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Perverse General Equilibrium Effects of Price Controls

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Perverse General Equilibrium Effects of Price Controls

If an imperfectly competitive firm sells capacity-constrained output in two jurisdictions, a price control in one jurisdiction can benefit or hurt consumers in the other jurisdiction. Examples include firms that sell goods that cannot practically be stored—such as electricity or agricultural products—in two states or countries, only one of which imposes a price ceiling.

To illustrate the idea as simply as possible, we consider the decision of a profit-maximizing monopoly that produces output at a constant marginal cost, m, up to its maximum capacity, $\bar{Q}$. It sells $Q_j > 0$ in jurisdiction $j = 1, 2$. In each jurisdiction, the inverse demand curve is $p_j(Q_j)$ and the revenue is $R_j(Q_j) = p_j(Q_j)Q_j$. If a price cap is imposed only in Jurisdiction 1, $p_1(Q_1) \leq \bar{p}$.

First, suppose no price cap is used, so that the relevant Lagrangean problem is

$$\max_{Q_1, Q_2, \lambda} L = R_1(Q_1) + R_2(Q_2) - m[Q_1 + Q_2] + \lambda[\bar{Q} - Q_1 - Q_2], \tag{1}$$

where λ is the Lagrangean multiplier associated with the capacity constraint. The Kuhn-Tucker first-order conditions are

$$L_{Q_1} = R_1'(Q_1) - m - \lambda = 0, \tag{2}$$

$$L_{Q_2} = R_2'(Q_2) - m - \lambda = 0, \tag{3}$$

$$L_\lambda = \bar{Q} - Q_1 - Q_2 \geq 0, \tag{4}$$

$$\lambda L_\lambda = 0, \tag{5}$$

$$\lambda \geq 0. \tag{6}$$

If the capacity constraint binds, Equation (6) holds with a strict inequality, $\lambda > 0$, and hence Equation (4) holds with equality. Equating Equations (2) and (3), we find that the marginal revenues in both jurisdictions are equal to each other and to the marginal opportunity cost:

$$MR_1 = MR_2 = m + \lambda, \tag{7}$$

where $MR_j \equiv R'_j \equiv dR_j/dQ_j$, λ is the shadow price of extra capacity, and $m + \lambda$ is the marginal cost of an extra unit sold in one jurisdiction. Figure 1 illustrates the equilibrium in Equation (7). In the figure, Q_1 is measured from left to right, Q_2 is measured from right to left, and the length of the quantity (horizontal) axis is $\overline{Q}$. The intersection of the two marginal revenue curves determines the amount of output sold in each jurisdiction and the shadow price of capacity: The height of the intersection point is $m + \lambda$.

Now suppose that there is a binding price constraint in Jurisdiction 1, so that the price in that jurisdiction is $\overline{p}$. Then the new problem is

$$\max_{Q_1, Q_2, \lambda} \; L = \overline{p}Q_1 + R_2(Q_2) - m[Q_1 + Q_2] + \lambda[\overline{Q} - Q_1 - Q_2]. \tag{8}$$

The solution is of the same form as before, except that the marginal revenue in the first jurisdiction is now $\overline{p}$, so the condition that $MR_1 = MR_2$ becomes $\overline{p} = MR_2$.

Figure 2 shows that a binding price control in Jurisdiction 1 may either raise or lower the price in Jurisdiction 2. The figure illustrates that the impact of the price control depends on where the MR_2 curve intersects the price control line at $\overline{p}$ and the MR_1 curve. When the price control binds, the relevant MR_1 curve is horizontal at $\overline{p}$ until it hits the demand curve, it then jumps (shown by a vertical dotted line) down to the original MR_1 curve.

The relatively high MR_2^A curve intersects MR_1 at point *a* and the price control line at *b*. Thus, the effect of the control is to reduce the amount of Q_1 to that at *b*, and to create a shortage equal to the difference between the quantity of Q_1 at *c* and *b*. Meanwhile, the quantity of Q_2 expands from that at *a* to that at *b*. Consequently, the price control causes prices to drop in both jurisdictions and creates a shortage in one. [In a price-taking world with a binding capacity constraint only this effect is possible.] For example, the 2002 price controls in Zimbabwe caused a shortage of sugar in that country and the price of sugar to fall in Zimbabwe and in surrounding countries.[1]

Given the MR_2^B curve, imposing the price control causes Q_1 to increase from *d* to *e*, a shortage equal to the difference in Q_1 at *c* and *e*, Q_2 to decrease from *d* to *e*, and hence p_2 to rise. The analysis is very similar with MR_2^C, however there is no shortage in Jurisdiction 1 because the quantity of Q_1 is the same at *g* and *c*. [There are several additional possibilities if the capacity constraint does not bind, but as we have shown that the key price effects can go in either direction, there is little point in describing them.]

Thus, a price control in one jurisdiction can have the "expected" result of decreasing output in that jurisdiction and thereby increasing output and lowering price in the other jurisdiction. However, the opposite quantity effect is also possible. This regulation may increase output to the first jurisdiction, and reduce output and raise the price in the second jurisdiction.

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[1] "Zimbabwe; Makoni Admits Price Controls to Blame for Thriving Black Market," *The Daily News*, May 10, 2002.

Figure 1

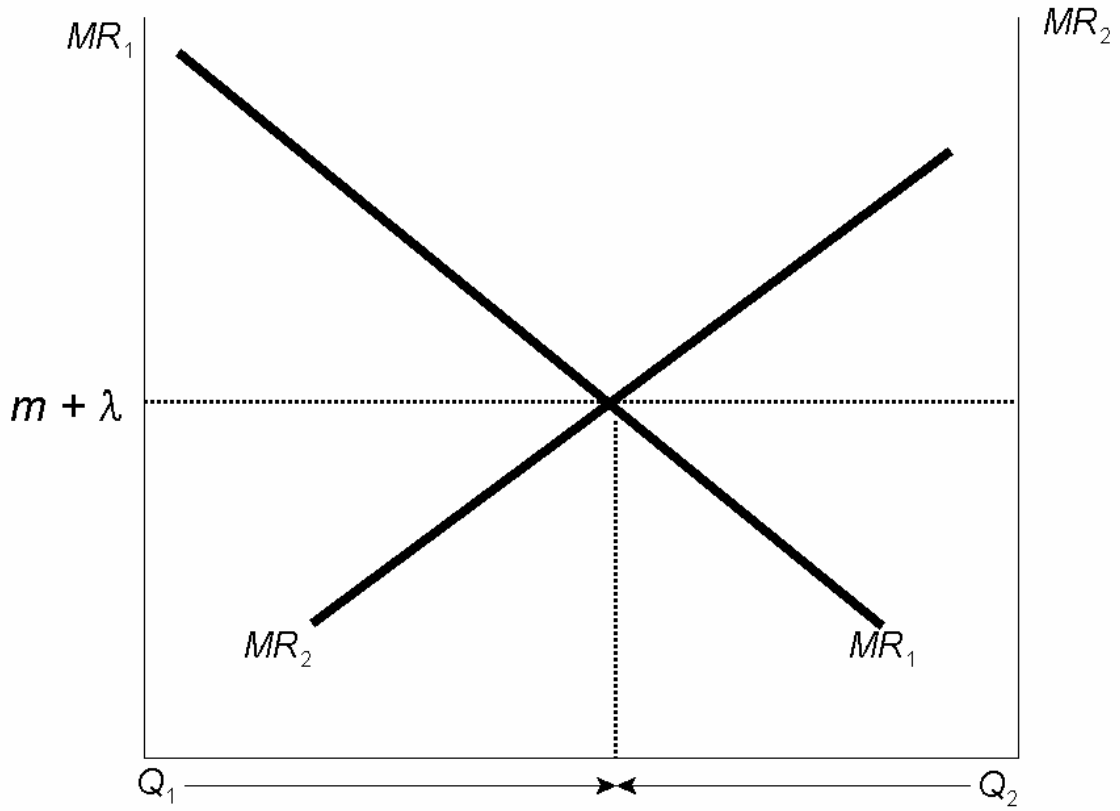
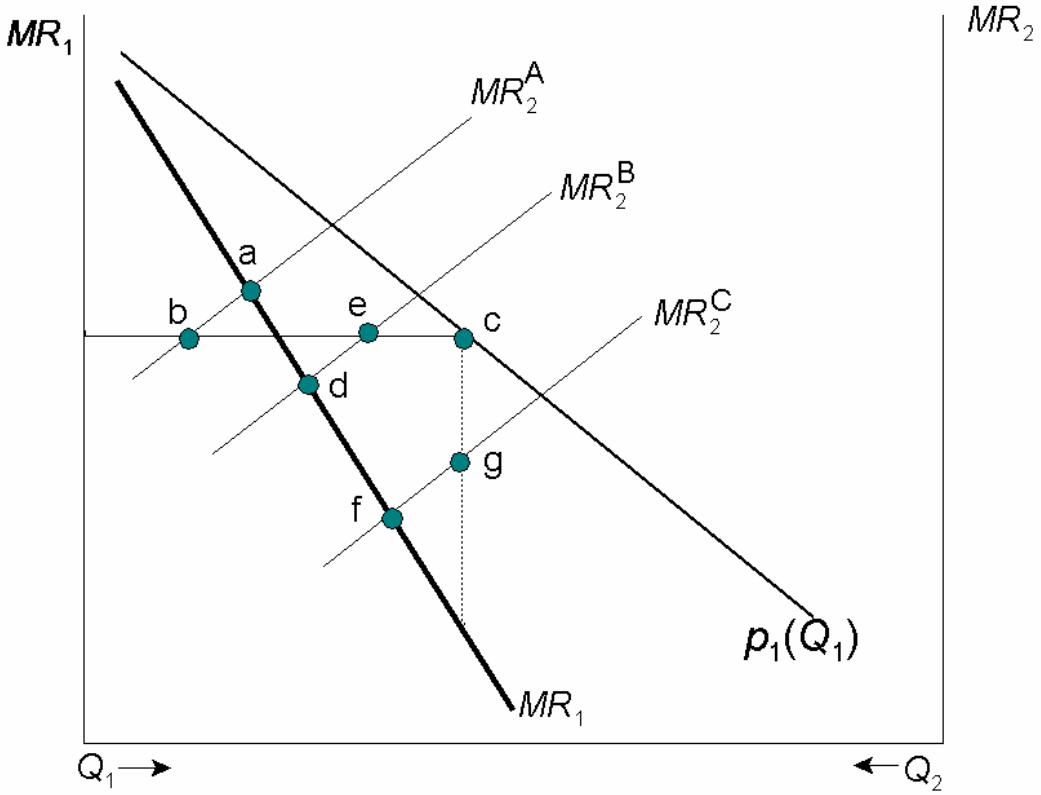
Figure 2