Firm Relocation Threats

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FIRM RELOCATION THREATS

Motivation

Like most states, Iowa provides tax incentives to respond to threats by existing firms to relocate. A Maytag plant got an $11 million package including more than $8.6 million worth of grants and tax credits. A publishing company got $10 million, and a spice packing company got $1.8 million to stay (Appendix B). Increasingly, state governments are “anteing up to keep home-grown companies from departing” (Behr 1995). States do this to demonstrate their commitment to economic development even if the short-run costs outweigh the benefits. States also have to defend against other states' recruiting efforts.

Tax incentive packages can cost much more than the foregone revenues from the single threatening firm. Other firms are encouraged to demand similar tax breaks. “One consequence of the state's more aggressive policy has been a rush by more than 100 other [in-state] companies to seek assistance,” said a business and economic development secretary (Behr 1995). These “copy cat” costs greatly diminish the benefits of retaining threatening firms. Copy cat costs are far too costly when a firm's relocation threat is a bluff. The information that helps states avoid responding to bluffs is thus worth paying for.

To investigate this we pose the firm relocation threat issue as a strategic game between a local government and a firm in an asymmetric/imperfect information context. We assume the threatening firm has full information on all alternatives but the local government does not. It is prohibitively expensive for a local government to unilaterally maintain firm-specific data on every possible alternative location for each firm in its jurisdiction. Furthermore, even if a local government maintained such a database, it would not know the exact recruitment offer during a bidding war. These information asymmetries are to the firm's advantage. How much is comparable information worth to the government? One result of our analysis is an indication of the value of information to a local government during a tax war.

A different risk of offering tax breaks is that it reduces a local government's ability to provide adequate public services. This aspect of the problem is also widely noted in the popular press (e.g., *Wall Street Journal*). And, although many practical issues remain unsolved, the theoretical issues have received significant attention in the literature. For a good discussion of the fundamentals about the choice of tax rates to compete for firms with other jurisdictions while generating sufficient revenue, see Wildasin (1991). We do not attempt to retrace any of that important material here.

We take for granted that the “tax war between the states,” (Federal Reserve Bank of Minneapolis 1994) is in full swing, and that “unilateral disarmament...is pretty naive,” (Behr 1995). We show how an appropriate local government strategy takes both the initial “tax incentive” cost and the “copy cat” tax incentive costs into account. Our paper is in the spirit of Oechssler (1994), “The City vs. Firm Subsidy Game." Oechssler assumes that a firm signals its threat by undertaking costly lobbying. The city may choose to incur the cost of an audit to determine the credibility of the firm's threat. Our approach is less complicated because we abstract from signaling and auditing and focus on the potentially more costly copy cat costs instead.

We assume that a firm's demand for lower taxes may be merely a bluff. Firms have incentives to play this game in the midst of the tax war between the states. In contrast to Oechssler's assumptions, firms have little (if anything at all) to lose. This is because firms in the real world need not lobby when governments actively prey on each other's industrial bases. When states assume the costs of recruiting (see Isserman 1994), the firms cost of signaling a relocation threat reduces to zero. Any firm can bluff. But a government cannot afford to treat all threats as bluffs. The government must weigh the possible consequences of keeping the firm at reduced direct and indirect tax revenues against losing the firm and all associated revenues outright.

The Model

Our story begins when a firm approaches a local government's economic development officer. The firm's representative says:

> “Our firm has been recruited by another government. The other government will even pay our relocation costs. We want to give this city an opportunity to retain us. If you can offer a package that makes it economically desirable to stay, we will stay. However, we are prepared to move if you do not help our firm.”

The local government's objective is to get re-elected. It realizes that it must, at least in the short run, provide public services at or above some minimum level and that at least a minimum amount of tax revenues must be collected from citizens and firms. We assume that these are non-rival public goods, so that the same level of public goods is needed with or without the threatening firm. If expected total tax revenues (if the firm stays) exceed the required level net of incentive costs, the government can respond with little to lose. This process may be healthy; it can squeeze the fat out of a government budget. More likely, the expected total revenues with a successful retention are lower than the required minimum level.

In the later situation the value of being able to distinguish a bluff from a credible threat is much larger. The marginal value of an additional dollar of tax revenue rises as the minimum finance requirement constraint tightens. Once a battle in the tax war begins, the local government can not increase its revenues; it can merely attempt to minimize the losses. The government's optimal strategy is chosen to minimize revenue losses due to the firm's relocation or from incentives granted to the original supplicant and the copy cats. This is consistent with the relatively short sighted view of many elected officials.

The firm's objective is to maximize profit. To focus on the role of taxes, we assume that the firm's output, prices and production costs (including rents, wages, and transport costs) are the same everywhere. Given that the recruitment package includes relocation costs, the only difference between locations is taxes. To maximize profits, the firm can attempt a bluff to lower its tax liability in its current location, or, if recruited, choose whichever location extracts the lowest taxes.

The firm and the government are the two basic players in this strategic game. The game is defined by (1) the choices available to the players, (2) the information available to the players, (3) the sequence of moves, and (4) the outcomes or payoffs. The payoff for the local government is summarized by the change in its total tax revenue relative to the status quo. The payoff for the firm is summarized by the change in its individual tax liability relative to the status quo. We employ the following notation to define these elements explicitly.

The local government's tax revenue ($\boldsymbol{\pi}$) consists of tax revenues from other firms ($\boldsymbol{\tau}$), tax revenue from the threatening firm at the original level (T_o) plus indirect tax revenues due to the firm operating in the jurisdiction (I). Indirect tax revenues include the income, property and sales taxes paid by employees of the firm, plus other tax revenues on economic activity associated with the firm's operations in the location.

(1) $$\boldsymbol{\pi} = \boldsymbol{\tau} + T_o + \mathbf{I}$$

Giving a tax incentive to the threatening firm may encourage other firms to follow the same process. We call this “copy cat” behavior. Other firms will see an opportunity to get a piece of the “tax incentive pie.” They could invite a recruitment offer, attempt a bluff, or simply demand the same tax relief. Thus, retaining the threatening firm, through an incentive package, leads to lower total revenues as π drops by the change in the tax levy ($T_o - T_r$) to T_r, and $\boldsymbol{\tau}$ drops to by the copy cat costs, C, to ($\boldsymbol{\tau} - \mathbf{C}$):

(2) $$\boldsymbol{\pi}_r = (\boldsymbol{\tau} - \mathbf{C}) + T_r + \mathbf{I}$$

If the government does not respond and loses the firm, its revenues drop to $\boldsymbol{\tau}$:

(2′) $$\boldsymbol{\pi}_o' = \boldsymbol{\tau} .$$

If the government acquiesces and the firm chooses to relocate, the government loses the threatening firm's direct and indirect revenues, plus, copy cat costs:

(2´´) $$\boldsymbol{\pi}_r' = (\boldsymbol{\tau} \; ! \; \mathbf{C})$$

Clearly, this third outcome is the worst, and the government would be willing to pay at least the difference between (2´´) and (2´), which is **C**, to avoid it. Even in the best case, the government that responds loses direct tax revenue plus copy cat revenues, $[(T_o \; ! \; T_r) + \mathbf{C}]$. Thus, **C** represents a lower bound on what a government stands to lose by inadvertently responding to a bluff. It could be estimated as the tax break rate per "footloose" firm.

Each player has a single strategic alternative. Upon hearing the threat, the local government must decide to continue with the original tax (O) or to provide a relief tax package, (R). Similarly, after making the threat the firm must decide to stay (S) or move (M). The firm's informational advantage over the government, however, is twofold. One, only the firm knows if it is bluffing. Two, the firm does not have to decide to stay or move until it also knows the local government's response. The government knows neither the credibility of the threat nor whether its offer will be sufficient to retain the firm.

Implicitly there is another player in this game, the hypothetical other government. Either it or the threatening firm takes an initial move: the other government recruits, or, the firm bluffs. The local government does not know which may have happened. It may know that other costs and revenues are the same elsewhere, but it can not tell if the firm has been recruited and has a credible threat or if it is bluffing.

When a player is uncertain about the outcome of a previous move, the game is referred to as a *game of incomplete information*. As explained by Fudenberg and Tirole (1993, p.209), Harsanyi showed how to convert games of *incomplete information* into a game of *imperfect information* by referring to the probabilities of outcomes. The information available to the local government can be characterized in some degree of uncertainty about the ranking of their tax offer relative to the hypothetical recruiting government's offer (T_z).

We apply this as follows. The local government assigns subjective probabilities P_1, P_2, and P_3 to the possible states of nature:

$\Pr(T_z < T_r) \quad = P_1$

$\Pr(T_r \; \# \; T_z < T_o) \quad = P_2$

$Pr(T_o \# T_z) \qquad = P_3$

where $0 \# P_1, P_2, P_3 \# 1$, and, $(P_1 + P_2 + P_3) = 1$.

P_1 is the probability that the firm actually has a tax package/location offer that the current local government cannot beat. P_2 is the probability that the firm is not bluffing, and, there is a relief tax package that the firm could accept and stay. P_3 is the probability the firm is bluffing.

Of course, only one of these rankings will be observed after all the information is revealed. The point of assigning probabilities is to make explicit that typically the local government does not know which ranking is correct. The interaction between the firm and the government mimics a *sealed bid auction* where local governments bid against each other for the location of the firm.

To highlight the value of information, we consider four possible cases.

Case 1: Perfect Information. The local government knows the other locations' tax offer and therefore the relative rankings of T_o, T_r, and T_z. Thus, P_i=1 and P_{-i}=0 ; for any i = 1,2,3 .

Case 2: It Depends. The local government knows that they can offer a relief package at least as low as another government. Recall that no government can reduce tax revenues so low that it cannot cover minimum costs of public good service delivery. This constraint may put a lower bound on T_r offered at any location. In this case, $T_z \$ T_r$ and not $T_z < T_r$; so $P_1 = 0$.

Case 3: No Bluff. The local government knows that the other government can beat their original tax, i.e., $T_z < T_o$; and thus $P_3 = 0$.

Case 4: Clueless. The local government has no information about the hypothetical other government's tax offer.

The tree or extensive form of the game allows us to depict the information set of the local government, the sequence of moves, and the probabilities of the tax package rankings. Each node represents a player and their possible moves. By reading Figure 1 from left to right we see how the different states of nature lead to different payoffs by following the sequence of moves. First, the tax package of the hypothetical other government, T_z, is announced by the threatening firm. There are three possible relative rankings for the tax package T_z, as described above. Next, the local government chooses the original (O) or a relief tax (R). The final move is the firm's decision to stay (S) or move (M).

After both the government and the firm have made their strategic choice, the payoffs to each are revealed. The payoff at the end of each branch of the tree corresponds to a state of nature and a unique sequence of choices made by each player relative to the status quo. For example, consider the situation in which $T_z < T_r$, the top branch. If the government does not flinch and maintains the status quo (O) and the firm stays (S), there is no net payoff or loss. If the firm moves away (M) in order to gain the tax differential ($T_o - T_z$), the local government loses the direct and indirect tax revenues (T_o + **I**).

The basic tree in Figure 1 can be adapted to differentiate the cases according to various mixes of information available to each player. The information set at any stage of the game can be shown by enclosing areas around nodes that are not known with certainty. If only $P_1 = 0$ is known with certainty, nodes 2B and 2C have strictly positive probabilities, so they would be encircled by dashed lines. If only $P_3 = 0$ is known (i.e. case 3), nodes 2A and 2B are encircled because the government does not know which one is the true state of nature. If the government is "clueless," all three nodes of the second stage are encircled.

The optimal choices can be determined through backward induction. Since the firm moves last and has full information, its move is deterministic rather than stochastic and will determine the payoffs. The profit maximizing firm picks the best tax deal relative to the status quo. In all cases, tax relief is better for the firm than the original tax; $T_r < T_o$, so ($T_o - T_r$) is always positive. The payoffs corresponding to the strategies that the firm will pick under each state of nature are **bold**.

Next, note the payoff to the other player (the government) at the firms optimally chosen branch. Recall that the local government's payoffs are also relative to the status quo. The government's general decision rule is to offer relief if the expected tax revenues from offering relief are at least as large as expected revenues of maintaining the original tax rates. Choose R iff

$$E[R] \geq E[O] . \tag{3}$$

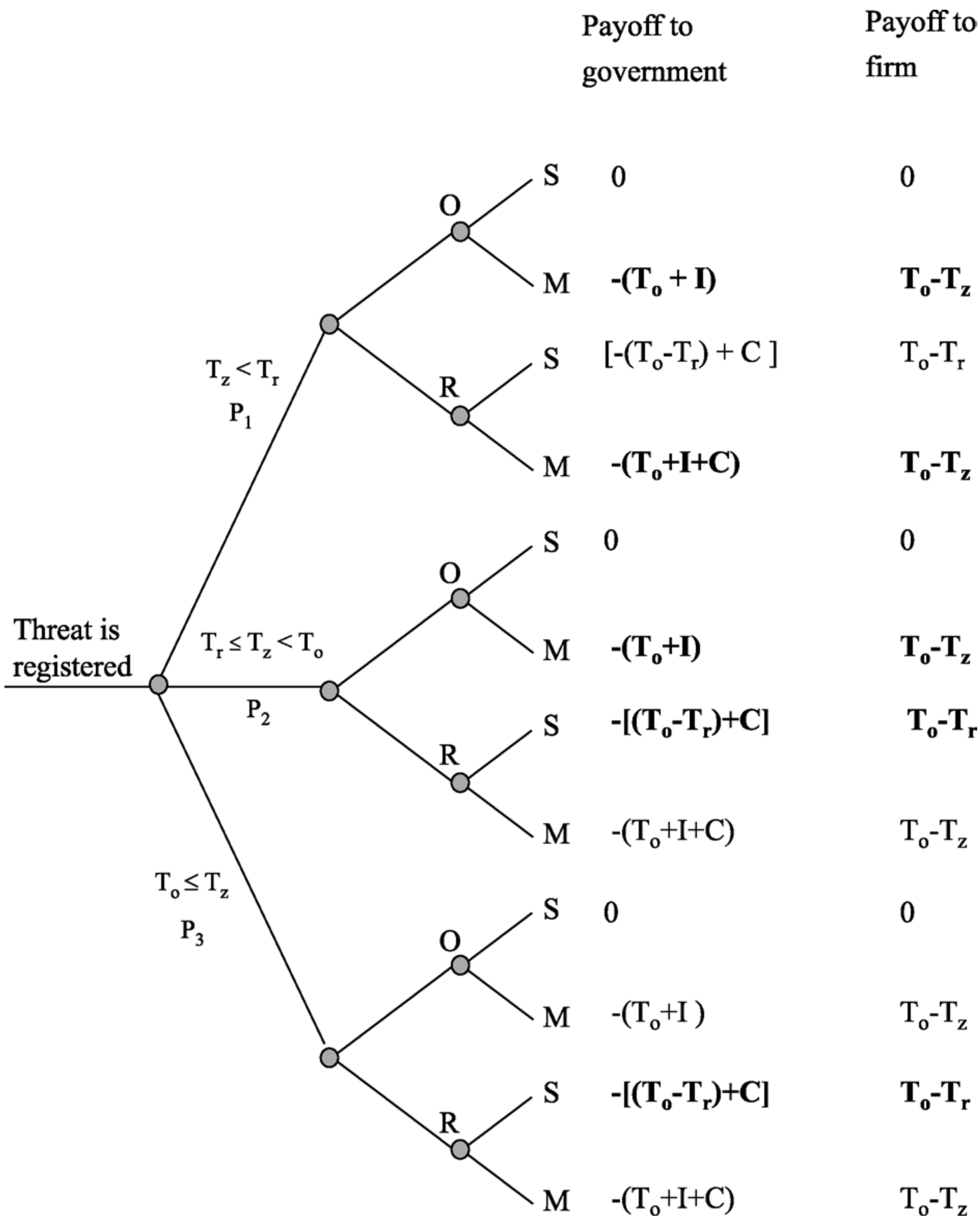

Figure 1. The firm relocation threat game tree with copy cat costs

When there is *Perfect Information* (Case 1), there are three subcases. Each subcase corresponds to one of the three probability rankings of tax packages. Recall that with perfect information, both the firm and the government know everything. The local government knows with certainty the alternative tax package (or the bluff). Subcases A and C are clear cut. The government should never offer relief, and the firm always moves in subcase A and always stays in subcase C. Subcase B is the interesting one, because the firm's optimal strategies depend on what the government does.

Subcase A is a *hopeless cause*. When $T_z < T_r$ the firm's payoff is highest when it moves, no matter what the local government does. The government can not beat the other offer and it knows it. Furthermore, if the government offers relief it would not only lose the direct and indirect revenues, but it would also lose copy cat costs. The firm will move and the government should maintain their original tax package.

Subcase C is the *bluff*. When $T_o \# T_z$, the other tax offer is either larger than the original tax liability of the firm or the firm is simply bluffing and has no better offer. The firm will stay at the current location no matter what the local government does. So the local government should not offer any relief.

Subcase B is the *mixed bag*. The firm will profit by moving if original taxes are maintained, but it profits by staying if relief is offered. The local government should only offer relief if the expected payoff from relief is at least as large as the expected payoff of their original tax strategy. Comparing the two payoffs to the government, this reduces to the basic decision rule: Choose relief iff

$$T_r+I \ \$ \ C\,. \tag{4}$$

The local government should offer tax relief when the direct revenues plus the indirect tax revenue due to the firm, even after relief, at least exceed copy cat costs.

Now consider the *imperfect information* cases 2, 3, and 4. Figure 2 focuses on the game one step back from the final step. This step is the government's move, given that the firm's decision has been determined. In each of these cases the government does not know which is the true state of nature. The optimal decision for the local government is to minimize its losses given the optimal choice of the firm. In cases 2, 3, and 4 of imperfect information, the government's expected payoffs are the probability-weighted revenue losses. The solutions to each case follow.

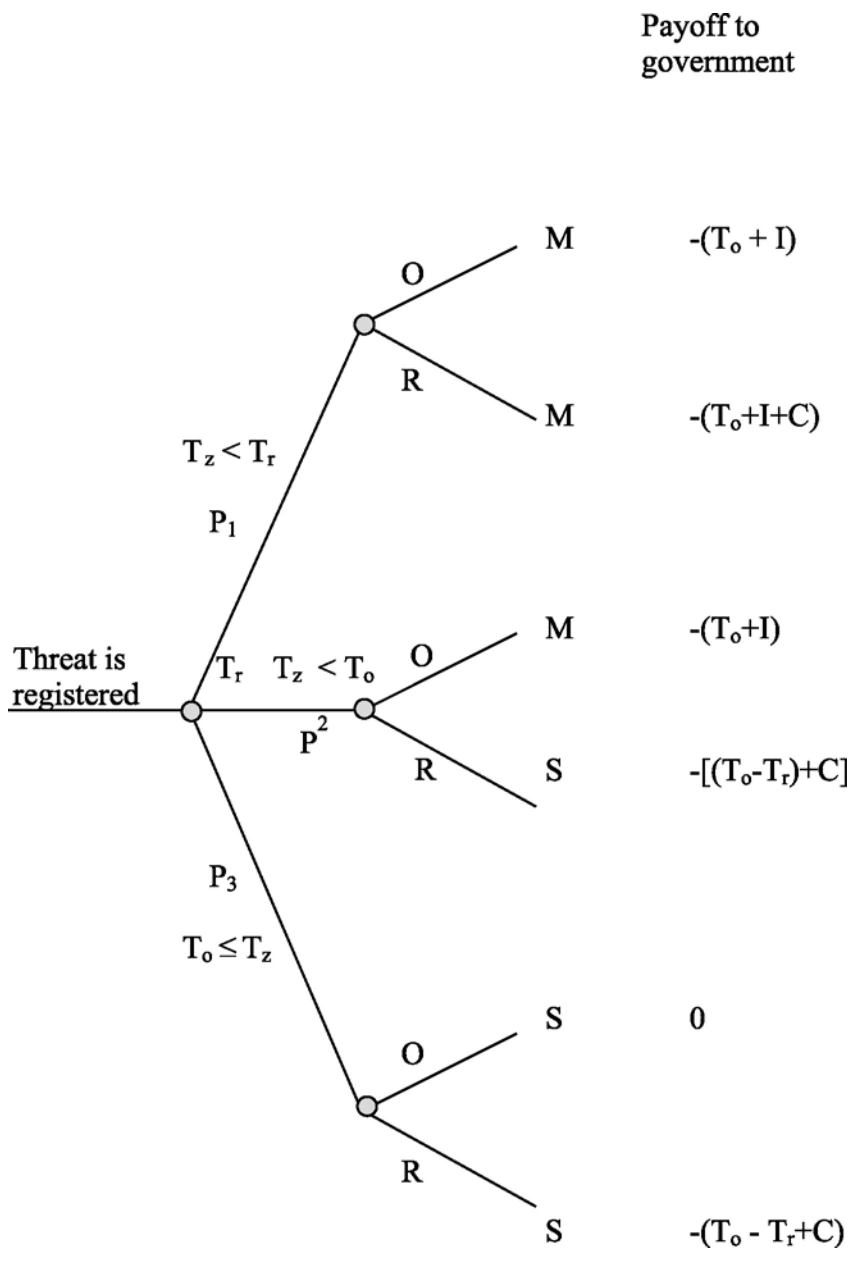

Figure 2. The firm's relocation threat game tree, one step back

In Case 2, *It Depends*. The local government can eliminate the possibility that another government could under-bid their relief offer. Since the local government can eliminate only one set of outcomes, there remains uncertainty about the other two possibilities. Thus, in case 2—P_1 is zero—the first set of outcomes have no weight:

$$E[R] = - \{ P_2[(T_o\text{-}T_r)+C)] + P_3[(T_o\text{-}T_r)+C)]\} = -[(T_o\text{-}T_r)+C)] \,, \tag{5}$$

$$E[O] = P_3(0) - P_2(T_o+I) = -P_2(T_o+I) \,, \tag{6}$$

$$E[R] \ \$ \ E[O] \ \text{ iff } \ [(T_o\text{-}T_r)+C)] \ \# \ P_2(T_o+I) \,. \tag{7}$$

The government should offer relief if and only if the inequality in (7) holds. This inequality can be expressed another way to highlight the probability P_2. If this subjective probability is greater than the rate of change of tax revenues then it would be optimal to offer relief. That is, offer relief if:

$$[(T_o\text{-}T_r)+C)]/(T_o+I) \ \# \ P_2 \tag{7′}$$

The smaller the tax revenue losses of offering relief are relative to the status quo firm-related revenues, the more likely relief can be optimally chosen. By the same token, the more likely that relief is an optimal strategy (P_2 higher), the larger rate of revenue loss the government is willing to accept. This criterion shows that rational governments optimally provide tax relief that may be quite costly.

Case 3 is the *No Bluff* case, in which the local government can only rule out the possibility of a bluff. The firm may have an opportunity to accept a tax package being smaller than the original tax package. The probabilities P1 and P2 cannot be given the value of zero since the government does not know the true state of nature, 2A or 2B. As before, weight the outcomes to find the expected values of each strategy:

$$E[R] = - \{ P_1(T_o+I+C) + P_2[(T_o\text{-}T_r)+C] \} \tag{8}$$

$$E[O] = - \{ P_1(T_o+I) + P_2(T_o+I)\} = - (T_o + I) \,. \tag{9}$$

The decision rule in this case is another version of the basic rule, (4). Choose relief iff:

(10) $$C \leq (1-P_1)(I) + P_2(T_r)\ .$$

Since $P_3 = 0$, $(1-P_1) = P_2$, so

(10′) $$C \leq P_2(T_r + I)\ .$$

This decision rule highlights the role of copy cat costs. As before, if they are expected to be high, relief is not likely to be optimal. The right hand side is something less than the direct plus indirect tax revenues. This is the upper bound for copy cat costs, above which a government should never offer relief.

Finally, consider the *Clueless* case of no information, Case 4. The government has no idea how its tax package compares with others. Given its subjective probabilities about the possible ranking of their own tax package relative to possible alternatives, we assume this government will still offer relief when relief gives the highest expected payoff. The probability-weighted payoffs are:

(11) $$E[R] = P_1[-\{T_o+C+I\}] + P_2[-\{(T_o-T_r)+C\}] + P_3[-\{(T_o-T_r)+C\}]\ ,$$

(12) $$E[O] = P_1[-\{T_o+I\}] + P_2[-(T_o+I)]\ .$$

Imposing the choice criterion to choose R iff $E[R] \geq E[O]$ and expressed in terms of the probability of a bluff, this implies that relief is optimally chosen when the probability of a bluff is below a given level:

(13) $$P_3 \leq P_2\ [(T_o+I)/(T_o - T_r)] - C/(T_o - T_r)\ .$$

The general decision rule under imperfect information can be illustrated by a graph of this equation in three dimensional space, where the dimensions are the probabilities (P_1, P_2, P_3); Figure 3. The rule is defined by a plane that is parallel to the P_1 axis, as indicated by the independence of the rule from the probability P_1 in condition 13. If copy cat costs are zero, this plane contains the P_1

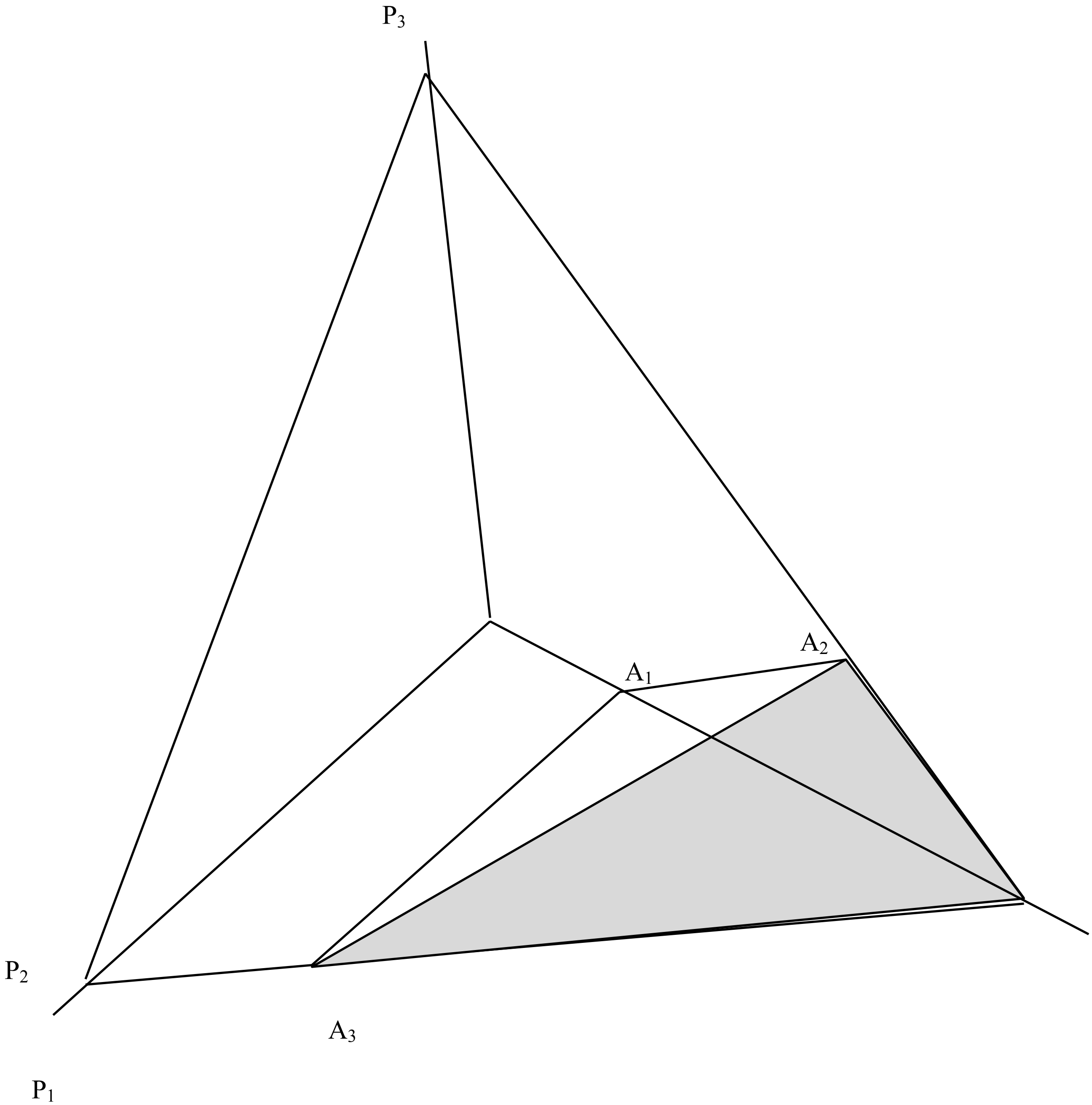

Figure 3. Probability space

axis. This clearly shows that the lower copy cat costs are, the larger the opportunity to successfully offer relief.

To construct the appropriate graph, combine the decision rule with the restrictions that guarantee proper probabilities, namely that the events are mutually exclusive, exhaustive and on the surface of the unit simplex. Analytically, this is defined by $(P_1+P_2+P_3) = 1$ and $0 \# P_1, P_2, P_3 \# 1$.

These three relationships delineate a portion of the face of the pyramidal space in three dimensions, given the is an intersection of the two planes. The analytical solution for the three points A_1, A_2, A_3 are derived in the mathematical appendix. These points can be combined with the constraints on the probabilities to determine extreme values for an intersection to exist. If an intersection does not exist then there is no set of subject probabilities under which relief is the dominant strategy and any such threat should be denied. The existence of an intersection depends on the relative magnitudes of C, T_0, T_r and I, as we show below.

$$P_2 = (T_o-T_r+C)/(T_o+I) \quad (=1) \tag{14}$$

The equation defines the coordinate along the P_2 axis. Similar calculations are done to solve for the coordinate along the P_3 axis. Taken together and imposing $0 \# P_2, P_3 \# 1$, implies:

$$!(T_o \ ! \ T_r) \ \# \ C \ \# \ T_r + I \ . \tag{15}$$

The first inequality says that copy cat costs are not below than the negative of the level of relief demanded. However, this constraint is non-binding since copy cat *gains* are irrational behavior. Common sense says that copy cat costs cannot be net gain for the local government, firms will not voluntarily offer to pay higher taxes, ceteris paribus. The second inequality is the basic rule: if copy cat costs exceed direct and indirect revenues related to the threatening firm, do not offer relief.

Since the decision rule (13) is independent of P_1 it is illustrative to examine the rule in the (P_2, P_3) plane. Figure 4 graphs the two operative constraints: (13) and $(P_2+P_3=1)$. The shaded area indicates the subjective probability values under which relief is the dominant strategy for the local government. The maximum value of P_3 under which relief is dominant is defined by the ordinate A_3, the following ordered pair.

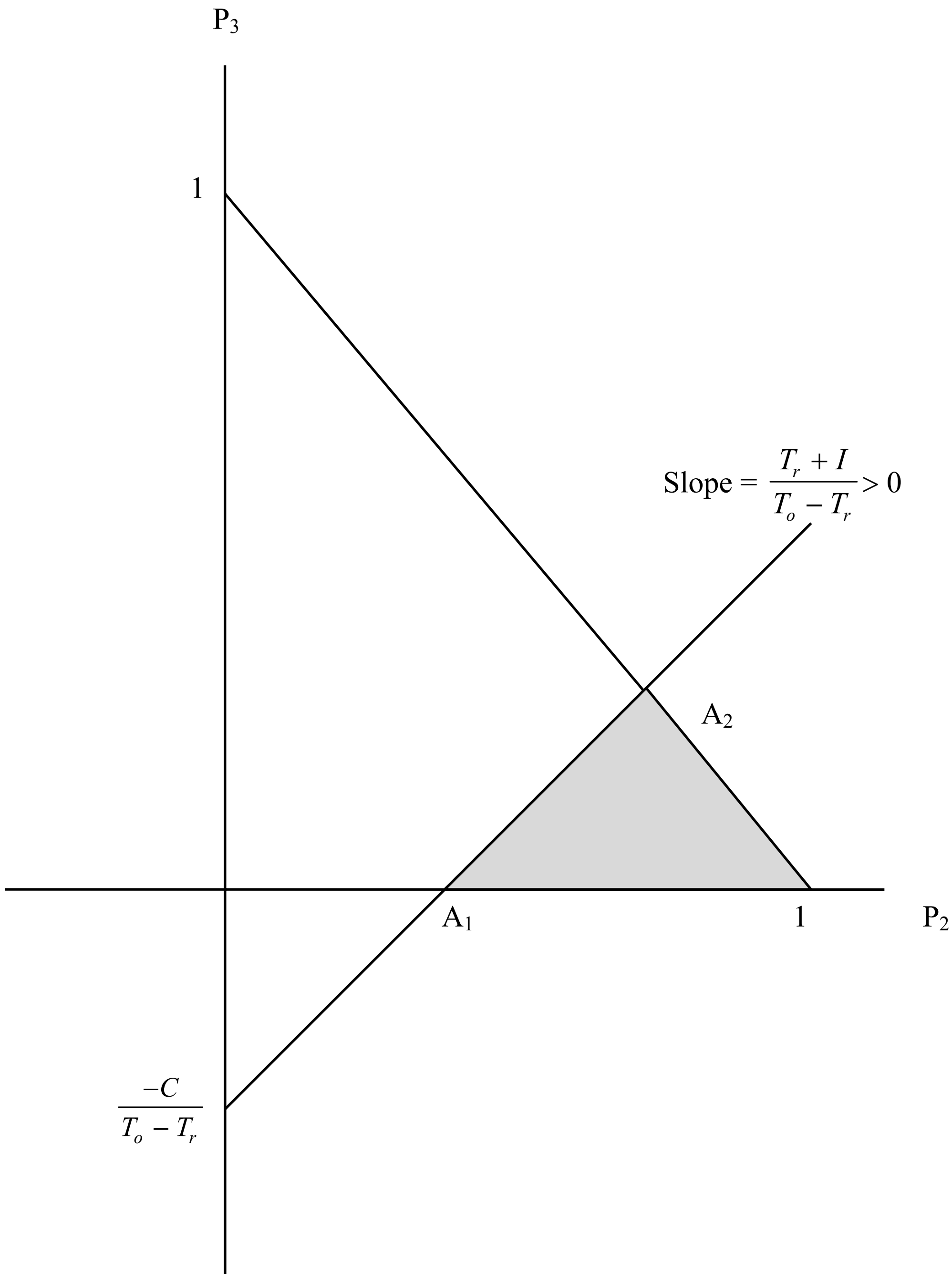

Figure 4. Delineating the “relief dominant” probabilities

$$A_3 = (P_2,\ P_3) = \left(\frac{(T_o - T_r\ ) + C}{(T_o - T_r\ ) + T_o + I} \ ,\ \ \frac{T_o + I\ \ - C}{(T_o - T_r\ ) + T_o + I} \right)$$

The presence of negative C in the numerator of the ordinate clearly shows that the larger are copy cat costs, the less likely a government would be to entertain a bluff. (Recall that P_3 is the probability of a bluff.) A decrease in copy cat costs causes a parallel shift up in the line defined by (13). This causes an increase in both the maximum value of P_3 and the area where relief is dominant. ceteris paribus.

We present (16) in terms of (T_o ! T_r) to highlight the role of the magnitude of relief demanded. How the governments optimal decision rule varies with changes in the elements of our model are presented in the mathematical appendix. The level of relief affects both the slope and intercept of the line defining the relief-dominant area, (13), in figure 4. An intersection of the two constraints implies the following

$$\frac{C}{(T_o + I\ )} \_\ 1$$

condition holds:

$$C \_\ (T_o + I\ )$$

equivalently:

This says that dominance of relief depends on copy cat costs being less that the initial value of the firm. If copy cat costs exceed the original value of the firm such requests for tax relief should be denied, even if the firm might relocate.

An increase in the level of relief demanded decreases the area where relief is optimal. Intuitively, the smaller the relief package demanded the easier it is for the government to offer it. Nevertheless, as the comparative static derivatives (see Appendix B) show, a low level of relief does not mean a government should be more willing to entertain a bluff. The effect of an increase in (T_0-T_r) on the ordinate, P_3, is ambiguous. The bottom line is that the dominance of relief, when a bluff is possible, will always depend on copy cat costs.

Conclusions

To retain firms, states are forgiving billions of dollars of tax liabilities (Bartik 1994). Some firms move anyway. Other firms obtain tax concessions by bluffing (*Des Moines Register* 1995). And when one firm in a jurisdiction gets a tax break, the other firms justifiably demand similar treatment. Tax incentive packages can cost much more than the reduced tax revenues from the single threatening firm.

We presented an analysis of the tax game between a local government and a firm in an asymmetric/imperfect information context. We demonstrated the importance of the probability of a bluff and the role of copy cat costs in the criteria for determining a government's dominant strategy. To focus on bluffs and copy cat costs we abstracted from two very important related issues. One is whether or not taxes matter in firm location choice in the short run. Local taxes add to location-specific costs and thus differentiate locations. The relatively higher tax locations should be *less attractive*, all else equal. All else is simply not equal. High taxes are often associated with high public good provision, productive amenities, and a highly educated workforce. This makes high tax locations *more attractive*. Furthermore, taxes are a small part of a firm's total costs. Other location-specific costs and characteristics are usually much more significant. Thus, empirical evidence that relative tax rates matter is mixed (see Charney 1983; Bartik 1985 and 1992; Nakosteen and Zimmer 1987; Smith and Fox 1990).

Thus, the probability that the place which imposes the lower tax liability gets the firm is not really equal to one. An explicit consideration of stochastic firm relocation behavior would require a much more complex model. In general, a doubt that a threatening firm will not simply locate where the tax liability is lowest scales expected payoffs in retention cases by the probability that the firm indeed could be retained. This adjustment would ambiguously affect the difference between the expected payoff to the government of the relief strategy relative to the original tax package strategy.

The second important issue is whether or not risking the budget is worthwhile in the long run. Again, empirical evidence is mixed. Lower tax revenues and/or higher spending on incentives mean less revenue available for public good provision. The costs of public good and service provision may exceed the locality's reduced fiscal capacity (e.g., Smith and Fox 1990). This can also undermine their ability to attract and retain firms in the long run (Isserman 1994). Localities that benefit from taking the risk probably have other characteristics that allow them to capture agglomeration economies, or to attract population by attracting and retaining employers, as shown by Wassmer (1994). On the other hand, if incentives include infrastructure investment, training, or other "self-help" activities, these outlays pay off in the long run regardless of whether or not a threatening firm was retained by them (Goss and Phillips 1994).

This paper provides a basic testable model of local government behavior in the midst of a 'tax war'. The model to test is whether or not local governments do in fact offer relief when after-relief direct and indirect tax revenues related to the firm ($T_r + I$) at least cover copy cat costs (C). This model can be posed as a discrete choice problem in which relief is a (0,1) dependent variable and the explanatory variables include relief tax levels and copy cat costs. The hypothesis that governments behave as we model would be supported by negative coefficients on level of relief, (T_o - T_r) and copy cat costs, C.

Our exact model cannot be tested explicitly since one of the arguments in the choice criterion is not observable. The arguments T_r and C (direct tax revenues and copy cat costs) are observable or at least estimable. However, the indirect tax revenues (I) due to the activity of the firm in the jurisdiction are typically estimated assuming that all revenues generated in a region is received and spent there. Particularly in rural areas this assumption is not true. In lieu of the this problem we can instrument the

$$\frac{C}{T_r + I} - 1$$

choice criterion (4) or the RHS of (15) by considering it in ratio form:

Consider the following scenario: A firm that employees a large portion of the labor force in a locality threatens to relocate for a better tax package. If it is a major employer, it provides relatively large indirect revenues and there are few firms to behave as copy cats, so C is likely small relative to the indirect revenues (I). The relief tax revenues reinforce the relative magnitudes in the inequality. Thus the ration in (17) is very likely less than unity and relief is likely the dominant strategy for the local government. In contrast, if a relatively small employer threatens, copy cat costs relative to direct and indirect revenues can exceed unity, and this firm's request for tax relief should be denied. This suggest that the threatening firm's portion of local employment as well as the tax rate of relief demanded would be relevant explanatory variables in a model predicting the probability that relief is offered. These are intuitively satisfying instruments, given the preponderance of reports of successful threats by relatively large firms. We can verify that in addition to being less newsworthy, "small firm" relief is less likely to be dominant as well.

Finally, state governments could use some help determining the probabilities that rank their tax burdens relative to others. Our analysis suggests that an estimate of the amount of money states would be willing to pay to avoid responding to a bluff is given by *copy cat costs*. This is some percentage of their current tax base. States could pool these (or far lesser) resources to finance the operation of an information clearinghouse that could generate “relocation threat credibility profiles” for firms by type and location.

Further research and empirical testing is warranted. If a government calls a firm's bluff and the firm stays, tax revenues would be secured and public services for the community would be provided.

However, if the local government conceded when copy cat costs were large they may not be able to provide necessary public services. Local governments need to become more informed about the other jurisdictions they are competing with. As local governments become more informed about the other government's tax offers it is less likely that they will needlessly offer a relief package.

Mathematical Appendix

Analytical solutions for points A_1, A_2, A_3 in figure 3. The unit simplex generalizes two of the special cases examined here.

Point A_1 = (0 , P_2 , 0) : This point below the unit simplex. Therefore, the probabilities are not required to sum to one.

Given

$$P_1 = 0$$

$$P_3 = 0$$

and equation (13)

$$P_3 = P_2\left(\frac{T_r + I}{T_0 - T_r}\right) - \frac{C}{T_0 - T_r}$$

$$P_2 = \left(\frac{C}{T_0 - T_r}\right)\left(\frac{T_0 - T_r}{T_r + I}\right) = \frac{C}{T_r + I}$$

Therefore,

$$A_1 = \left(0,\ \frac{C}{T_r + I},\ 0\right)$$

#

Point A_2 = (0 , P_2 , P_3) : Point A_2 is our case 2 : "It Depends".

Given

$$P_1 = 0\ ,$$

the unit simplex

$$P_1 + P_2 + P_3 = 1$$

and equation (13)

$$P_3 = P_2\left(\frac{T_r + I}{T_0 - T_r}\right) - \frac{C}{T_0 - T_r}.$$

By substitution

$$(1-P_2) = P_2\left(\frac{T_r+I}{T_0-T_r}\right) - \frac{C}{T_0-T_r}$$

$$P_2\left(-1-\frac{T_r+I}{T_0-T_r}\right) = \frac{-C}{T_0-T_r} - 1$$

$$P_2 = \left(\frac{T_0-T_r+C}{T_0+I}\right)$$

finally,

$$P_3 = 1-P_2 = 1-\left(\frac{T_0-T_r+C}{T_0+I}\right) = \left(\frac{T_r+I-C}{T_0+I}\right)$$

Therefore,

$$A_2 = \left(0,\ \frac{T_0-T_r+C}{T_0+I},\ \frac{T_r+I-C}{T_0+I}\right)$$

#

Comparative Static Analysis with $P_1 = 0$.

$$A_2 = (P_2, P_3) = \left(\frac{T_0-T_r+C}{T_0+I}, \frac{T_r+I-C}{T_0+I}\right)$$

$$\frac{\partial P_2}{\partial C} = \frac{1}{T_o+I} > 0$$

$$\frac{\partial P_3}{\partial C} = -\frac{1}{T_o+I} < 0$$

#

Point A_3 = (P_1 , P_2 , 0): Notice that this is our Case 3, "No Bluff". The point A_3 obtained by solving the following equations :

Given

$$P_3 = 0,$$

the unit simplex

$$P_1 + P_2 + P_3 = 1$$

and equation (13)

$$P_3 = P_2\left(\frac{T_r + I}{T_0 - T_r}\right) - \frac{C}{T_0 - T_r}$$

By substitution,

$$\frac{C}{T_0 - T_r} = (1 - P_1)\left(\frac{T_r + I}{T_0 - T_r}\right)$$

Solving for P_1,

$$P_1 = 1 - \frac{C}{T_o + I} = \frac{T_r + I - C}{T_o + I}$$

And solving for P_2

$$P_2 = 1 - P_1 = 1 - \frac{T_r + I - C}{T_0 + I} = \frac{T_0 - T_r + C}{T_0 + I}$$

Therefore,

$$A_3 = \left(\frac{T_r + I - C}{T_0 + I},\ \frac{T_0 - T_r + C}{T_0 + I},\ 0\right)$$

#

Comparative static analysis of the area of the triangle in Figure 4.

$$\text{Area} = (1/2)\text{bh} \quad = \frac{1}{2}\left(1 - \frac{C}{T_o + I}\right)\left(\frac{T_r + I - C}{T_o + I} - 0\right)$$

$$= \frac{1}{2}\left(\frac{T_o + I - C}{T_o + I}\right)\left(\frac{T_r + I - C}{T_o + I}\right)$$

$$= \frac{(T_o + I - C)(T_r + I - C)}{2(T_o + I)^2}$$

$$= \frac{(T_o + I)(T_r + I) - C(T_o + I + T_r + I) + C^2}{2(T_o + I)^2}$$

$$\frac{\partial Area}{\partial C} = \frac{-(T_o + I + T_r + I) + 2C}{2(T_o + I)^2}$$

$$sign\left(\frac{\partial Area}{\partial C}\right) = sign(-(T_o + I + T_r + I) + 2C)$$

Assuming an intersection exists, we can utilize the following inequality.

$$\frac{C}{T_r + I} \le 1 \qquad \Rightarrow C \le T_r + I$$

Then

$$(-(T_o + I + T_r + I) + 2C) \le -(T_o + I + T_r + I) + 2(T_r + I) = T_r - T_o < 0$$

Therefore,

$$\frac{\partial Area}{\partial C} < 0$$

##

APPENDIX B. RELEVANT NEWSPAPER ARTICLES

1. *Des Moines Register*, January 20, 1994
2. *Des Moines Register*, April 23, 1995
3. *Washington Post Weekly* August 28-,1995
4. *Wall Street Journal*, April 11, 1995
5. *Des Moines Register*, January 30, 1994

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