housing service will decline. (iii) There will be an excess demand for $Q_2 - Q_1$ units of housing service, and hence there will be nonprice rationing. (iv) If there is an increase in demand while rent control is in effect there will be an increase in the extent of excess demand but no change in the output of housing services or the price level. (v) If there is an increase in variable costs while rent control is in effect, there will be a decline in the output of housing services. (vi) Landlords will suffer losses as a result of rent control, since the price p_1 is below SRAC at the output q_1.

In the long run, all rental dwelling units existing at the time rent control was imposed would be removed from the market.[9] In order to derive additional long run predictions from the model, we must specify whether new entrants to the rental housing industry would be subject to the same rent control. If new entrants would be subject to rent control, there

would be no new entrants and hence there would be no output of rental housing services. If they would be exempt from such controls, new entrants would restore the initial euqilibrium output (Q_0) and price (p_0). In the latter case, rent control would have no long run effect on the rental housing market.[10]

5. Analysis of Rent Control as a Revenue Constraint[11]

A second form of rent control would impose a ceiling on the rent of a dwelling unit. Rent control of this form would impose an inequality constraint, $p \cdot q \leq \overline{R} < p_0 \cdot q_0$, on the representative firm's revenue and would restrict the firm to price-output combinations on or below the rectangular hyperbola $p \cdot q = \overline{R}$ in Figure 4.[12]

Consequently, in the presence of the revenue constraint, the short run supply curve of the firm will consist of the segment of the SRMC curve between the AVC curve and the rectangular hyperbola, and the segment of the rectangular hyperbola above the SRMC curve, i.e., the line BEFG. The long run supply curve of the firm will be the segment of the rectangular hyperbola above the LRAC curve, i.e., the line FG.

If revenue constraints are placed at the same fraction of $p_0 \cdot q_0$ for all existing firms supplying rental housing services, the short run market supply curve would be $S"HS_{SR2}$.

The new position of short run market equilibrium would occur at the intersection of DD and $S"HS_{SR2}$.[13] The model thus leads to the following predictions concerning the second form of rent control in the short run: (i) The aggregate output of housing services will decline from Q_0 to Q_3. The representative firm in Figure 4 will allow its dwelling units to deteriorate until the flow of housing services declines from q_0 to q_3.

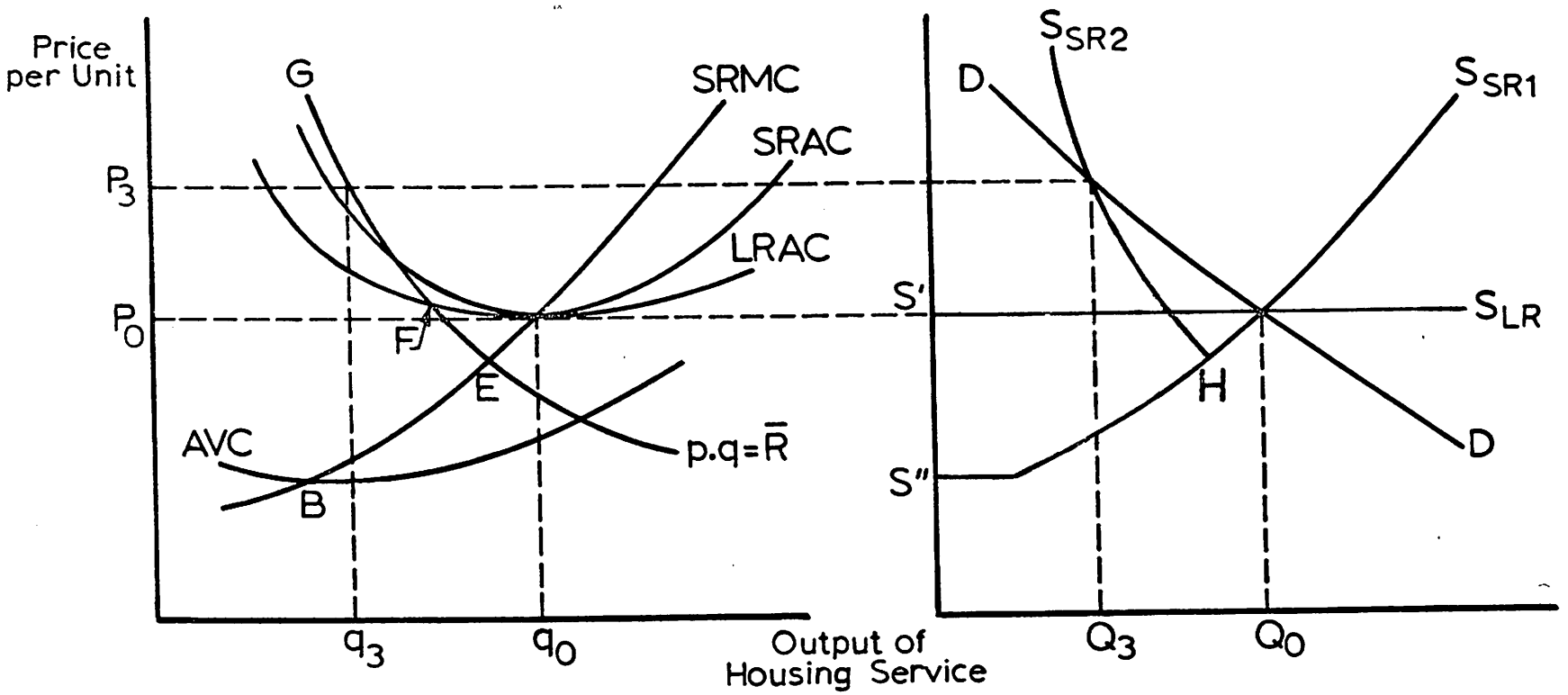

FIGURE 4: Model of Firm Supplying Rental Housing Services with Application to Rent Control as a Revenue Constraint

FIGURE 5: Model of Market for Rental Housing Services with Application to Rent Control as a Revenue Constraint

(ii) The price per unit of housing services will increase from p_0 to p_3. (iii) There will not be excess demand for housing services or nonprice rationing, because short run equilibrium will be re-established by the reduction in the quality of the housing stock.[14] (iv) If there is an increase in demand for housing services while rent control is in effect, there will be a decline in the quality of the housing stock. (v) If there is an increase in variable costs while rent control is in effect, there would not necessarily be any effect on the output or price of housing services. (vi) Finally, rent control could lead to short run profits for existing landlords, although it would not necessarily do so. In Figure 4, the representative firm would be earning profits at its new short run equilibrium output q_3. The possibility of profits occurs if the reduction in output of housing services reduces costs by more than the revenue constraint reduces revenue. Rent control could thus provide a mechanism to lead a competitive industry closer to the position of joint profit maximization.

In order to derive long run predictions concerning rent control, we must specify whether potential new entrants to the rental housing industry would be subject to rent controls. If they would be subject to such controls at a level equal to those for the representative firm in Figure 4, they would enter the industry, industry output would increase, and the price of housing services would decline until profits for the representative firm were reduced to zero. Equilibrium for the firm would be determined at point F, and equilibrium for the industry would be at the point along the demand curve where the price is at the level indicated by point F for the firm.

If new entrants to the rental housing industry were not subject to

rent controls, then in the long run new entrants would restore the initial equilibrium output (Q_0) and price (p_0). All rental dwelling units which existed at the time rent control was imposed would be removed from the market, but rent control would have no long run effect on price and output in the rental housing market.

6. Weaknesses of the Model with Quality Variable

One can question the appropriateness of several assumptions made in the model of the housing market discussed in sections 3 - 5. First, it might take a rather long period of time for a firm to adjust to a new "short run" equilibrium position. In the shorter period of time relevant to some issues in rent control, there may be narrow limits on the amount by which a profit-maximizing firm would reduce the flow of housing services from a dwelling unit. Rapid deterioration may not represent an optimal path to a lower quality level, and the "very short run" marginal cost curve for housing services might intersect the quantity axis at $q > q_3$ in Figure 4. As a result, in the very short run the firm might supply housing services at a price lower than that which would clear the market under rent control, and there would be excess demand for housing services.

Second, tenants may make expenditures to increase the flow of housing services from dwelling units subject to rent control. Consequently, a model intended to predict the effect of rent control on the quality of the rental housing stock must allow for the investment behavior of tenants.

Third, because of indivisibilities in the supply of housing services from existing dwelling units, it might not be appropriate to analyze the market for housing services in terms of single market supply and demand functions. However, if there is sufficient divisibility of households

through doubling and undoubling, we would be justified in ignoring indivisibilities on the supply side.

Apart from weaknesses of the model of the housing market discussed above, the form of rent control analyzed may not correspond to what is typically applied in the real world. Rent control may be accompanied by enforcement of codes which constrain the level of housing services or quality, rent control may be evaded,[15] rent control may be imposed on only part of the rental housing stock, and rent control may be perceived as temporary.

7. Conclusion

The distinctions between the models of the housing market and the forms of rent control discussed in this paper have been summarized in section 1. Because different sets of assumptions lead to very different predictions concerning the effects of rent control, it is important that more quantitative empirical research be done on the effects of rent control.[16]

FOOTNOTES

*I am grateful to J. S. De Salvo, J. C. Leith, J. R. Melvin, and an anonymous referee for comments on a draft of this paper. The paper has been accepted for publication in Urban Studies and is distributed in this series because of its relevance to other work to be done in the research program.

[1]Brown [1974, pp. 156-58], Eckaus [1972, pp. 508-11], Hordon [1973, pp. 71-73], and Kohler [1973, pp. 266-68]. Assumption (b) typically is not explicit, but it is implicit in the treatment of dwelling units as homogeneous commodities.

[2]See Phelps Brown and Wiseman [1964] for an analysis of rent control which is representative of the literature on both of these points. See Johnson [1951] for a detailed study of the income distributional effects of rent control which assumes that landlords lose. See Lowry [1970] for a description of the effect of rent control on the quality of the housing stock.

[3]Moorhouse [1972] confounds the two forms of rent control. For the most part his verbal discussion deals with the second form, and the data that he uses to test his predictions come from a situation where rent control evidently took the form of a revenue constraint. Yet his geometric and mathematical models are appropriate only for the first form of rent control. If he meant to analyze the second form, he has drawn his diagrams incorrectly. Thus, his prediction that under rent control an increase in demand for housing services will lead to a decrease in

quality, while correct for the second form of rent control, does not follow from the geometric model in his Figure 1 as his verbal discussion [1972, p. 95] would suggest. Furthermore, his verbal and geometric analyses of the effects of an increase in costs under rent control [1972, Figure 2 and p. 96] do not allow for the revenue constraint.

[4]See Olsen [1969a, 1969b, 1972] for a discussion of housing services as a homogeneous commodity traded in a perfectly competitive market.

[5]Eckaus [1972, pp. 508-11] explicitly applies this model to both the short run and the long run. However, it would be difficult to justify the relationship he assumes between the positions of the short run and long run supply curves.

[6]As a description of the real world, it would be more accurate to assume that rent control freezes rents at R_0 and to analyze the effeet of an increase in demand or costs on the housing market with and without rent control. However, this is not the usual practice in the literature.

[7]The horizontal long run market supply curve is based on the assumptions that all firms have the same minimum LRAC and that there are no technological or pecuniary externalities. The latter assumption permits us to construct the short run market supply curve as the horizontal summation of the short run firm supply curves. The qualitative predictions of the model concerning the effects of rent control would be virtually unchanged if the long run market supply curve sloped upward. The only difference is that in the case of rent control as a price constraint not all dwelling units existing at the time rent control was imposed would

necessarily be removed from the market.

[8]This form of rent control could be imposed by (a) placing a ceiling on the rent of a dwelling unit and (b) providing that the ceiling would be adjusted if the level of housing services yielded by the dwelling unit changed. Although rent control legislation sometimes makes provision for such adjustments, the problems of measuring the quantity of housing services and the required appeal procedures are so burdensome that such adjustments are only partial. Consequently, this form of rent control does not exist in the real world in its pure form. In the academic literature, this form of rent control appears in Moorhouse [1972, Figures 1 and 2].

If only part of the rental housing stock were subject to rent control, the analysis would be more complicated. The controlled dwelling units operated by the firm depicted in Figure 2 might be voluntarily vacated by the tenants before the output of housing services declined to q_1. Faced with this prospect, the profit-maximizing landlord might not reduce the flow of housing services to q_1, unless the rent control law provided that his dwelling units would be decontrolled when the initial tenants move. A similar complication arises if households substitute owner-occupied for rental housing.

[9]One could arrive at a different conclusion if one assumed that existing units would eventually be decontrolled, e.g., when they were vacated by the tenants who occupied them at the time rent control was imposed.

[10]This conclusion ignores general equilibrium effects which might result from the redistribution of income during the transition to the new long run equilibrium.

[11]The model presented in this paper was developed before I learned that Olsen [1969b] had independently used a rectangular hyperbola revenue constraint to analyze the effects of rent control. Olsen's analysis differs in a number of respects from that presented here because Olsen assumes that rent control is imposed on only part of the rental housing stock and that the rents of controlled dwelling units will be decontrolled when the units are vacated by the tenants who occupied them at the time controls were imposed.

[12]If the firm is an apartment house, rent control imposes a constraint on the revenue of each dwelling unit as well as on the revenue of the firm as a whole. However, this additional set of constraints in unimportant here since we can assume that all dwelling units and rent control ceilings for a given firm are identical.

[13]If the price elasticity of demand was always less than or equal to unity, the curves would not intersect. On the other hand, the demand curve could intersect $S''HS_{SR2}$ more than once. In the latter case, any equilibria where the demand curve intersected $S''HS_{SR2}$ from above would be unstable, but there would be a stable equilibrium at a lower price. The demand curve could also be tangent to $S''HS_{SR2}$. In this case, the tangency equilibrium would be stable from below and unstable from above.

[14]This prediction would have to be qualified if certain assumptions of the model did not hold. See section 6 below.

[15]For an analysis of the effect of a price ceiling on price and quantity when the price ceiling is subject to evasion, see Becker [1971, pp. 106-109].

[16]The only careful quantitative analyses of rent control with which the author is familiar are De Salvo [1970], Johnson [1951], and Olsen [1972]. (Note: After the final draft of the present paper was completed, I received a copy of another study which should be added to this list: E. J. Arnault, "Profit-Maximizing Expenditures for Maintenance of New York City's Rent-Controlled Housing," Ph.D. Thesis, Department of Economics, University of Pennsylvania, 1973.)

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