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Private Takings

by Ed Nosal

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This paper considers the implications associated with a recent Supreme Court ruling that can be interpreted as supporting the use of eminent domain in transferring the property rights of one private agent--a landowner--to another private agent--a developer. Compared to voluntary exchange, when property rights are transferred via eminent domain, landowners' investments in their properties become more inefficient and, as a result, any any benefit associated with mitigating the holdout problem between landowners and the developer is reduced. Social welfare can only increase if the holdout problem is significant; otherwise, social welfare will fall when property rights are transferred via eminent domain.

Key words: eminent domain, social welfare, property rights, holdout problem, bargaining.

JEL code: C7, D61, H11, P14.

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1 Introduction

A recent Supreme Court decision (*Kelo v. New London*) has effectively given communities the green light for *private takings*, where local and state governments have the authority to condemn private property for other *private* use. The ruling is controversial. Some observers believe the use of eminent domain in the *Kelo* case does not fulfil the public use criterion as stated in the fifth amendment to the U.S. constitution: "nor shall private property be taken for *public* use, without just compensation" (my emphasis). They also might point out that the recent ruling seems to contradict an earlier Court ruling (*Hawaii Housing Authority v. Midkiff*): "A purely private taking could not withstand the scrutiny of the public use requirement; it would serve no legitimate purpose of government and would thus be void ... The court's cases have repeatedly stated that 'one person's property may not be taken for the benefit of another private person without a justifying public purpose, even though compensation be paid,' ." Other observers, however, believe that *Kelo* ruling is fully consistent with both the constitution and previous Court decisions. The Holmes Court ruled in 1925 what constitutes public use should be determined by state legislatures; so if legislatures deem that economic development of private property *by private agents* provides benefits to the community at large—due to, say, higher employment levels and tax base—then such a taking fulfils the public use criterion as stated in the constitution. Proponents of the *Kelo* ruling would point out that the Supreme Court had no choice but to rule for the City of New London since the taking was motivated by the public benefits associated with economic development.

From a public policy prospective, attempting to assess whether a taking is "appropriate" by determining whether or not it fulfils the public use criterion in the constitution seems almost pointless: given the way the Court has interpreted public use, "almost anything goes" in the sense that if a state government *claims* that there is a public benefit associated with a taking, then there *is* a public benefit associated with the taking. A more meaningful and relevant exercise would be assess the social welfare implications associated with takings along the lines of *Kelo*, i.e., where the government takes property from one private agent and gives it to another (assuming, of course, that the former receives just compensation). In this paper I present a model where a developer has the opportunity to redevelop private property that is currently owned by another private party, a landowner. The developer can obtain the property rights from the landowner directly—by purchasing the property rights from the landowner—or indirectly—by having the government take the landowner's property rights, subject to providing the landowner with just compensation. When the landowner purchases the property rights directly from the landowner, the price of the property rights is determined as a outcome to a bargaining problem; when the government takes the property from the landowner, the landowner receives the market value of the taken property, which is paid for by the developer. Compared to various bargaining schemes, the use of eminent domain always distorts the landowner's property investment away from what is efficient.

I consider two different bargaining schemes when the developer directly purchases property rights from landowners. In one scheme I assume that the developer has a fixed bargaining weight, independent of how many landowners he bargains with. In this situation, the use of eminent domain to transfer property always lowers social welfare compared to bargaining. This scheme, however, may suffer from a shortcoming. Some commentators have pointed out that when a developer agent attempts purchase a number of properties for a project, he may be subject to the holdout problem, i.e., potential sellers will withhold their property in an attempt to obtain a larger surplus. In fact, it has been suggested that the use of eminent domain can be interpreted as the government's solution to this holdout problem. A bargaining scheme that has a developer with a fixed bargaining weight effectively assumes away the holdout problem. I, therefore, consider an alternative bargaining scheme that has the bargaining weight of the developer declining with the number of landowners he bargains with. Such a bargaining scheme can be interpreted as embodying a notion of the holdout problem. I find that even when the holdout problem present, the use of eminent domain to transfer property rights may lower social welfare. The holdout problem has to be "significant" if the use of eminent domain is to have any social value.

The seminal economics paper on eminent domain and takings is Blume, Rubinfeld and Shapiro (1984). This paper, and the rather sizeable literature that follows it, focus on the issue of compensation in an environment where the condemned property is converted into a *public* good. The takings literature that addresses the condemnation of private property for other private use is extremely small. Rolnik and Davies (2006) and Garrett and Rothstein (2007), relying on solid economic reasoning, point out that when governments interfere with the market place, bad outcomes usually follow. Both of these discussions, however, are not conducted within the context of an explicit model.

The remainder of the paper is as follows. The next section considers a simple redevelopment-takings environment with one developer and one landowner. In section 3, this environment is extended to one of a single developer and many landowners. The final section concludes.

2 A Simple Model with One Landowner

There is a single landowner who is endowed with capital K_ℓ and property rights to a tract of land. The landowner can invest his capital in two ways. He can invest in a safe asset that provides a gross rate of return R and he can make an irreversible investment $x \leq K_\ell$ on his land, which gives a payoff of $f(x)$, where $f' > 0$, $f'' < 0$ and $f'(0) > R$.

A developer is endowed with capital K_d. He can redevelop the landowner's land and invest in the safe asset. If land is redeveloped, the investment x—and therefore, potential payoff $f(x)$—is destroyed. Let y represent the amount spent on redevelopment by the developer. There are two states of the world for redevelopment: a good state and a bad state. The probability that the state is good is $1-\theta$. In the good state, redevelopment spending $y \geq \bar{y}$ generates a payoff of Y and spending $y < \bar{y}$ gives a zero payoff. In the bad state, any expenditure $y \geq 0$ gives a zero payoff.

In order to redevelop land, the developer must acquire the property rights from the landowner. If he purchases these rights directly from the landowner, then the purchase price, p, is determined by bargaining and is given by the solution to the generalized Nash bargaining problem. The developer's generalized Nash bargaining weight is denoted by β, where $0 < \beta < 1$, and the landowner's bargaining weight is $1-\beta$. Since $0 < \beta < 1$, both the landowner and the developer have some bargaining power.

There exists a government that can condemn and expropriate, i.e., *take*, the landowner's property. When the government revokes the landowner's property rights, it sells them to the developer. The law requires the government provide "just compensation" to the landowner in the event that his land is taken. In this article, just compensation will be defined as $f(x)$—the value of the property to the landowner in the event that his property is not taken. One can interpret a taking as essentially by-passing the bargaining process between the developer and landowner. The government must balance its budget. Hence, if land is taken, the government sells the property rights to the developer for $f(x)$.

The timing of events is as follows. At date 0, the landowner is born; he invests x in his property and $K_\ell - x$ in the safe asset. In between dates 0 and 1, the state of world—good or bad—is revealed. At date 1, the developer is born; he decides whether or not to redevelop the landowner's property. In the event that the redevelopment takes place either the developer bargains with the landowner or the government takes the landowner's property rights and sells them to the developer. In either case, the developer spends either p or $f(x)$ (at date 2) to acquire the property rights, where he spends p if the he bargains with the landowner and $f(x)$ if he gets the property rights, via eminent domain, from the government. The developer invests $(K_d - y)$ in the safe asset if he obtains the property rights to the land; otherwise he invests K_d in the safe asset. At date 2 all investments pay off, payments are exchanged and the landowner and developer consume.

The objective of the landowner and the developer is to maximize their expected payoffs. The timing of the births of a landowner and the developer prevents them from interacting before the landowner makes his investment decision. This timing assumption is designed to reflect the real world fact that developers enter the scene long after initial investments are undertaken.

2.1 Social Optimum

At date 0, the landowner invests x in his property. With probability θ, the state of the world is bad and it is not efficient to redevelop the land. In this situation the payoff to the landowner is $f(x) + (K_\ell - x)R$ and the payoff to the developer is $K_d R$. With probability $(1-\theta)$, the state is good and it will be efficient to redevelop the land only if the total payoff to redevelopment, $Y + (K_d - \bar{y})R + (K_\ell - x)R$, exceeds the payoff to not redeveloping the land, $f(x) + K_d R + (K_\ell - x)R$; or if $Y - \bar{y}R \geq f(x)$. Define a critical level of investment in land, x_c, as

$$Y - \bar{y}R = f(x_c).$$

If $x \leq x_c$, then it is efficient to redevelop the land in the good state; if $x > x_c$, then it is not. To make the redevelopment problem interesting, I will assume the efficient level of investment in land—described below—is strictly less than x_c. If the efficient level of investment in land is greater than x_c, then redevelopment never socially optimal.

The efficient level of investment in land is determined by the solution to

$$\max_x \theta (f(x) + K_d R) + (1-\theta)(Y + (K_d - \bar{y})R) + (K_\ell - x)R, \tag{1}$$

i.e., the efficient level of investment in land maximizes total expected payoff to society. The efficient level of investment in land, x^*, is given by the first-order condition to (1), i.e.,

$$\theta f'(x^*) = R. \tag{2}$$

The social optimum is characterized by:

1. the landowner investing x^* at date 0;

2. the developer spending $\bar{y}$ on redevelopment in the good state; and

3. no redevelopment in the bad state.

2.2 Redevelopment Under Bargaining

The developer has no incentive to obtain property rights in the bad state. In the good state, the (date 2) payoff to the developer when he does obtain property rights is $(Y - \bar{y}R - p)$ and (date 2) the payoff to the landowner is $(p - f(x))$. Note that the developer spends $y = \bar{y}$ for redevelopment. At the time of bargaining, the investment x is sunk for the landowner but the investment $\bar{y}$ for the developer is not; this is why the term "$\bar{y}R$" shows up in the developer's payoff function and there is no comparable term in the landowner's payoff function. Define the total surplus associated with redevelopment in the good state as $S(x)$, where

$$S(x) = Y - \bar{y}R - f(x),$$

$S'(x) < 0$ for all $x > 0$ and $S(x_c) = 0$. If $S(x) > 0$—or equivalently $x < x_c$—then the developer will want to redevelop the land; if $S(x) \leq 0$—or equivalently $x \geq x_c$—then he will not. If $S(x) > 0$, then the price that the developer pays for the landowner's property rights, p, is given by the solution to

$$\max_p (Y - \bar{y}R - p)^{\beta} (p - f(x))^{1-\beta},$$

which is

$$p = \beta f(x) + (1-\beta)(Y - \bar{y}R).$$

Suppose first that the landowner believes (correctly) that $S(x) \geq 0$ for his choice of x; then the optimal investment in his property is given by the solution to

$$\max_x \theta f(x) + (1-\theta)[\beta f(x) + (1-\beta)(Y - \bar{y}R)] + (K_\ell - x) R. \tag{3}$$

Note that the landowner's objective function can be rewritten as

$$f(x) + (1-\theta)(1-\beta) S(x) + (K_\ell - x) R.$$

The solution, x_B, is characterized by

$$(\theta + (1-\theta)\beta) f'(x_B) = R, \tag{4}$$

where "B" stands for "bargaining." Comparing (4) with (2), note that $x_B > x^*$; the landowner's investment in his property is larger than what is socially optimal.

Suppose now the landowner believes (correctly) that $S(x) < 0$ for his choice of x; then his optimal investment investment is given by the solution to

$$\max_x f(x) + (K_\ell - x) R. \tag{5}$$

The solution of (5) is characterized by

$$f'(x_N) = R, \tag{6}$$

where the "N" stands for "no bargaining." Comparing (4) with (6), note that $x_N > x_B > x^*$. Since $S'(x) < 0$ for all $x > 0$,

$$S(x^*) > S(x_B) > S(x_N).$$

If $S(x_N) > 0$, i.e., $x_N < x_c$, then the developer will always redevelop the landowner's land in the good state. If $S(x_N) > 0$, then the relevant problem for landowner is (3) and he invests x_B.

If $S(x_B) < 0$, i.e., $x_B > x_c$, then developer will never redevelop the landowner's property and relevant problem is given by (5). Hence, the landowner invests x_N and no redevelopment takes place.

Finally, if $S(x_B) > 0$ and $S(x_N) < 0$, then landowner's level of investment will determine whether or not there will be redevelopment in the good state. That is, if the landowner believes that redevelopment will occur, then he will invest x_B and redevelopment will occur in the good state. If he believes that redevelopment will not occur, then he will invest x_N and in the good state, the developer will have no incentive to redevelop the landowner's land. How much will the landowner invest at date 0, x_B or x_N? While one might be tempted to conjecture that the landowner will invest x_B, since the surplus associated with investment x_B is greater than investment x_N, the landowner may actually invest x_N. This possible outcome is a feature associated with generalized Nash bargaining: the generalized Nash bargaining solution is not monotonic, which implies that although total surplus increases, the landowner's expected share (and payoff) decreases. So although $S(x_B) > 0$ and $S(x_N) < 0$, it may be the case that

$$f(x_N) + (K_\ell - x_N) R > f(x_B) + (1-\theta)(1-\beta) S(x_B) + (K_\ell - x_B) R. \quad (7)$$

Therefore, if $S(x_B) > 0$ and $S(x_N) < 0$ and condition (7) holds, then the landowner will invest x_N; if condition (7) does not hold, then he will invest x_B.

Note that there are inefficiencies associated with redevelopment via bargaining, compared to the social optimum. First, the landowner always "overinvests" in his property since $x_N > x_B > x^*$. Second there may be too little redevelopment. In the social optimum, it is always efficient to redevelop in the good state. If $S(x_B) < 0$, then redevelopment will never occur under bargaining; and if $S(x_B) > 0$, $S(x_N) < 0$and condition (7 holds, then redevelopment will not occur under bargaining.

2.3 Eminent Domain

Under eminent domain, a government can take the landowner's property but must provide "just compensation," $f(x)$, to the landowner. The government then sells the property rights to the developer for $f(x)$. In terms of the model, eminent domain can be interpreted as giving all of the bargaining power to the developer since the landowner does not receive any of the surplus associated with redevelopment.

Proposition 1 *Using eminent domain to transfer property rights never increases but can decrease social welfare compared to bargaining.*

Proof. If the level of landlord investment, x, is such that redevelopment will occur in the good state, i.e., $x < x_c$, then social welfare can be written as

$$W(x) = f(x) + (1-\theta) S(x) - xR + (K_d + K_\ell) R;$$

If landlord investment is such that redevelopment does not occur in the good state, i.e., $x \geq x_c$, then social welfare is given by

$$\tilde{W}(x) = f(x) - xR + (K_d + K_\ell) R.$$

Note that if the landowner optimally chooses $x = x_B$ under bargaining, then necessarily, redevelopment occurs under bargaining. Under eminent domain, the landowner will always receive a payoff of $f(x) + (K_\ell - x) R$, independent of the redevelopment outcome, which means that he will always invests x_N. When $x = x_N$, redevelopment may or may not occur under eminent domain depending on whether $x_N < x_c$ or $x_N \geq x_c$, respectively. Hence, if $x_N < x_c$, we have

$$W(x^*) > W(x_B) > W(x_N) > W(x_c)$$

since $W(x)$ is strictly concave for all $x \in [0, x_c]$. If $x_B < x_c < x_N$, we have

$$W(x^*) > W(x_B) > \tilde{W}(x_N) > W(x_c) = \tilde{W}(x_c)$$

There are a number of cases to consider:

1. If $S(x_B) < 0$, then redevelopment does not take place under bargaining and the landowner invests x_N; in this case, eminent domain and bargaining generate the same level of welfare.

2. If $S(x_N) > 0$, then under bargaining the landowner invests x_B and redevelopment occurs in the good state. Under eminent domain, the landowner invests x_N and the developer redevelops in the good state. In this case, the overinvestment problem is exacerbated under eminent domain, compared to bargaining—since $x_N > x_B > x^*$; here social welfare is lower under eminent domain compared to the bargaining since $W(x_B) > W(x_N)$.

3. If $S(x_B) > 0$ and $S(x_N) < 0$ and condition (7) does *not* hold, then under bargaining, the landowner will invest x_B and redevelopment will occur in the good state. In this case, welfare is $W(x_B)$. Under eminent domain, the landowner will invest $x_N > x_c > x_B$; there will be too much investment and too little redevelopment. In this case welfare is $\tilde{W}(x_N)$. Since $\tilde{W}(x_N) < W(x_B)$, the use of eminent domain strictly lowers welfare. If, however, $S(x_B) > 0$ and $S(x_N) < 0$ and condition (7) holds, then the landowner will invest x_N under both eminent domain and bargaining. Social welfare will be the same under bargaining and eminent domain.

From all of this we can conclude that the use of eminent domain will never increase social welfare but may lower it. ■

2.4 Discussion

Up to this point, the analysis seems to indicate that the recent Supreme Court on *Kelo v. New London* is wrong-headed: eminent domain, in conjunction with just compensation, can never increase social welfare and can only lower it. Eminent domain, along with just compensation, effectively gives all of the bargaining power to the developer, i.e., eminent domain and just compensation effectively sets $\beta = 1$ in the landowner's investment problem (3), making it equivalent to (5). It is true that, absent eminent domain, the level of landowner investment x is too high, but the use of eminent domain, along with just compensation, can only exacerbate the overinvestment problem. Not only may there be too much investment but the higher level of landowner investment may result in no redevelopment at all in the good state.

Parties who have their property taken by the government often claim that they are undercompensated. In the context of the model, if a landowner is compensated $f(x)$ for his property rights, then there is legitimacy to the claim that he is undercompensated. In the real economy, there does not exist a market with a well-defined price for, say, real estate. The price for real estate is typically determined by bargaining between a seller and buyers. The purchase price of land via bargaining, p, is always strictly greater than the level of just compensation, $f(x)$, as long as both parties to the bargain have some bargaining power, i.e., $\beta f(x) + (1-\beta)[Y - R\bar{y}] > f(x)$. So, in fact, landowner's receive a lower price for their property via eminent domain than they could have obtained by dealing directly with buyers (developers).

There are two ways that one can restore social efficiency via governmental takings. One way has the government giving "more than just compensation" to the landowner. To see this, suppose that government compensates the landowner by transferring the entire (net) surplus to him. Such a scheme is equivalent to the landowner having all of the bargaining power. When the landowner has all of the bargaining power, then the landowner's decision problem is given by (3) with $\beta = 0$; the solution to this problem is $x = x^*$. A second way to restore efficiency is to give a fixed payment c, perhaps equal to zero, to the landowner. (In light of the results of Blume, Rubinfeld and Shapiro (1984), this result should not be that surprising.) In this case, the landowner's investment problem is

$$\max_x \theta f(x) + (1-\theta) c + (K_\ell - x) R,$$

which has the solution $x = x^*$.

In practice, one would conjecture the neither one of these schemes would be implemented as a policy. An arbitrary fixed payment c would probably not pass a "just compensation" criterion. Passing a law that requires the entire net surplus associated with redevelopment be transferred away from developers to the landowners when eminent domain is used would probably not gain sufficient support in a legislature since, by using eminent domain, the legislature wants developers to redevelop; giving them zero surplus might have the opposite effect.

3 A Model with Many Landowners

In the model presented in section 2, the only interesting decision problem is that of the landowner; the developer simply decides whether or not to redevelop the landowner's property since the amount spent on redevelopment is essentially predetermined. In this section, we make the developer's problem more interesting *and realistic* by having him determine both the amount of land to redevelop and the amount to spend on redevelopment. This richer environment can be had by making only slight modifications to the model in section 2.

Suppose now there are N landowners, each having property rights to their own tract of land. The total value associated with property redevelopment is given by $Y = F(A, y)$, where A represents the tracts of land or properties used for redevelopment and y is the total amount spent on redevelopment. I assume the function $F(A, y)$ is strictly concave and increasing in both of its arguments, with $F_A(0, y) = F_y(A, 0) \to \infty$ for $y, A > 0$.[1]

The timing of events is as follows: At date 0, landowners are born and invest x in their property and $K_\ell - x$ in the safe asset. At date 1, the developer is born; he decides how many properties he wishes to redevelop, A, and the total amount that he will spend on redevelopment, y. The developer either bargains with a set of A landowners or the government takes the landowners' property rights away from A landowners and sells them to the developer. In either case the developer spends Ap or $Af(x)$ (at date 2) to acquire the property rights. The developer invests $(K_d - y)$ in the safe asset. At date 2, all investments pay off, payments are exchanged and the landowners and the developer consume.

3.1 Social Optimum

Let $W(x, y, A)$ represent the total payoff to society. The efficient values of investment, x and y, and property redevelopment, A, are given by the solution to

$$\max_{x,y,A} W(x, y, A) = \max_{x,y,A} (N - A) f(x) + F(A, y) + N(K_\ell - x) R + (K_d - y) R \quad (8)$$

All N landowners invest x in their property and the remainder of their capital in the safe asset. A total of A properties will be redeveloped. Hence, the total payoff to landowner investment will be $(N - A) f(x)$ and the payoff to redevelopment is $F(A, y)$. The developer spends y on redevelopment, which implies that he invests $(K_d - y)$ in the safe asset. The efficient levels of investments, x and y, and property redevelopment, A, are by characterized by the first-order conditions to problem (8), i.e.,

$$\frac{N - A}{N} f'(x) = R, \quad (9)$$

$$F_y(A, y) = R. \quad (10)$$

and

$$F_A(A, y) = f(x) \quad (11)$$

[1] One can assume, as in Nosal (2001), that only a fraction of properties are suitable for redevelopment. Qualitatively speaking, this would not affect any of the results.

Conditions (9) and (10) simply say that the expected return to investments x and y, respectively, equals the opportunity cost of capital, R. In terms of property redevelopment, condition (11), the developer continues to redevelop properties until the value last unit redeveloped equals the (social) cost of redevelopment, which is the value of the landowner's destroyed investment, $f(x)$. I compactly denote the efficient levels of investment and property redevelopment by (x^*, y^*, A^*).

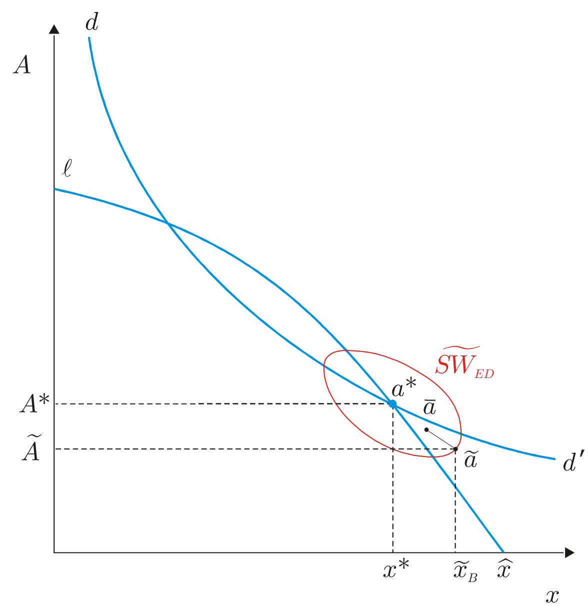
Let $A(x)$ denote the efficient amount of land redevelopment given that (i) landowners invest x and (ii) spending on redevelopment, y, is efficient, i.e., given by equation (10). For what follows, it will be useful to diagrammatically characterize the social optimum in (x, A) space. The slope of the locus of points described by (9) is negative and is given by

$$\frac{dA}{dx} = \frac{f''(x)}{f'(x)}(N - A) < 0. \tag{12}$$

Equation (9) is depicted in figure 1 as $\ell\hat{x}$; "ℓ" for landowner. Note that the allocation $(\hat{x}, 0)$ lies on locus $\ell\hat{x}$, where $\hat{x}$ solves $f'(\hat{x}) = R$. As well, since $A \to N$ as $x \to 0$, allocation $(0, N)$ lies on locus $\ell\hat{x}$. The slope of the locus of points described by equation in (11), conditional on efficient redevelopment spending y, is also negative and given by

$$\frac{dA}{dx} = \frac{f'(x)}{F_{AA} - \frac{F_{Ay}^2}{F_{yy}}} < 0, \tag{13}$$

since, from (10), $dy = -F_{Ay}/F_{yy} dA$ and F is strictly concave. Figure 1 depicts equations (10) and (11) as dd'; "d" for developer.



Social Optimum
Figure 1

In figure 1, $\ell\hat{x}$ and dd' loci intersect twice; social welfare is maximized at point a^*, where the slope of $\ell\hat{x}$ curve is steeper than that of the dd' curve.[2] Moving away from the point of intersection $a^* = (x^*, A^*)$ *along* either curve $\ell\hat{x}$ or dd' unambiguously lowers social welfare. Assuming that condition (10) holds, the slope of a social welfare indifference curve is given by

$$\frac{dA}{dx} = \frac{(N - A) f'(x) - NR}{f(x) - F_A(A, y)}.$$

For allocations on the $\ell\hat{x}$ curve, the slope of the social welfare indifference curve is zero and for allocations on the dd' curve, it is infinite. A typical social welfare indifference curve that intersections allocation $\tilde{a}$ (where $\tilde{A} > A^*$ and $\tilde{x} < x^*$) is given by the ellipse denoted $\widetilde{SW}$ in figure 1. Note that for allocations that are south-east of allocation $a^* = (x^*, A^*)$ and that lie in between (but not on) the $\ell\hat{x}$ and dd' curves—such as allocation $\tilde{a}$—the slopes of the social welfare indifference curves are all strictly positive and finite. This implies that if two allocations lie in the cone given by $\hat{x}a^*d'$ and a line that connects the two allocations has a strictly negative slope, such as allocations $\bar{a}$ and $\tilde{a}$ in figure 1, then the allocation that has higher redevelopment, A, and lower investment, x, will generate a higher level of social welfare, i.e., the social welfare associated with allocation $\bar{a}$ exceeds that of $\tilde{a}$ in figure 1.

3.2 Redevelopment Under Bargaining

Unless the developer plans on only redeveloping one tract of land, he must bargain with more than one landowner. Since bargaining theory does not offer a definitive approach when bargains involve more than 2 parties, I will consider two bargaining schemes. In one scheme, it is assumed that the developer has a fixed bargaining power—i.e., a fixed bargaining weight in the generalized Nash bargaining problem—β, independent of how many landowners he bargains with. Without loss of generality, it is assumed that $\beta = 1/2$. In the other scheme, it is assumed that the developer's bargaining power $\beta(A)$ falls as the number of landowners he bargains with, A, increases, i.e., $\beta'(A) < 0$. For simplicity, I will assume that $\beta(A) = 1/(A+1)$.

3.2.1 Fixed Bargaining Power

It is assumed that the developer's bargaining weight is $\beta = 1/2$ and, if there are A landowners involved in the bargain, each landowner's bargaining weight is $(1-\beta)/A = 1/(2A)$. The net surplus received by the developer if each landowner receives p for transferring his property rights to the developer is $F(A, y) - yR - pA$; the net surplus received by each of the A landowners is $p - f(x)$. The compensation p that each

[2] The appendix constructs an example where the $\ell\hat{x}$ and dd' curves intersect twice—as in figure 1—and demonstrates that a^* is the solution to problem (8).

landowner receives for transferring their property rights to the developer is given by the solution to the multiperson generalized Nash bargaining problem,

$$\begin{aligned} & \max_p \left(F(A,y) - yR - pA\right)^{\frac{1}{2}} \left(p - f(x)\right)^{\frac{1}{2A}} \cdots \left(p - f(x)\right)^{\frac{1}{2A}} \\ = & \max_p \left(F(A,y) - yR - pA\right)^{\frac{1}{2}} \left(p - f(x)\right)^{\frac{1}{2}}, \end{aligned}$$

which is

$$p = \frac{1}{2} f(x) + \frac{1}{2} \frac{\left(F(A,y) - yR\right)}{A}. \tag{14}$$

Each landowner's investment choice is given by the solution to

$$\max_x \frac{N-A}{N} f(x) + \frac{A}{N} \left(\frac{1}{2} f(x) + \frac{1}{2} \frac{F(A,y) - yR}{A} \right) + (K_\ell - x) R. \tag{15}$$

The solution to this problem is given implicitly by

$$\left(\frac{N-A}{N} + \frac{A}{2N} \right) f'(x_B) = R. \tag{16}$$

The developer's choice of property redevelopment, A, and spending on redevelopment, y, is given by the solution to

$$\max_{A,y} F(A,y) - pA + (K_d - y) R.$$

Given (14), the developer's problem can be rewritten as

$$\max_{A,y} \frac{1}{2} \left(F(A,y) - Af(x) - yR\right) + K_d R.$$

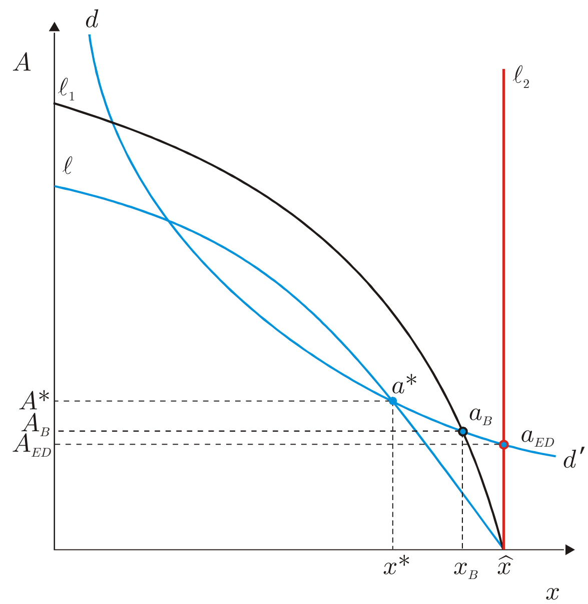
The solution to the developer's problem is given by

$$F_y(A,y) = R \tag{17}$$

and

$$F_A(A,y) = f(x). \tag{18}$$

Note a few things. First, the developer's choice of y and A does not depend directly on his bargaining strength; the choices do depend *indirectly* on bargaining strength since the landowner's choice of x depends upon on the bargaining strengths and the developer's choice variables depend on x. Second—and this is related to the first observation—given the amount of investment undertaken by landowners, x, the amount of property redeveloped, A, and the amount spent on redevelopment, y, are efficient, i.e., compare (17) and (18) with (10) and (11), respectively. The developer will choose y and A so as to maximize total surplus since this also maximizes his share of the surplus. Diagrammatically speaking, the developer's decision is described by locus dd' in figure 2, which is identical to the locus dd' in figure 1.



Fixed Bargaining Power
Figure 2

The the locus of points that describe the landowner's optimal investment decision, (16), in (x, A) space is depicted in figure 2 as $\ell_1\hat{x}$. The slope of this locus is

$$\frac{dx}{dA} = \frac{f''}{f'}\left(N - \frac{A}{2}\right). \tag{19}$$

Comparing (19) with (12), we see that locus $\ell_1\hat{x}$ is steeper than locus $\ell\hat{x}$ since

$$N - \frac{A}{2} > N - A.$$

From figure 2, the equilibrium outcome $a_B = (x_B, A_B)$ is given by the lower intersection of the $\ell_1\hat{x}$ and dd' curves. It is evident that when the developer and landowners bargain over the price of landowners' property rights, there will be, from a social perspective, too much investment in property, $x_B > x^*$, and, as a result, too little redevelopment activity, $A_B < A^*$. (The total amount of investment associated with redevelopment, y, can be higher than, lower than or equal to y^*, depending on the sign of F_{Ay}.)

The equilibrium outcome $a_B = (x_B, A_B)$ differs from the socially efficient levels because landowners take account of the fact that if their property is purchased for redevelopment, then, through the bargaining process, the purchase price will depend positively on the amount of investment undertaken. Because of this, landowners will tend to overinvestment in their properties.

3.2.2 Variable Bargaining Power

Here I assume that the developer's bargaining power declines with the number of landowners he bargains with, i.e., $\beta'(A) < 0$. I will further assume that each party to the bargain has the same bargaining power which implies that $\beta(A) = (A+1)^{-1}$. As in the previous section, the net surplus that the developer receives is $Y(A, y) - pA - Ry$ and $p - f(x)$ is the surplus that each landowner who sells his property rights receives. The compensation p that each landowner receives for transferring their property rights to the developer is given by the solution to

$$\max_{p} \left(F(A, y) - pA - Ry\right)^{\frac{1}{A+1}} \left(p - f(x)\right)^{\frac{A}{A+1}},$$

which is

$$p = \frac{f(x) + F(A, y) - yR}{A+1}.$$

Each landowner's investment choice is given by the solution to

$$\max_{x} \frac{N-A}{N} f(x) + \frac{A}{N} \frac{f(x) + F(A, y) - yR}{A+1} + (K_\ell - x) R.$$

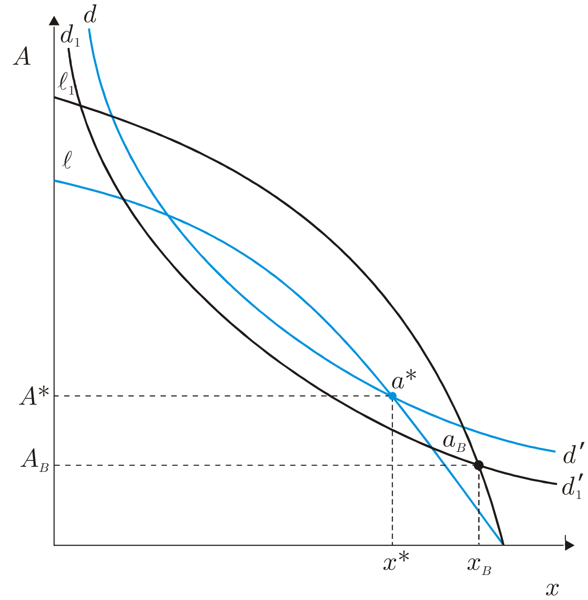
The solution to this problem is given implicitly by

$$\left(\frac{N-A}{N} + \frac{A}{N}\frac{1}{A+1}\right) f'(x) = R \tag{20}$$

and is depicted by the curve $\ell_1\hat{x}$ in figure 3. The slope of this locus of points in (x, A) space is

$$\frac{dA}{dx} = \frac{N - A + \frac{A}{A+1}}{1 - \frac{1}{(A+1)^2}} \frac{f''}{f'} < 0,$$

which is steeper than the planner's locus, $\ell\hat{x}$, see figure 3.



Variable Bargaining Power
Figure 3

The developer's choice of property redevelopment, A, and spending on redevelopment, y, is given by the solution to

$$\max_{A,y} F(A,y) - \frac{A}{A+1}\left(f(x) + F(A,y) - yR\right) + (K_d - y)R.$$

The solution to the developer's problem is given by

$$F_A(A,y) = f(x) + \frac{F(A,y) - Af(x) - yR}{A+1} \tag{21}$$

and

$$F_y(A,y) = R \tag{22}$$

The level of redevelopment spending, y, is efficient for a given level of property redevelopment, A, i.e., equation (22). However, the amount of property that will be redeveloped, A, is no longer efficient for a given x. This should not be surprising. Intuitively, the developer now faces a trade off when increasing the number of properties he develops from socially inefficient levels: although total surplus increases, his share of the surplus decreases. The end result is that for a given x, the developer will "under-redevelop." By under-redevelop, I mean that the level of property redevelopment, A, is less than what is efficient given x, $A(x)$, where $A(x)$ solves equations (10) and (11). To see that there is under-redevelopment, note that equation (21) implies that, if there is under redevelopment, then

$$F_A(A(x), y) < f(x) + \frac{F(A(x), y) - A(x)f(x) - yR}{A(x)+1}. \tag{23}$$

Consider now the effect of a change in A on the left-hand side of (21), given that equation (22) holds, i.e.,

$$\frac{dF_A}{dA} = F_{AA} - F_{Ay}\frac{dy}{dA} = F_{AA} - \frac{F_{Ay}^2}{F_{yy}} < 0;$$

hence, a decrease in A will increase F_A. Now consider the effect of a change A on the right-hand side of (21), given that equation (22) holds, i.e.,

$$\frac{d\left[f(x) + \frac{F(A,y)-Af(x)-yR}{A+1}\right]}{dA} = \frac{F_A(A,y)}{A+1} - \frac{F(A,y) - Af(x) - yR}{(A+1)^2} > 0;$$

hence, a decrease in A will decrease the right-hand side of (22). Reducing property redevelopment from what is efficient will increase the left-hand side and will reduce the right-hand side of (23). Therefore, equation (21) is characterized by a level of property redevelopment that is less than what is efficient.

The developer's behavior, as given by equations (21) and (22), is described in figure 3 by locus d_1d_1', (the planner's decision along these dimensions is represented by locus dd'.) The equilibrium $a_B = (x_B, A_B)$ is characterized by the lower intersection of the d_1d_1' and $\ell_1\hat{x}$ loci. As in the case of fixed developer's bargaining strength, compared to the social optimum $a^* = (x^*, A^*)$ landowners overinvest and the developer redevelops less than A^* properties. However, whereas, *for a given* x, the developer's level of redevelopment is efficient when he has fixed bargaining strength, i.e., his redevelopment decision lies on locus dd, when he has variable bargaining strength, he under redevelops.

Intuitively, the "distance" between the dd' and d_1d_1' loci can be interpetted as a measure of the holdout problem between the developer and the landowners. If the holdout problem is not very significant, then the distance between these two loci will not be not very great; as the holdout problem worsens, the distance between the dd' and d_1d_1' loci increases.

3.3 Eminent Domain

We assume, as above, that if the landowners' property rights are transferred to the developer under eminent domain, then each landowner will receive $f(x)$ as "just compensation."

Since, under eminent domain, landowners understand that their payoff will be $f(x)$ independent of whether or not their property is taken, the optimal behavior for the landowner is given by $f'(x) = R$ or $x = \hat{x}$. The locus of points that describe the landowner's optimal investment decision under eminent domain is given by $\ell_2\hat{x}$ in both figures 2 and 4, for, respectively, fixed and variable bargaining strengths. The developer's decision problem is to choose the level of property development, A, and spending on redevelopment, y, given that he must pay $f(x)$ for each property redeveloped, i.e.,

$$\max_{A,y} F(A,y) - f(x) A + (K_d - y).$$

The solution to this problem is

$$F_y(A,y) = R$$

and

$$F_A(A,y) = f(x),$$

which is identical to (17) and (18), respectively (i.e., it is the same as the solution to the developer's problem when he has fixed bargaining strength and property rights are transferred via bargaining). Diagramatically speaking, solution to the the developer's decision when property is transferred via eminent domain is represented by by locus dd' in figures 1, 2 and 4.

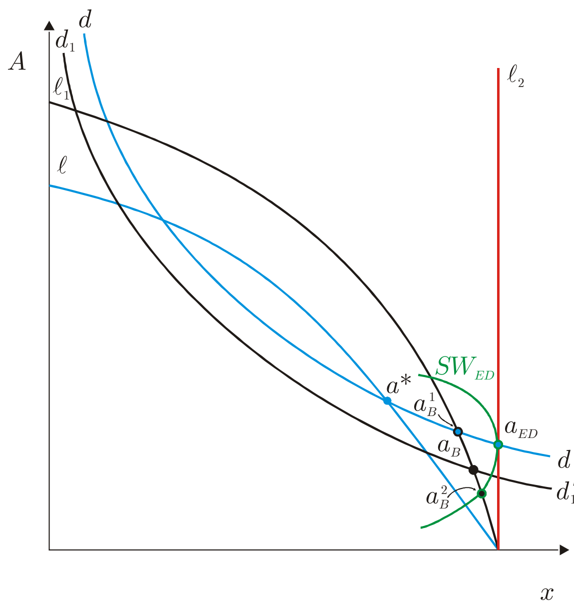
The following two propositions demonstrate that eminent domain may have some rather undesirable consequences.

Proposition 2 *When the developer has fixed bargaining strength, if landowners believe that redevelopment will occur under eminent domain, then social welfare is strictly lower under eminent domain than under bargaining.*

Proof. The equilibrium under bargaining, $a_B = (x_B, A_B)$, is given by the intersection of the $\ell_1\hat{x}$ and dd' loci in figure 2. The equilibrium under eminent domain, $a_{ED} = (\hat{x}, A_{ED})$, is given by the intersection of the $\ell_2\hat{x}$ and dd' loci. Since social welfare unambiguously falls as one moves away from $a^* = (x^*, A^*)$ along the dd' locus, the social welfare associated with allocation a_B is strictly higher than that of allocation a_{ED}. ■

Proposition 3 *When the developer has variable bargaining strength, if landowners believe that redevelopment will occur under eminent domain, then social welfare is strictly lower under eminent domain than under bargaining unless the holdout problem is "significant"; when the holdout problem is significant, welfare under eminent domain exceeds that of bargaining.*

Proof. The equilibrium under bargaining *when there is no holdout problem* is given by allocation $a_B = (x_B, A_B)$ in figure 4, while the equilibrium under eminent domain—for either fixed or variable bargaining—is given by allocation $a_{ED} = (\hat{x}, A_{ED})$. The level of social welfare associated with the use of eminent domain is represented by the indifference curve labeled SW_{ED}. When the developer has variable bargaining strength, the equilibrium under bargaining can lie anywhere on the locus $a_B\hat{x}$. Suppose the holdout problem is not significant in that the d_1d_1' locus intersects



Variable Bargaining Power2
Figure 4

the $\ell_1\hat{x}$ locus in-between allocations a_B and a_B^1, i.e., at a_B^2 in figure 4. Then the level of social welfare associated with allocation a_B^2 exceeds that of the eminent domain allocation, a_{ED}. If, however, the holdout problem is significant, resulting in a d_1d_1' locus—which is suppressed in figure 4—intersecting locus $\ell_1\hat{x}$ at a_B^3, then the social welfare associated with the eminent domain allocation, a_{ED}, will exceed that of the bargaining allocation, a_B^3; see figure 4. ■

3.4 Discussion

When the bargaining power of the developer is fixed, the results regarding the use of eminent domain mirror that of the one landlord case. That is, compared to bargaining, the use of eminent domain exacerbates the landowners' overinvestment problem and social welfare is lowered. As well, the level redevelopment is also reduced. When the bargaining power of the developer is variable, it is still the case that the use of eminent domain exacerbates the overinvestment problem. If the holdout problem is not too severe, then—as with the case of a fixed bargaining power—social welfare will decrease if eminent domain is used to reallocate property rights from landlowners to the developer. If, however, the holdout problem is severe, then the use of eminent domain can actually increase social welfare, compared to bargaining.

If policy makers could reliably and costlessly observe the magnitude of the holdout problem, then the selective use of eminent domain to transfer property rights for redevelopment could be a social enhancing policy. That is, eminent domain would be used only when the holdout problem is severe; otherwise, the developer would bargain directly with landowners. Of course, the problem here is that one cannot costlessly observe the magnitude of the holdout problem. And one cannot rely on developers or landowers to inform policy makers of the extent of the holdout problem. Developers have an incentive to claim that the holdout problem is severe, since the use of eminent domain implies that property can be purchased cheaper than through direct bargaining. Landowners' would have an incentive to claim that there is no holdout problem and that they would settle for the same proposed price with anyone who wanted to purchase their property via bargaining.

In defending the state's right to take property from one private agent and give it—in exchange for just compensation—to another private agent, proponents of the *Kelo* decision—who are often local governments—point to the increased benefits associated with higher levels of redevelopment, such as employment and taxes. Although it is true that the use of eminent domain will increase the level of redevelopment—and other activities associated with it—it is not obvious that this translates into higher social welfare. For example, allocation a_{ED} in figure 4 has a higher level of redevelopment compared to allocation a_B^2, but a lower level of social welfare. If local goverments equate higher levels employment and tax revenue, that usually accompany higher levels of redevelopment, with a higher level of social welfare, then allowing communities to use eminent domain to promote redevelopment will lead to bad outcomes in many circumstances. In particular, local governments will use their power of eminent domain even when the holdout problem is not severe.

4 Conclusion

One might think that a government policy that allows developers to purchase as many properties that they want for "just" compensation would promote redevelopment and enhance social welfare. If there is no holdout problem, then such a policy would, in fact, reduce both redevelopment and welfare. When a holdout problem exists, such a policy may, indeed, promote redevelopment but it is not at all obvious that social welfare would be enhanced. Although the use of eminent domain mitigates the holdout problem, it also exacerbates landowner's overinvestment problem. If the latter effect dominates the former—and this would occur if the holdout problem is not too severe—then social welfare will be reduced if local governments resort to their power of eminent domain.

5 References

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6 Appendix

The necessary conditions for a maximum to problem (8) are given by (9), (10) and (11). These conditions will identify a (local) maximum if the following second-order conditions are satisfied,

$$F_{yy} < 0 \tag{24}$$

$$F_{yy}F_{AA} - F_{Ay}^2 > 0 \tag{25}$$

$$(N-A) f''(x) \left[F_{yy}F_{AA} - F_{Ay}^2\right] - F_{yy} f'(x)^2 < 0 \tag{26}$$

Conditions (24) and (25) are satisfied since $F(A, y)$ is strictly concave. Condition (26) can be rewritten as

$$\frac{f'(x)}{F_{AA} - \frac{F_{Ay}^2}{F_{yy}}} > \frac{f''(x)}{f'(x)} (N - A).$$

This condition has a nice interpretation; the first order conditions identify a (local) maximum if the $\ell\hat{x}$ curve is steeper than that of the dd' curve, i.e., compare (12) and (13).

To show that an equilibrium exists and is characterized by what is identified in the text, consider the following example. Let $f(x) = x^{.5}$and $Y(A, y) = A^{.4}y^{.4}$. For these functional forms, the first-order conditions for problem (8) are

$$\frac{N-A}{2N} x^{-0.5} = R \tag{27}$$

$$.4A^{.4}y^{-0.6} = R \tag{28}$$

$$.4A^{-0.6}y^{.4} = x^{.5} \tag{29}$$

The decision of a landlord is given by (27) and can be rewritten as

$$\frac{N-A}{2NR} = x^{.5};$$

this function is represented as $\ell\hat{x}$ in figure 1. The decision of the developer is given by equations (28) and (29), which can be combined to read

$$.4^{\frac{10}{6}} R^{-\frac{2}{3}} A^{-1} = x^{.5}.$$

Note that $A \to \infty$ as $x \to 0$ and $x \to \infty$ as $A \to 0$. This function is represented as dd' in figure 1. Together, the first-order conditions (27), (28) and (29) can be rewritten as the quadratic equation

$$-A^2 + AN - KN = 0,$$

where $K = (0.8)(0.4)^{\frac{2}{3}} R^{\frac{1}{3}}$. The solution to this quadratic is

$$A = N \pm \frac{\sqrt{N(N-4K)}}{2}.$$

If $N > 4K$, there will be two solutions, as depicted in figure 1. If $N > 4K$, then the maximum is given by allocation given by point a^*, since at point x the slope of the $\ell\hat{x}$ curve is steeper that that of the dd' curve, (at point b the slope of the dd' curve is steeper that that of the $\ell\hat{x}$ curve.) If $N \leq 4K$, then the solution is $A = N$. In the text, the more interesting case of $N > 4K$ is assumed.