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AUTHOR: Daniel Berkowitz
University of Pittsburgh

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1755 Massachusetts Avenue, N.W.
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CONTRACTOR: University of Arizona

PRINCIPAL INVESTIGATOR: Beth Mitchneck and Daniel Berkowitz

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Price Liberalization and Local Resistance

JEL Classification: P22, P35 and H42

Daniel Berkowitz*
Assistant Professor
Department of Economics
University of Pittsburgh
Pittsburgh, PA 15260

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Abstract

Many economic theorists and policy makers have argued that a rapid liberalization of state-sector prices in the formerly centrally planned economies is critical for a successful transition to a market economy. This paper does not dispute the wisdom of free-market pricing. However, it does offer an explanation of why local governments have resisted raising prices of many consumer goods.

This paper argues that under the new conditions in which voting has become more important, local governments have a consumption bias. An alternative way of stating this is to say that they are willing to forego an increment of locally generated profits in order to increase consumer welfare. The existence of a consumption bias explains why local governments would continue to hold down prices when private-capacity holdings are sufficiently low. It also predicts that once private-capacity holdings reach a sufficiently large level, a local government would increase both consumer and producer surplus and, when there is more than one private firm, stabilize private pricing by supporting a price liberalization.

Because of the slow progress of large-scale privatization in the former Soviet Union and Eastern Europe, state-owned enterprises continue to coexist with an emerging private sector. Despite the advantages of a flexible price system, many state firms continue to charge prices at which demand exceeds supply. A case in point is the recent experience of the Russian Republic. On January 2, 1992, President Yeltsin issued a decree which released approximately 90 percent of retail prices and 80 percent of wholesale prices from administrative control (Bush 1991: 22; Decree 1991). Yet during the course of the year, many local governments continued to order their state firms to maintain prices below market levels.
Local government resistance to market pricing is most evident in consumer goods and services. When the price liberalization began, the Russian federal government established regulated prices for fourteen basic food products such as salt, sugar, bread, and dairy products. Although most local governments did not receive sufficient federal funding to support these low prices, "in many regions the mandatory list was expanded at the initiative of the local administration" (Demchenko 1992: 29). During the first half of 1992, prices of some twenty-seven food groups were controlled by local authorities. In the second quarter of 1992, the Russian federal government gradually began to lift price restrictions on basic foodstuffs. However, most local governments continued subsidies with funds from their own budgets (Demchenko 1992a: 29). Table 1 shows that in mid-1992 and mid-1993, many local governments continued to administer food prices.

The objective of this paper is to model the conditions under which a local government would support or resist a price liberalization in its state retail stores. A liberalization means that the state price is allowed to rise to a level in which demand is no less than supply. A local government resists liberalization when it sets a state price at which demand exceeds supply. While local resistance and support for centrally mandated price liberalization is generally relevant for economies in transition, the argument in this paper is based on the Russian experience.1

Recent papers by Boycko (1992), Osband (1992), and Weitzman (1991) argue that the persistence of prices at which demand exceeds supply in formerly centrally planned economies

---

1 For an account of how local authorities resisted a federally mandated price liberalization in Mongolia, see Murrell, Turner, and Korson (1992).
Table 1
Controls on Food Prices, mid-1992 and mid-1993
for a sample 132 Russian Cities

<table>
<thead>
<tr>
<th>Product</th>
<th>Proportion of Cities where the price remained controlled around July 1, 1992 (in percentages)*</th>
<th>Proportion of Cities where the price remained controlled around July 1, 1993 (in percentages)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>44</td>
<td>33</td>
</tr>
<tr>
<td>Kefir</td>
<td>36</td>
<td>23</td>
</tr>
<tr>
<td>Fat cottage cheese</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Rye bread</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Mixed rye-wheat bread</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Grade 1 and 2 wheat bread</td>
<td>32</td>
<td>48***</td>
</tr>
<tr>
<td>Top-quality wheat bread</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>30</td>
<td>14</td>
</tr>
<tr>
<td>Salt</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Meat products</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Butter</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>14</td>
<td>7</td>
</tr>
</tbody>
</table>

** State Committee of Statistics (Goskomstat) for the Russian Federation.
*** This figure combines all four bread groups.
cause major welfare losses because they induce agents to engage in unproductive activities such as queuing, hoarding, bribery, and search. While these papers argue that a rapid price liberalization is critical to a successful reform, they do not explain why prices that are not market-clearing persist.

Shleifer and Vishny (1992) argue that an important reason for this persistence is the "self-interested behavior by the ministry bureaucrats who set planned prices and outputs" (p. 238). They contend that because the state sector profits tax is typically very high, if markets cleared, most of the state firm's reported profits would flow directly into the state treasury. By maintaining rationing, ministerial bureaucrats and their managers reap bribe revenues which tend to be much larger than the share of official profits that the bureaucrats and the managers are allowed to keep. And because the bribes are not official transactions, none of them goes to the treasury. As a result, the industry is better off creating a shortage of the goods and collecting the bribes than making the official profits it cannot keep. To collect bribes, socialist industries will always try to produce a level of output entailing a shortage at official prices. (p. 238.)

This paper argues that another reason for the persistence of rationing in many regions is that local government politicians (deputies) are trying to win the loyalty of their constituents, who now have the power to vote them out of office. Depending upon local market conditions, a local government maximizes constituent loyalty by either resisting or supporting a state-sector price liberalization.
When the Soviet Union was intact, local governments (local soviets) were responsible for overseeing pricing, sales, payments, and tax collection in state enterprises providing consumer goods to their constituents (see Berkowitz and Mitchneck 1993: 4-6, and Wallich 1992). Under the current system, Russian oblasts (districts) have received more responsibility for managing consumer goods enterprises and the lower level cities and rayons (districts within a city) now have the responsibility to regulate prices in many state consumer enterprises and organizations.

Local government incentives have changed dramatically. Before Gorbachev’s perestroika, local voting was a pro-forma exercise which generally legitimized candidates chosen by local party officials. In principle, deputies to the local soviets were supposed to represent their constituents. However, since spending and hiring policies were for the most part made by higher level organizations (Hahn 1991: 93), local deputies were more accountable to the bureaucrats in these organizations than to their own constituents.

During the perestroika, deputies to the local soviets ran for office in competitive elections for the first time. The extent to which the local deputies are accountable to their constituents is controversial. As Jeffrey Hahn notes:

Critics of the soviets contend that the 1990 elections … did not accurately reflect voters’ preferences because they were manipulated by existing authorities. This view may have some merit, but there was little evidence of widespread cheating.

(Hahn 1992: 10.)

Since elected deputies do not have to run for office in another round of competitive elections until 1995 (unless early elections are called for), it is not clear how well developed their sense
of accountability to their constituents is. However, the potential for electoral accountability clearly is greater than under the old system of local governance.

The different regions within the former Soviet Union have always had different mixes of private and public (state) provision of consumer goods. This paper argues that the capacity of the local private sector to provide consumer goods is an important predictor of whether a local government resists or supports a state sector price liberalization. When privately controlled capacity is small, a local government may maximize the loyalty of its constituents by resisting a price liberalization. A low state sector price forces a small private sector to price at the competitive level and provides a discount to shoppers in the state sector.

When privately controlled capacity is sufficiently large, a local government will either resist or support a price liberalization. A large private sector has market power and always prices above the competitive level. By resisting liberalization, a local government still provides a discount to shoppers in the state sector. However, a low state sector price induces a large private sector to withhold goods from the market and to charge the monopoly price. Liberalization induces a large private sector to cut its price and sell at full capacity. However, in a liberalization regime, state sales fall and shoppers in the state sector do not receive a discount.

Thus, the message of this paper is that it is the market power of a large private sector which is necessary for a local government to liberalize. Specifically, a local government supports liberalization when the gains in constituent loyalty from curtailing the monopolistic behavior of a large private sector exceed the losses in loyalty caused by a higher state-sector price and lower
state-sector sales. A basic result is that a local government is more likely to liberalize as private capacity and state-sector costs increase.

This paper is related to two bodies of literature. Papers by Rees (1984, Section 7.1), Bos (1986), Hagen (1979), Harris and Wiens (1980), and Beato and Mas-Colell (1984) analyze how a public (state) firm in competition with a private firm can improve efficiency in an imperfectly competitive market. These contributions analyze the extent to which a public firm should optimally deviate from marginal cost pricing under different assumptions regarding the timing of the public/private interaction. In all of these studies, markets clear. This paper extends these works by incorporating disequilibrium pricing.

This paper also uses the literature on price competition under capacity constraints that began with Edgeworth (1897) and continues with Levitan and Shubik (1972), Kreps and Scheinkman (1983), Brock and Scheinkman (1985), Davidson and Deneckere (1986), and Deneckere and Kovenock (1992). In these studies, all firms maximize profits. In this paper, although a private firm maximizes profit, the state firm maximizes constituent loyalty.

The paper is organized in the following manner: Section I sets up the model for an economy with a state and a private firm. Section II analyzes the reasons for persistence of price controls when the private sector is small. Section III argues that a local government's incentive to liberalize increases as the private sector grows larger. Section IV extends the analysis to a local economy with two private firms and argues that a price liberalization can eliminate private sector price volatility. Section V concludes.
I. The Model

In a local market, there is a capacity profile, \((k_s, k_p)\), in which \(k_s\) and \(k_p\) are state and private components controlled by a local government and a private firm. The analysis is restricted to the short run, and each firm can sell up to \(k_s\) and \(k_p\) units of a homogeneous consumer good at a constant per-unit cost. The state firm may be at a cost disadvantage, and, private costs are normalized: \(c_s \geq c_p = 0\). The market demand curve, \(D(p)\), is linear, and the inverse market demand curve is given by \(P(q) = a - q \geq 0\).

To focus on the local government’s rationale for setting prices at which demand exceeds supply, several assumptions are employed. First, capacity is insufficient to cover the entire potential of a market, and:

\[
P(k_s + k_p) = a - k_s - k_p > c_s \geq c_p = 0
\]  

(A1)

where \(P(k_s + k_p)\) denotes the competitive price. Assumption (A1) says that both firms can earn positive profits at the competitive price. Second, when there is price differentiation, consumers first buy from the cheapest supplier, and income effects are absent. Third, when there is no price dispersion, all consumers prefer the state good.\(^2\) Therefore, when \(p_s \geq p_p\), the private firm faces the residual demand curve of \(a - p_p - k_s \geq 0\), and sells \(z_p\):

\[
z_p = \min (k_p, \max (0, a - p_p - k_s))
\]  

(1.1)

When \(p_s > p_p\), the state faces the residual demand curve of \(a - p_s - k_s \geq 0\), and sells \(z_s\):

\[^2\text{The analysis could be conducted under the more general rule (see Kreps and Scheinkman, 1983: 328, eq. 3) in which consumers are indifferent between the two sellers when there is no price differentiation.}\]
\[ z_s = \min (k_s, \max [0 - p_s - k_p]) \] (1.2)

The rationing scheme underlying this specification of residual demand is called the efficient rationing rule.\(^3\)

A simple strategic interaction between the state and private firm is assumed. The structure of demand and capacity holdings are common knowledge, and there are two periods. The local government moves first and irrevocably sets the state firm's price. In the second period, the private firm chooses a price. The goods are then sold in the local market.\(^4\)

The private firm maximizes its profits:

Choose \( p_p \in [0, a] \):

\[ \max p_p z_p \] (1.3)

In order to gain the loyalty of its constituents, the local government maximizes a weighted sum of consumer surplus, \( CS \), and aggregate private and state sector profits (producer surplus), \( \Pi \):

---

\(^3\) This rationing rule was first used by Levitan and Shubik (1972) and has since been employed by Brock and Scheinkman (1985) and Kreps and Scheinkman (1983), among others.

\(^4\) The order of moves reflects a situation in which the private firm is more flexible in its pricing policy than the state firm. The state firm may have significant "menu costs" since pricing decisions are subject to the approval of government officials who do not work directly for the firm. However, an unregulated private firm can simply change its price without bureaucratic interference. For a discussion of how the order of moves could be endogenized in this class of models, see Deneckere and Kovenock (1992).
Choose \( p_s \in [c_s, a] \):

\[
\text{Max } + (1 - \lambda)CS \lambda II
\]

Since \( p_s \) is constrained: \( p_s \leq c_s \), the state firm has a break-even constraint. This could be relaxed to incorporate subsidies with no loss of generality. An alternative specification for the local government, when it cannot collect taxes from private producers, would be to maximize the weighted sum of consumer surplus and state-sector profits. In the appendix, it is shown that this alternative has no impact on the results of this paper.

The analysis is limited to cases in which the local government has a consumption bias:

\[
\lambda \in [0, .5]
\]

The consumption bias assumption fits with three aspects of the current local environment in Russia. First, local politicians must be more responsive to their constituents, most of whom are consumers who do not directly benefit from gains in state or private-sector profits. Second, local state enterprises have become a weaker tax base for the following reasons: the enterprise profits tax has been lowered, much of the collection is controlled by nonlocal administrators; many state enterprises are in arrears and are unable to make payments (see Ickes and Ryterman 1992). Third, the private sector is an unreliable tax source for local governments. This suggests that a local government would put a higher weight on consumer surplus than producer surplus.

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5 I wish to thank members of the Yaroslavl' city and oblast (district) government, especially V.V. Istominova, for emphasizing this point to me during interviews conducted in the summer of 1992.
II. A Small Private Sector

When the private sector is small, a local government resists liberalization and sets $p^*_i = c, < P(k_p + k)$. The logic of this result is straightforward. Any profit-maximizing firm sets at least the competitive price, $P(k_p + k)$. However, a profit-maximizing firm with sufficiently small capacity always sets a full-capacity price. By setting a price below the competitive level, the local government drives down the private-sector price to the competitive level. Furthermore, when $p_s < p_p = P(k_p + k)$, the state firm services the high valuation consumers and has the potential to earn profits of $[P(k_p + k) - c]k$. However, since the local government has a consumption bias, it sets $p^*_i = c$, and transfers these potential profits to consumers in order to win their loyalty.

The next lemma establishes that any profit-maximizing firm sets at least the competitive price, $P(k_p + k)$.

Lemma 2.1. The private firm sets $p_p \geq P(k_p + k_p)$.

Proof (see Kreps and Scheinkman, 1983, Lemma 2). By naming $p_p < P(k_p + k)$, private profits are at most, $p_p k_p$. By setting $p_p \geq P(k_p + k)$, private profits are at least, $P(k_p + k_p)k_p$.

By lemma 2.1, the private firm maximizes profits according to the program.
Choose $p_p \in [P(k_p, k_i), a]$:

$$\begin{align*}
\max \left[ \begin{array}{l}
\max_{p_p} \min(k_p, \max(0, a - p_p - k_i)) \quad \text{s.t. } p_p \geq p_i,
\max_{p_p} \min(k_p, a - p_p) \quad \text{s.t. } p_p < p_i
\end{array} \right]
\end{align*}$$

The private sector is small if it lacks the capacity to capture monopoly profits when $p_p \geq p_i$, and it faces the residual demand curve $a - k_p - p_p$. Thus a small private firm operates at full capacity when it services residual demand. By inspection of the private firm's program $(P)$, $p_p \geq p_i$, and $z_p = k_p$ imply that $p_p = a - k_p - k_i = P(k_p + k_i) \geq p_i$, and private profits are $\Pi_p = P(k_p + k_i)k_p$. Since the private firm is capacity constrained, $\partial \Pi_p / \partial k_p = a - 2k_p - k_i \geq 0$. Therefore, the private sector is small when

$$2k_p + k_i \leq a \quad (2.1)$$

Figure 1 illustrates the capacity space $(k_p, k_i) \in \mathbb{R}^2$ for a local market. All points to the southwest of segment BCD satisfy the assumption (A1) that $P(k_p + k_i) > \epsilon_{j}$. Thus, the set OBD, with open upper bound BCD, is the feasible set. Segment AC contains the set of feasible capacity profiles: $2k_p + k_i = a$. Thus, the private sector is small when the capacity profile is contained in the set OACD, in which segment CD is an open upper bound.

The next proposition derives the optimal private-pricing policy when the private sector is small.

**Proposition 2.1**: If $2k_p + k_i \leq a$, and both firms have positive market share, then

i) the private sector never operates with excess capacity, and
Figure 1

- **Large private sector**
- **Small private sector**
ii) \( p_p(p_p) = P(k_p + k_p) \): \( p_p \leq P(k_p + k_p) \)

iii) \( p_p(p_p) = p_s - e \): \( P(k_p + k_p) < p_s < a - k_p \)

Proof: see the appendix.

The basic logic of proposition 2.1 is straightforward. By lemma 2.1, \( p_p \geq P(k_p + k_p) \). Thus, if \( p_s \leq P(k_p + k_p) \), then \( p_p \geq p_s \) and private firm operates at full capacity and sets a competitive price \( P(k_p + k_p) \). When \( P(k_p + k_p) < p_s < a - k_p \), the small private firm may either service residual demand or undercut the state firm. If the private firm sets \( p_p \geq p_s \) and services residual demand, then \( P(k_p + k_p) < p_s \leq p_p \), which implies that \( z_p = a - k_p - p_p \leq a - k_p - p_s < k_p \), and the private firm operates with excess capacity. This is not an optimal policy, since a small private firm servicing residual demand operates at full capacity. Therefore, when \( P(k_p + k_p) < p_s < a - k_p \), a small private firm undercuts the state firm and operates at full capacity.

Thus when \( c_s \leq p_s < a - k_p \), and the private sector is small, the private firm operates at full capacity. When the state firm prices above the competitive level, then \( z_p = k_p \), \( z_s = a - k_p - p_p < k_p \), and there is excess state capacity. However, if \( p_s \leq P(k_p + k_p) \), then the private price is the competitive price, and all local capacity is sold: \( z_p = k_p, z_s = k_p \). Clearly constituent loyalty is higher when the state firm prices at or below the competitive level. This idea is formally analyzed in the next proposition.

Proposition 2.2: If \( 2k_p + k_s \leq a \), then \( a - k_p > p_s > P(k_p + k_p) \) is not an optimal state sector pricing policy.

Proof. If \( a - k_p > p_s > P(k_p + k_p) \), then
CS = \[a - .5k_p - p_s + e\]k_p + .5(a - k_p - p_s)^2,

II = (p_s - c_s)(a - k_p - p_s) + (p_s - e)k_p, and

\[
\frac{d}{dp_s} [(1 - \lambda)CS + \lambda II] = -(1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s) < 0
\]

when \(\lambda \in [0, .5].\)

According to proposition 2.2, if \(p_s > P(k_p + k_r)\), the local government would increase its payoff by cutting the state-sector price. The assumption of a consumption bias is sufficient, though not necessary, for the gain in consumer surplus to outweigh the possible loss in consumer surplus.\(^6\)

Figure 2 illustrates the local market when \(p_s \leq P(k_p + k_r)\) and \(p_s = P(k_p + k_r)\). When \(p_s = P(k_p + k_r)\), consumer surplus is the area of triangle EFG and producer surplus is the area of the pentagon HFGKIL. By driving down the state-sector price to \(c_s\), a local government transfers state firm profits (area of rectangle HFJL) to the consumers which it services. Thus, the following proposition holds.

\(^6\) By inspection of the expression for \(\frac{d}{dp_s} [(1 - \lambda)CS + \lambda II]\), in the proof of proposition 2.2, a necessary and sufficient condition is:

\[
\lambda(2a + c_s - 3p_s) < a - p_s.
\]

Condition (i) always holds when \(3p_s \geq 2a + c_s\). When \(3p_s < 2a + c_s\), then (i) holds when

\[
\lambda < \frac{a - p_s}{2a + c_s - 3p_s},
\]

where \(p_s > c_s\) implies that \(\frac{a - p_s}{2a + c_s - 3p_s} > .5\).
Figure 2
Proposition 2.3 If \(2k_p + k_s < a\), then \(p^*_s = c_s\) is the optimal state sector pricing policy.

Proof. By proposition 2.2, if the state-sector price is optimal, then \(c_s = p_s = P(k_p + k_s)\) and

\[
CS = [a - 5k_s - p_s]k_s + .5(k_p)^2
\]

\[
\Pi = (p_s - c_s)k_s + P(k_p + k_s)k_p, \text{ and}
\]

\[
\frac{\partial[(1 - \lambda)CS + \lambda\Pi]}{\partial p_s} = (2\lambda - 1)k_s < 0,
\]

when \(\lambda \in (0, .5)\).

III. A Large Private Sector

The private sector is large if it has the capacity to capture monopoly profits when it services residual demand. If the large private firm sets \(p_p = p_s\), then

\[
p_p = .5(a - k_p), \quad z_p = .5(a - k_p) < k_p
\]

\[
\Pi_p = .25(a - k_p)^2
\]

The inequality \(z_p < k_p\) implies that the private sector is large when

\[
2k_p + k_s > a
\]

A large private sector is illustrated in the open set ABC in figure 1.

The large private firm could also undercut the state firm:

\[
p_p = p_s - \epsilon, \quad z_p = k_p
\]

\[
\Pi_p = (p_s - \epsilon)k_p
\]

The large private firm's decision to either undercut the state firm or to service residual demand depends on \(p_s\). Let \(\Pi_p(p_p < p_s)\) and \(\Pi_p(p_p \geq p_s)\) denote private profits for either strategy.
Then the private firm will undercut when \( \Pi_p(p_s < p) > \Pi_p(p_s \geq p) \). Otherwise, it will set an excess-capacity price. Clearly the higher \( p_s \) is, the more profitable it is for the large private firm to undercut the state firm. This idea is formally analyzed in the next proposition.

**Proposition 3.1** If \( 2k_p + k_s > a \), and both firms have positive-market share, then

\[
\begin{align*}
(i) & \quad p_s(p_s) = 0.5(a - k_s); \quad p_s < \frac{25(a - k_s)^2}{k_p}, \text{ where} \\
& \quad z_p < k_p, z_s = k_s; \\
(ii) & \quad p_s(p_s) = p_s - c_s; \quad p_s > \frac{25(a - k_s)^2}{k_p} > P(k_p + k_s), \text{ where} \\
& \quad z_p = k_p, z_s < k_s.
\end{align*}
\]

*Proof:* See the appendix.

When the local government prices in the high range: \( a > p_s \geq \frac{25(a - k_s)^2}{k_p} \), there is excess state capacity and the private sector operates at full capacity. However, when the local government prices in low range: \( \frac{25(a - k_s)^2}{k_p} > p_s \geq c_s \), there is excess private capacity and no excess state capacity.

When \( p_s \) is in the high range, a local government would price at its lower bound: \( p_s = \frac{25(a - k_s)^2}{k_p} \). There are two reasons for this. First, a cut in \( p_s \) lowers the level of excess state
capacity, $k - z = k + k_p - a$. Since more consumers can buy state goods at a lower price, the gain in state-sector consumer surplus exceeds any possible loss in state-sector profits. Second, a cut in $p_s$ induces a cut in the private-sector price, $p_p = p_s - e$. Since the private firm sells at full capacity, a cut in $p_p$ results in a one-to-one transfer of private profits to consumers.

When $p_s$ is in the low range, a local government would price at its lower bound: $p_s = c_s$. State sector pricing in the low range has no impact on private pricing or sales, since $p_p = 0.5(a - k)$, $z_p = 0.5(a - k)$. However by setting $p_s = c_s$, the local government transfers potential state-sector profits of $[P(k_p + k) - c_s]k_s$ to consumers in the state sector in an effort to win over their loyalty. This idea is formally analyzed in the next proposition.

**Proposition 3.2** If $2k_p + k_s > a$, then the optional state sector pricing policy is either to resist liberalization:

$p_s^* = c_s$

or to liberalize:

$p_s^* = \frac{0.25(a - k)^2}{k_p}$

**Proof:** See the appendix.

When the local government chooses $p_s^* - c_s$, it resists price liberalization because it maintains rationing in the state sector. In the "resistance" regime, consumer and producer surplus can be computed as
\[ CS^{\text{res}} = \frac{1}{2}(z_p^{\text{res}} + k)^2 + (z_p^{\text{res}} - c)k = \frac{1}{2}(\text{aggregate sales}^{\text{res}})^2 + (z_p^{\text{res}} - c)k, \]

\[ \Pi^{\text{res}} = (z_p^{\text{res}})^2, \]

where superscript "res" denotes the resistance regime. When the local government sets

\[ p^*_s = \frac{1}{25}(a - k_s)^2 \]

it eliminates rationing in the state sector and, liberalizes:

\[ CS^{\text{lib}} = \frac{1}{2}(k_p + z_{p}^{\text{lib}})^2 = \frac{1}{2}(\text{aggregate sales}^{\text{lib}})^2 \]

\[ \Pi^{\text{lib}} = (z_p^{\text{res}})^2 + \left(\frac{(z_p^{\text{res}})^2}{k_p} - c\right)^{\text{lib}} \]

where superscript "lib" denotes the liberalization regime.

By inspection of eqs. (3.4) and (3.5), producer surplus is always higher in the liberalization regime. Therefore, a sufficient, though not necessary, condition for a local government to support a price liberalization is that \( CS^{\text{lib}} \geq CS^{\text{res}} \). In other words, consumer surplus does not fall. Let \( \Gamma(k_p, k_s, c) \) denote the function that compares consumer welfare in the liberalization and resistance regimes:

\[ \Gamma(k_p, k_s, c) = CS^{\text{lib}} - CS^{\text{res}} \]

The next proposition analyzes the impact of changes in capacity and costs on a local government's incentive to liberalize.
Proposition 3.3 If $2k_p - k_s > a$, then

$$\frac{\partial \Gamma(k_s, k_p, c_p)}{\partial k_p} > 0,$$

$$\frac{\partial \Gamma(k_s, k_p, c_p)}{\partial c_s} > 0$$

(3.7)

$$\frac{\partial \Gamma(k_s, k_p, c_p)}{\partial k_s} = \left(\frac{\gamma - .5k}{k_p}\right) + c_s = ?$$

Proof. See the appendix.

In the liberalization regime, an increase in $k_p$ induces a fall in prices, $p_p$ and $p_s$, which increases aggregate sales. Thus $CS^{lib}$ is increasing in $k_p$. The only impact of an increase in $k_p$ in the resistance regime is that excess private capacity, $k_p - .5(a - k_s)$, increases. Since there is no change in prices and sales, consumer welfare does not change. Thus, a local government is more likely to support liberalization as private capacity holdings increase.

An increase in the state firm's costs, $c_s$, has no impact on prices and sales and, therefore, no impact on welfare in the liberalization regime. However, an increase in $c_s$ in the resistance regime means that the state firm sells the same amount of goods at a higher price, while the private firm's price and sales level remain constant. This induces a fall in consumer surplus and implies that the local government is more likely to support liberalization.

In the liberalization regime, an increase in state-capacity holdings, $k_s$, results in a fall in prices, $p_p$ and $p_s$, and increase in aggregate sales. Thus $\partial CS^{lib}/\partial k_s > 0$. While an increase in $k_s$ has no impact on the state sector price in the resistance regime, it drives down the private-sector price, $p_p^* = .5(a - k_s)$, and aggregate sales increase. Thus $CS^{res}$ is also increasing in $k_s$, and
the impact of an increase in $k$, on a local government’s incentive to liberalize is ambiguous. By inspection of Eq. (3.7), a sufficient condition for $\frac{\partial T(k, k_p, c_p)}{\partial k} > 0$ is that $z^lb$ is sufficiently large, i.e., $z^lb \geq 0.5k_p$.

IV. Competition within the Private Sector

As shown earlier, when the private sector is small, a local government will tend to resist a price liberalization. However when the private sector is large, a local government will either resist or support liberalization. In this case, an increase in either private capacity or state-sector costs increases a local government’s incentive to liberalize.

The basic model used for making this point is a market in which a state firm competes with a private firm. This section extends this model to a market with two private firms. In this case, a local government still tends to resist liberalization when the private sector is small. Furthermore, when the private sector is large, an increase in $k$, and $c$, increases a local government’s incentive to liberalize. However, the incorporation of two private firms means that there is competition within the private sector, and this has two important implications. First, the size of the capacity space in which the private sector is small and always operates at full capacity, increases. Second, if the private sector is large and a local government maintains state-sector rationing, private firms engage in price wars. The impact of price liberalization is to eliminate private sector price instability.

---

7 It is simple, but algebraically messy, to have $n \geq 2$ private firms.

8 Technically, each private firm has a mixed-price strategy. This result was first discovered by Edgeworth (1897) and then formally analyzed in Shubik and Levitan (1972) and Kreps and Scheinkman (1983).
Index the private firms $i = 1, 2$. For simplicity, suppose that the private firms have the same capacity:

$$k_1 = k_2 = \frac{1}{2} k_p$$

(4.1)

Following the previous analysis, assume that the state firm can afford to sell at the competitive price, $P(k_s + k_p)$, capacity is insufficient to cover the potential market, and the state firm may be at a cost disadvantage:

$$P(k_s + k_p) = a - k_s - k_p > c_s \geq c_p = 0$$

(A1)

In the first period, the local government irrevocably sets the state-sector price. In the second period, the two private firms simultaneously and independently choose a prices and sales are then realized. The efficient rationing rule introduced in Section II is employed. In addition, when there is no price differentiation within the private sector, then

if $p_s \leq p_1 = p_2$

$$z_i = \min (k_i, \max \left[\frac{a - p_i - k_p}{2}, a - p_i - k_s - k_j\right]), i = 1, 2: i \neq j$$

(4.2)

if $p_s > p_1 = p_2$

$$z_i = \min (k_i, \max \left[\frac{a - p_i}{2}, a - p_i - k_s\right]), i = 1, 2: i \neq j$$

(4.3)

The next lemma characterizes the local market when the private sector is small and then analyzes the optimal pricing policies.

**Lemma 4.1** If the private sector is small, then $1.5k_s + k_p \leq a$. In this case,

(i) both private firms never operate with excess capacity

(ii) $p_1(p_s) + p_2(p_s) = P(k_s + k_p)$; $p_s \geq P(k_s + k_p)$
(iii) \( p_1(p_\ast) = p_2(p_\ast) = p_\ast - \varepsilon; \quad P(k_p + k_p) < p_\ast < a - k_p, \)

and the local government resists liberalization:

\[ p_\ast = c_x. \]

Proof. See the appendix.

Figure 3 compares the capacity space for the case in which there are one and two private firms. When there is one private firm, the set ACDO illustrates a small private sector. When there are two private firms, this set expands to EFCDO, where \( k_p = k_1 + k_2. \) Thus fixing aggregate private capacity, free entry increases the size of the capacity space in which the private sector is small.\(^9\)

Lemma 4.1 generalizes the analysis and establishes that a local government maintains state-sector rationing when the private sector is small. By setting \( p_\ast = c_x, \) a local government drives private sector prices down to the competitive level and also transfers its potential profits to consumers shopping in the state sector.

When the private sector is large, a pure private price strategy does not always exist. In this case, it is assumed that the private firms maximize expected profit, \( \Pi_p, \) and the local government maximizes its expected payoff, \( (1 - \lambda)ECS + \lambda \Pi. \) The next lemma analyzes state-sector pricing when the private sector is large.

\(^9\) It is simple to show that the size of the capacity space for which the private sector is small is increasing in the number of private firms. Furthermore under assumption (A1), as the number of private firms becomes large, the private sector is always small.
Lemma 4.2. If the private sector is large, then $k_s + 1.5k > a$. In this case, either both private firms have a mixed price strategy yielding the payoffs:

$$E\Pi_1 = E\Pi_2 = .25(a - .5k_p - k_s)^2: \quad p_s < .5(a - .5k_p - k_s)^2/k_p$$

or both private firms set a full capacity price:

$$p_1(p_s) = p_2(p_s) = p_s - c: \quad a - 2k > p_s \geq .5(a - .5k_p - k_s)^2/k_p$$

The local government either resists liberalization:

$$p_s^* = c_p$$

or liberalizes:

$$p_s^* = .5(a - .5k_p - k_s)^2/k_p$$

Proof. See the appendix.

When the private sector is large and the state price is in the low range: $p_s < .5(a - k_s - .5k_p)^2k_p$, then a pure private pricing does not exist. There is excess private capacity and price volatility within the private sector, and the state prices at full capacity. In this case, the local government sets $p_s^* = c_p$. While this policy has no impact on the private-sector behavior, it maximizes the surplus of consumers in the state sector. In this regime, the local government resists liberalization and, by simple calculation
\[ E_{CS}^* = \frac{1}{2}(k_p)^2 + (a - k_s - c_s)k_s + \frac{1}{4}(a - k_s - 0.5k_p)^2 \]
\[ E_{II}^* = \frac{1}{2}(a - 0.5k_p - k_s)^2. \]  

When the private sector is large and \( p_s \) is in the high range:
\[ \frac{1}{2}(a - k_s - 0.5k_p)^2/k_p < p_s < a - k_p, \] then a pure private pricing strategy exists. Each private firm undercut the state firm, and there is excess state capacity: \( z_s = a - k_p - p_s < k_s \). In this case, the optimal state pricing policy is \( p_s^* = \frac{1}{2}(a - 0.5k_p - k_s)/k_p \) since this maximizes consumer surplus in both the state and private sectors. In this case, local government supports price liberalization:
\[ E_{CS}^{lib} = \frac{1}{2}(k_p + z_s^{lib})^2 = \frac{1}{2}(aggregate\ sales^{lib})^2 \]
\[ E_{II}^{lib} = \frac{1}{2}(a - 0.5k_p - k_s)^2 + \left( \frac{1}{2}(a - 0.5k_p - k_s) - c_s \right) z_s^{lib} \]  

By inspection of eqs. (4.4) and (4.5), producer surplus is strictly greater in the liberalization regime. Thus a sufficient, though not necessary, condition for a local government to support a price liberalization is that expected consumer surplus in the liberalization regime is no less than expected consumer surplus in the resistance regime. By simple differentiation of \( \Gamma(k_p, k_s, c_s) = E_{CS}^{lib} - E_{CS}^{rea} \), it is simple to show that:
\[ \frac{\partial \Gamma(k_p, k_s, c_s)}{\partial k_p} > 0 \]  
\[ \frac{\partial \Gamma(k_p, k_s, c_s)}{\partial c_s} > 0 \]

Thus when the private sector is large, a local government is more likely to liberalize when \( k_p \) and \( c_s \) are large. Furthermore, when there is competition within the private sector, a price liberalization stabilizes private-sector pricing.
V. Conclusions

Many economic theorists and policy makers have argued that a rapid liberalization of state-sector prices in the formerly centrally planned economies is critical for a successful transition to a market economy. This paper does not dispute the wisdom of free-market pricing. However, it does offer an explanation of why local governments have resisted raising prices of many consumer goods.

This paper has argued that under the new conditions in which voting has become more important, local governments have a consumption bias. An alternative way of stating this is to say that they are willing to forego an increment of locally generated profits in order to increase consumer welfare. The existence of a consumption bias explains why local governments would continue to hold down prices when private-capacity holdings are sufficiently low. It also predicts that once private-capacity holdings reach a sufficiently large level, a local government would increase both consumer and producer surplus and, when there is more than one private firm, stabilize private pricing by supporting price liberalization.
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Appendix

Section II.

Proposition 2.1 Proof.

(i) Since \( a \geq 2k_p + k_s \), then \( P(k_p + k_s) \geq .5(a - k_s) \). By Lemma 2.1,
\[
P_p \geq P(k_p + k_s).
\]
Thus, if \( p_s \leq P(k_p + k_s) \), then
\[
P_p \geq p_s \text{ and } p_p \geq .5(a - k_s) \text{ and},
\]
\[
\pi_p = p_p (a - k_s - p_p), \text{ where}
\]
\[
\frac{\partial \pi_p}{\partial p_p} = a - k_s - 2p_p \leq 0
\]
since \( p_p \geq .5(a - k_s) \).
Therefore, \( p_p = P(k_p + k_s) \), and \( z_s = k_s \), \( z_p = k_p \).

(iii) If the private firm sets \( p_p \geq p_s \) and has positive market share, then
\[
p_p < a - k_s \text{, and}
\]
\[
\pi_p = p_p (a - k_s - p_p).
\]
In this case, \( p_p = p_s \), and
\[
\pi_p = p_s (a - k_s - p_s), \text{ because}
\]
\[
\frac{\partial \pi_p}{\partial p_p} = a - k_s - 2p_p < 0
\]
since \( p_p \geq p_s > P(k_p + k_s) \) and \( 2k_p + k_s \leq a \), imply that
\[
p_p \geq p_s > .5(a - k_s)
\]
If the private firm c under-cuts the state firm, then it receives profits \( \pi_p \).
\[
\pi_p = (p_s - c)k_p
\]
To establish that \( \pi_p > \pi_p \), observe that since \( p_s > P(k_p + k_s) \),
\[
\lim_{c \to 0} \pi_p = p_s [p_s - P(k_p + k_s)] - k_p c = p_s [p_s - P(k_p + k_s)] > 0
\]
and \( z_p = k_p \), \( z_s = a - k_p - p_s < k_s \).

(i) This follows from (ii) and (iii).
Proposition 2.2 Proof for a local government which maximizes the weighted sum of consumer surplus and state sector profits, $(1 - \lambda)CS + \lambda\pi_s$.

In this case,

$$\frac{\partial}{\partial p_s} [(1 - \lambda)CS + \lambda\pi_s] = - (1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s + k_p) < 0$$

for $\lambda \in [0, .5)$.

Proposition 2.3 Proof for a local government which maximizes the alternative objective function, $(1-\lambda)CS + \lambda\pi_s$.

In this case,

$$\frac{\partial}{\partial p_s} [(1 - \lambda)CS + \lambda\pi_s] = (2\lambda - 1)k_s < 0 \text{ for } \lambda \in [0, .5)$$

Therefore, $p_s$ is set at its minimal level, $c_s$.

Section III.

Proposition 3.1 Proof.

(i) If $a < 2k_p + k_s$, then $P(k_p + k_s) < .5(a - k_s)$. If $p_p = p_s$, then

$$(p_p(p_s)) = \arg\max_p \pi_p = .5(a - k_s)$$

$$(z_s, z_p) = k_s, .5(a - k_s) < k_p$$

and

$$\pi_p = .25(a - k_s)^2.$$  

If this is a best response, then the private is no better off by under-cutting the state firm and earning profits

$$\pi_p = p_s - k_p, \text{ where } p_p = p_s - c.$$  

Therefore, $p_p = .5(a - k_s)$ is a best response when

$$\pi_p = .25(a - k_s)^2 \geq \pi^*_p = (p_s - c)k_p,$$

which implies that

$$.25(a - k_s)^2 / k_p > p_s.$$
(ii) From (i), it follows that if

\[ a < 2k_p + k_s \text{ and } P(k_p + k_s) < 0.25(a - k_s)^2/k_p \leq p_s, \text{ then} \]

\[ p_p(p_s) = p_s - c; c \to 0, \text{ where} \]

\[ z_p = k_p, z_s = a - k_p - p_s < k_s. \]

Note that \( P(k_p + k_s) < 0.25(a - k_s)^2/k_p \), since

\[ P(k_p + k_s) = 0.25(a - k_s)^2/k_p, \text{ when} \]

\[ a = 2k_p + k_s, \text{ and} \]

\[ \frac{\delta P(k_p + k_s)}{\delta k_p} = -1 < \]

\[ \frac{\delta (0.25(a - k_s)^2/k_p)}{\delta k_p} = -0.25(a - k_s)^2/k_p^2. \]

when \( a < 2k_p + k_s. \)

---

**Proposition 3.2** Proof for a local government which maximizes either

\[ (1-\lambda)CS + \lambda \pi_s \text{ or } (1-\lambda)CS + \lambda \pi. \]

If \( p_s < 0.25(a - k_s)^2/k_p \), then

\[ CS = [a - 0.5k_s - p_s]k_s + 0.125(a - k_s)^2 \]

\[ \pi_s = (p_s - c_s)k_s, \]

\[ \pi_p = 0.25(a - k_s)^2 \]

\[ \Pi = (p_s - c_s)k_s + 0.25(a - k_s)^2. \]

Therefore,

\[ \frac{\delta [(1 - \lambda)CS + \lambda \pi]}{\delta p_s} = \frac{\delta [(1 - \lambda)CS + \lambda \pi_s]}{\delta p_s} = \]

\[ = (2\lambda - 1)k_s < 0 \text{ for } \lambda \in [0, 0.5) \]

and, \( p_s \) is set at its lower bound \( c_s \).

Suppose \( 0.25(a - k_s)^2/k_p \leq p_s < a - k_p \). Then

\[ CS = [a - 0.5k_p - p_s + c]k_p + 0.5[a - k_p - p_s]^2 \]

\[ \pi_s = (p_s - c_s)(a - k_p - p_s), \]

\[ \pi_p = (p_s - c)k_p, \]

\[ \Pi = (p_s - c_s)(a - k_p - p_s) + (p_s - c)k_p \]

Therefore,
\[ \frac{\partial}{\partial p_s} [(1 - \lambda)CS + \lambda \Pi] = - (1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s + k_p) < 0 \text{ for } \lambda \in (0, .5), \]

and

\[ \frac{\partial}{\partial p_s} [(1 - \lambda)CS + \lambda \Pi] = - (1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s) < 0 \text{ for } \lambda \in (0, .5), \]

and \( p_s \) is set at its lower bound \( .25(a - k_s)^2/k_p \).

Therefore, either \( p_s^* = c_s \) or \( p_s^* = .25(a - k_s)^2/k_p \).

**Proposition 3.3 Proof.**

When \( p_s^* = .25(a - k_s)^2/k_p \), the local government supports liberalization and

\[ CS_{lib}^{11b} = [a - .5k_p - p_s + c]\k_p + .5[a - k_p - p_s]^2 \quad (i) \]

Substituting in \( z_{lib}^{11b} = a - k_p - p_s^* - c \) into (i):

\[ CS_{lib}^{11b} = .5k_p^2 + k_p z_{lib}^{11b} + .5(z_{lib}^{11b})^2 \]

\[ = .5(k_p + z_{lib}^{11b})^2 = .5(\text{aggregate sales}^{11b})^2 \]

When \( p_s^* = c_s \), the local government resists liberalization and

\[ CS_{res} = k_p [a - .5k_p - c_s] + .125[a - k_p]^2 \quad (iii) \]

Substituting in \( z_{res} = .5(a - k_p) \) into (iii):

\[ CS_{res} = .5k_p^2 + (2z_{res} - c_s)k_p + .5(z_{res})^2 \]

\[ = .5k_p^2 + k_p z_{res} + .5(z_{res})^2 + (z_{res} - c_s)k_p \]

\[ = .5(k_p + z_{res})^2 + (z_{res} - c_s)k_p \]

where

\[ \Gamma(k_p, k_s, c_s) = CS_{lib}^{11b} - CS_{res} \quad (v) \]

Let \( p_s^* = .25(a - k_s)^2/k_p = \theta. \) Substituting (i) and (iii) into (v)

\[ \frac{\partial \Gamma(k_p, k_s, c_s)}{\partial k_p} = -(a - k_p - \theta)\theta/\partial k_p + \theta > 0 \quad (vi) \]

Since

\[ \frac{\partial \theta}{\partial k_p} = -.25(a - k_s)^2/k_p^2 = -\theta/k_p < 0, \]
Therefore, 
\[ \frac{\partial \Gamma}{\partial k_p} = \frac{\alpha(a - \alpha)}{k_p} > 0 \]

Substituting (i) and (iii) into (v)
\[ \frac{\partial \Gamma}{\partial a_c} = k_s > 0 \]  
\[ (vii) \]
Substituting (ii) and (iv) into (v)
\[ \frac{\partial \Gamma}{\partial k_s} = \left\{ \frac{(k_p + Z_{1b})z_{1b}^s}{\partial k_s} \right\} - \]
\[ \left\{ \frac{k_s + 2z_{1b}^s - c_s + [2k_s + z_{1b}^s]z_{1b}^s}{\partial k_s} \right\} \]

Note that
\[ \frac{\partial z_{1b}^s}{\partial k_s} = -0.5 \]  
\[ (ix) \]
\[ \frac{\partial z_{1b}^s}{\partial k_s} = 0.5(a - k_s)/k_p = z_{1b}^s/k_p \]  
\[ (x) \]
Substituting in (ix) and (x) into (viii)
\[ \frac{\partial \Gamma}{\partial k_s} = \{z_{1b}^s - 5k_s\}{z_{1b}^s/k_p} + c_s \]  
\[ (xi) \]

Because \( \text{sgn} (z_{1b}^s - 5k_s) \) is ambiguous, \( \text{sgn} \) of eq. (xi) is ambiguous.

Section IV.

In this section, for \( i = 1,2 \), let
\[ p_i = \text{infinuum of the support of prices named by private firm } i, \]
\[ = \sup\{p_i: \text{frim } i \text{ names } p_i \text{ greater than } \bar{p}_i \text{ with probability one}\}. \]

Then, by Kreps and Scheinkman (193, p.330), Lemma 2:
\[ p_i \geq P(k_s + k_p) = a - k_s - k_p \]

Lemma 4.1 Proof.

First it is established that if \( 3k_i = 1.5k_p + a - k_s \), then no private firm facing residual demand has the capacity to capture monopoly profits. Therefore, the private sector is small.

Suppose that a private firm holds excess capacity. Then there are two cases.

Case I - \( p_1 > p_2 \).
In this case, if both private firms have positive market share, then \( z_1 < 0.5k \) and \( z_2 = 0.5k \):

\[
\begin{align*}
z_1 &= a - k_s - 0.5k - p_1 < 0.5k_p \quad \text{and} \\
p_1 &= \arg\max \pi_{p_1} = 0.5(a - k_s - 0.5k_p),
\end{align*}
\]

which implies

\[
\begin{align*}
z_1(p_1) &= 0.5(a - k_s - 0.5k_p)\\
\end{align*}
\]

Note that \( z_1(p_1) < 0.5k_p \) implies that \( 1.5k > a - k_s \) which is a contradiction.

Case II - \( p_1 = p_2 \).

If a private firm \( i \) holds excess capacity, then

\[
\begin{align*}
z_1 &= 0.5(a - k_s - p_i) < 0.5k_p \\
\end{align*}
\]

which implies that

\[
\begin{align*}
2k_p > a - k_s & \geq 1.5k_p \\
p_i &= \arg\max \pi_{p_i} = 0.5(a - k_s) \quad \text{and} \\
z_i(p_i) &= 0.25(a - k_s) \quad \text{and} \\
\pi_{p1} &= \pi_{p2} = 0.125(a - k_s)^2
\end{align*}
\]

For this to exist as a pure strategy response, then neither private firm can have an incentive to deviate and undercut the other private firm:

\[
\begin{align*}
\pi_{p1} &= 0.125(a - k_s)^2 \geq (0.5(a - k_s) - c)(0.5k_p),
\end{align*}
\]

which implies that

\[
\begin{align*}
2k_p < a - k_s \quad \text{(ii)}
\end{align*}
\]

which contradicts (i).

Since no private firm holds excess capacity as a pure strategy, then if a pure strategy exists and both firms have positive market share, both set a full capacity price.

Proof of (ii).

Suppose that
Therefore, by Kreps and Scheinkman, Lemma 2, the private firms will never undercut the state firm and

\[ p_i \geq p_s \]  \hspace{1cm} \text{(ii)}

This implies that \( z_s = k_s \) and the residual demand is \( a - k_s > 0 \). Therefore, by Brock and Scheinkman (1985, p. 373), Proposition 1, since

\[ 3k_i = 1.5k_p \leq a - k_s \text{, then} \]

\[ p_1 = p_2 = P(k_s + k_p) \text{ and} \]

\[ z_1 = z_2 = 0.5k_p. \]

Proof of (iii). Suppose that

\[ P(k_s + k_p) < p_s < a - k_p \]  \hspace{1cm} \text{(i)}

Suppose that some private firm \( i \) sets \( p_i \geq p_s \). Since the private sector is small, firm sets a full-capacity price:

\[ z_i = \min[0.5k_p, 0.5(a - k_s - p_i)] = 0.5k_p \]  \hspace{1cm} \text{(ii)}

Eq. (ii) implies

\[ p_s \leq p_i \leq P(k_s + k_p) \]  \hspace{1cm} \text{(i)}

Eq. (iii) is a contradiction, since \( p_s > P(k_s + k_p) \).

Suppose \( p_1 = p_2 = p_s - \epsilon \geq P(k_s + k_p) \), where

\[ \pi_1 = (p_s - \epsilon)0.5k_p \]  \hspace{1cm} \text{(iv)}

To show that a private firm would never deviate with a price increase:

\[ p_i = p_s \text{, observe that if } p_i = p_s, \text{ then} \]

\[ \pi_1 = p_s (a - k_s - 0.5k_p - p_s) < (p_s - \epsilon)0.5k_p, \text{ since} \]

\[ p_s (a - k_s - k_p - p_s) = \]

\[ p_s (P(k_s + k_p) - p_s) < 0 \leq -\epsilon(0.5k_p), \text{ for } \epsilon \to 0 \]

If \( p_i > p_s \text{, then:} \]

\[ \frac{\partial \pi_1}{\partial p_i} \bigg|_{p_i > p_s} = a - k_s - 0.5k_p - 2p_s < 0 \]

\[ \frac{\partial \pi_1}{\partial p_i} \bigg|_{p_i > p_s} = a - k_s - 0.5k_p - 2p_s < 0 \]
since
\[ p_1 > p > P(k_s + k_p) \text{ and } a > k_s + 1.5k_p \text{, imply} \]
\[ p_1 > 0.5(a - k_s - 0.5k_p) \]

Proof of (i).
This follows from the proofs of (ii) and (iii).

To complete the proof, it is established that the local government
resists liberalization: \( p_s^* = c_s \). If \( P(k_s + k_p) < p_s < a - k_p \), then
\[
CS = [a - 0.5k_p - p_s + \epsilon]k_p + 0.5[a - k_p - p_s]^2
\]
\[ \pi_s = (p_s - c_s)(a - k_p - p_s), \]
\[ \pi_p = \pi_{p1} + \pi_{p2} = (p_s - \epsilon)k_p \]
\[ \Pi = (p_s - c_s)(a - k_p - p_s) + (p_s - \epsilon)k_p \]
Therefore,
\[
\delta[(1 - \lambda)CS + \lambda\pi_s]/\delta p_s = \]
\[-(1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s + k_p) < 0 \text{ for } \lambda \in [0, 0.5] \]
\[
\delta[(1 - \lambda)CS + \lambda\Pi]/\delta p_s = \]
\[-(1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s) < 0 \text{ for } \lambda \in [0, 0.5] \]
which implies that \( P(k_s + k_p) < p_s \) is not an optimal policy.

If \( P(k_s + k_p) \geq p_s \), then
\[
CS = [a - 0.5k_s - p_s]k_s + 0.5k_s^2
\]
\[ \pi_s = (p_s - c_s)k_s \]
\[ \pi_p = \pi_{p1} + \pi_{p2} = P(k_p + k_s)k_p \]
\[ \Pi = (p_s - c_s)k_s + P(k_p + k_s)k_p \]
Therefore,
\[
\delta[(1 - \lambda)CS + \lambda\pi_s]/\delta p_s = (2\lambda - 1)k_s < 0 \text{ for } \lambda \in [0, 0.5] \]
\[
\delta[(1 - \lambda)CS + \lambda\Pi]/\delta p_s = (2\lambda - 1)k_s < 0 \text{ for } \lambda \in [0, 0.5] \]
which implies that \( p_s^* = c_s \).
Lemma 4.2 Proof.

Proof of (i). Suppose that the private firms face residual demand of $a - k_s$. This implies

$$p_i \geq p_s$$  \hspace{1cm} (1)

Therefore, by Brock and Scheinkman (1985, p.373), Proposition 1, if

$$3k = 1.5k_p > a - k_s$$, then

$$E\pi_1 = E\pi_2 = .25(a - .5k_p - k_s)^2$$

$$z_1 = z_2 = .5k_p$$.

To derive conditions under which eq (1) holds, observe that in equilibrium $E\pi_1 = .25(a - .5k_p - k_s)^2$. If private firm $i$ deviates and chooses $p_i < p_s$, then it would earn less than $.5p_s k_p$. Thus, the optimal private payoff holds, when it is not profitable to deviate:

$$\frac{.5(a - .5k_p - k_s)^2}{k_p} > p_s$$  \hspace{1cm} (ii)

Proof of (ii).

If $p_s \geq \frac{.5(a - k - k_s)^2}{k_p}$, then each firm can earn

$$\frac{.5(p_s - c)k}{k_p} = E\pi_1 = .25(a - k - .5k_p)^2$$, since

$$p_s - .25(a - k - .5k_p)^2/k \geq \epsilon .5k_p \geq 0$$, for $\epsilon \rightarrow 0$.

Therefore, in this region the private firms choose the pure strategy:

$$p_i = p_s - \epsilon; \ Z_i = .5k_p$$.

Observe that the private firms have no incentive to under cut each other in the region.

To complete the proof, the optimal state-sector pricing policy is derived. If $p_s < \frac{.5(a - .5k_p - k_s)^2}{k_p}$, then

$$ECS = [a - .5k_s - p_s]k_s + .25(a - k_s - .5k_p)^2$$

$$\pi_s = (p_s - c_s)k_s$$
\[ E_{p} = E_{p1} + E_{p2} = 0.5(a - 0.5k_p - k_s)^2 \]
\[ \Pi = (p_s - c_s)k_s + 0.5(a - 0.5k_p - k_s)^2 \]

Therefore,
\[ \left(1 - \lambda\right)E_{CS} + \lambda\Pi / \partial p_s = (2\lambda - 1)k_s < 0 \text{ for } \lambda \in [0, 0.5) \]
\[ \left(1 - \lambda\right)E_{CS} + \lambda\Pi / \partial p_s = (2\lambda - 1)k_s < 0 \text{ for } \lambda \in [0, 0.5) \]

Therefore, \( p_s^* = c_s \) and:
\[ E_{CS}^{11b} = k_s[a - 0.5k_2 - c_s] + 0.25(a - 0.5k_2)^2 \]  \( \ldots(1) \)

If \( p_s \leq 0.5(a - 0.5k_p - k_s)^2/k_p \), then
\[ C = (a - 0.5k_p - p_s + c)k_p + 0.5(a - k_p - p_s)^2 \]
\[ \pi_s = (p_s - c_s)(a - k_p - c_p) \]
\[ \pi_p = \pi_p1 + \pi p2 = (p_s - c)k_p \]
\[ \Pi = (p_s - c_s)(a - k_p - p_s) + (p_s - c)k_p \]

Therefore,
\[ \delta[(1 - \lambda)C + \lambda\pi_s] / \partial p_s = \]
\[ - (1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s + k_p) < 0 \text{ for } \lambda \in [0, 0.5) \]
\[ \delta[(1 - \lambda)C + \lambda\pi_s] / \partial p_s = \]
\[ - (1 - 2\lambda)(a - p_s) - \lambda(p_s - c_s) < 0 \text{ for } \lambda \in [0, 0.5) \]

Therefore \( p_s^* = 0.5(a - 0.5k_p - k_s)^2/k_p \) and
\[ C_{res} = k_p[a - 0.5k_p - \alpha + \epsilon] + 0.5(a - 0.5k_p - \alpha)^2 \]  \( \ldots(11) \)

Derivation of eqs. (4.5) and (4.6)

Using eqs. (1) and (11) from the last section of the proof to lemma 4.2, then
\[ \Gamma(k_p, k_s, c_s) = 0.5[a - k_p - \phi]^2 + k_p[a - 0.5k_p - \phi] + c_s k_s \]
\[ - k_s[a - 0.5k_s] - 0.25[a - 0.5k_p - k_s]^2, \]
where
\[ \phi = 0.5(a - 0.5k_p - k_s)^2/k_p \]
and \( \epsilon \rightarrow 0. \)
\[ \frac{\partial \Gamma(k_p, k_s, c_s)}{\partial k_p} = -\frac{\partial \varphi}{\partial k_p} [a - k_p - \theta] + 0.25 [a - 0.5k_p - k_s] > 0, \]

since

\[-\frac{\partial \varphi}{\partial k_p} > 0, a - k_p - \theta > 0, a - 0.5k_p - k_s > 0.\]

\[ \frac{\partial \Gamma(k_p, k_s, c_s)}{\partial c_s} = k_s > 0 \]