Economics Bulletin

Volume 38, Issue 3

Malice in auctions and commitments to cancel

Brishti Guha
Jawaharlal Nehru University

Abstract

A bidder is “malicious” if his valuation includes, apart from his intrinsic valuation for the object, a malice component from depriving other bidders. A bidder has malice even if the auction is cancelled as this prevents the other bidder from getting the object. I consider a second price sealed bid auction of a single object with two potentially malicious bidders. Valuations, including malice components, are private knowledge. Suppose the seller commits to cancel the auction if either bidder drops out. Then, while bidders with standard preferences never drop out, malicious bidders do so over a non-empty parameter range, and the auction is cancelled despite the absence of any entry fees or reserve prices. This could also be true of spiteful bidders. However, if valuations are common knowledge, the bidder with the higher intrinsic valuation never drops out in an auction with two spiteful bidders (given the seller's commitment to cancel if he does): however, in an auction with two malicious bidders, both might drop out. Experimenters might thus be able to distinguish between (i) standard bidders versus malicious or spiteful ones, and (ii) spiteful versus malicious bidders. For specific distribution functions, the tendency to drop out is increasing in the bidder's malice.

I am grateful to the editor, John Conley, associate editor, Parimal Bag, and an anonymous referee.
Citation: Brishti Guha, (2018) "Malice in auctions and commitments to cancel", *Economics Bulletin*, Volume 38, Issue 3, pages 1623-1631
Contact: Brishti Guha - brishtiguha@gmail.com.
Submitted: January 19, 2018.   **Published:** September 07, 2018.

1. Introduction

This paper contributes to the literature on integrating behavioral economics into auction theory (Kaplan and Zamir 2015 provide an excellent survey). Psychological motives influencing bidders include regret (Engelbrecht-Wiggans 1989) and spite (where a bidder's payoff is negatively related to the surplus of another bidder). In particular, Morgan et al (2003) study auctions where bidders have a common spite parameter. They show that spite causes overbidding relative to the spiteful bidder's true valuation. Nishimura et al (2011) show that if low-valuation bidders "overbid" due to spite, this could be counterbalanced by high-valuation bidders underbidding under perfect information.

I incorporate a motive labeled "malice" into a second price sealed bid auction with a single indivisible object and two potential bidders. A bidder is malicious if, in addition to his intrinsic valuation for the object, he obtains a utility from "malice" in any outcome when the other bidder does not obtain the object. A specific instance is when the auctioneer cancels the auction and retains the object; in this event, a malicious bidder gets a positive payoff from malice. Overall valuation and willingness to pay comprise of two components – intrinsic value for the object, and malice utility (obtaining the object deprives the other bidder). This allows me to incorporate malice into the bidder's valuation in a very simple form.

A general perception exists that sellers are hurt when auctions have too few bidders since these bidders may not bid competitively (Bulow and Klemperer 1996; Klemperer 2004; Tietze 2012). Indeed, actual auctions have been called off when "too few" bidders show up to the auction.[1] I consider a game where the seller commits to call off the auction if either of the two bidders drops out. I show that while such a commitment will not affect standard bidders, it will cause malicious bidders to drop out for a non-empty parameter range. This might also be true of spiteful bidders. However, if valuations are common knowledge rather than private knowledge, the higher value bidder in an auction with spite never drops out, while *both* bidders in an auction with malice might drop out. I discuss ways in which experimenters could distinguish standard bidders from those with malice or spite, and ways in which they could distinguish between malicious and spiteful bidders. The possibility of malice can make it counterproductive for the seller to commit to cancel when there are too few bidders. However, such a commitment can help an experimenter, or a patent authority who wants to prevent patent shelving (this last point is explained in Section 4).

That malice motivates many has been experimentally shown (Beckman et al (2002), Bosman and van Winden (2002), Bosman et al (2006), Albert and Mertins (2008), Zizzo and Oswald (2001), Abbink and Sadrieh (2008), and Abbink and Herrmann (2011), among others). This paper is also related to Guha (2014), which incorporates malice into the mechanism design problem (outside the context of auctions), Guha (2016), which shows how malice plays a role in the courtroom, and to Guha (2018), which shows how malice affects the Rubinstein bargaining game.

---

[1] A 3G licence auction scheduled in Indonesia in June 2012 was cancelled when one telecom giant dropped out, due to concerns about too few bidders leading to uncompetitive bids (Jeffreys et al 2013). In India, coal mine auctions were cancelled by the Coal Ministry because they received too few bids (http://www.thehindubusinessline.com/economy/policy/fourth-round-of-coal-mine-auctions-cancelled/article8045702.ece).

Section 2 contains a proof, for general distributions, that malicious bidders will prefer to drop out of the auction if doing so would get the auction cancelled, over a non-empty parameter space. This is also contrasted with the case where preferences are spiteful in the sense of Morgan et al (2003). I also discuss two methods that experimenters can use, to distinguish between (a) bidders with standard preferences versus those with malice or spite, and (b) spiteful versus malicious bidders. Section 3 contains examples with specific distribution functions, where the tendency to drop out is directly related to the magnitude of the bidder's malice. Section 4 concludes.

2. A Result for a general distribution function

A single indivisible object is to be auctioned in a second-price sealed bid auction with two possible bidders, 1 and 2. Each bidder i, i $\in\{1,2\}$, draws a realization v_i (representing intrinsic valuation) and simultaneously also draws a realization κ_i (which represents bidder i's malice utility, or the payoff he gets whenever bidder j, j$\neq$i, does not obtain the object). We define a random variable $z = v + \kappa$ and call z_i bidder i's *valuation* (inclusive both of intrinsic value and malice components). This denotes bidder i's overall willingness to pay for the object. We denote the probability density function of z by $f(z)$ and the corresponding cumulative distribution function by $F(z)$. Each bidder only knows his own realizations and knows simply that the other bidder's valuation is drawn from the same distribution.

If a second price sealed bid auction were held without the auctioneer making any special announcements, each bidder would play his dominant strategy, bidding his true valuation z, and the higher bidder would win the auction.[2] However, we consider a modified game G where:

1. The seller announces that if either bidder drops out, the auction will be cancelled.
2. The bidders draw their realizations of intrinsic and malice utility.
3. Each bidder individually decides on whether to participate in the auction or drop out.
4. If one or both bidders decides to drop out in step 3, the auction is cancelled and the object remains with the seller.
5. Otherwise, the auction is held and the object allocated to the higher bidder.

Remark. A non-malicious bidder playing G never drops out.

Intuitively, a non-malicious bidder knows that if he drops out and the auction is therefore cancelled, he would obtain 0, while his expected payoff from participating in the auction is positive.

Malice changes this. If a malicious player drops out and the auction is cancelled, he still obtains his malice utility since he knows that the other player will not obtain the object, either.

Proposition 1. *Suppose G is played. Then, for any positive κ_i, bidder i drops out of the auction if v_i is below a cap $v^*(\kappa_i)$.*

[2] Note that this differs from Morgan et al's approach to spite because I incorporate malice into the overall valuation and therefore into the bid that a buyer is willing to offer. Thus, it continues to be a dominant strategy to bid one's valuation, *inclusive of malice.*

Proof. Consider the case where bidder i is malicious and has positive κ_i, but has an intrinsic valuation v_i of zero. Then, if this bidder drops out and the auction is therefore cancelled, he obtains his malice utility, κ_i, as bidder j does not obtain the object. By participating in the auction, bidder i would not get anything in case bidder j won, and would obtain κ_i in case he wins the auction himself, which happens if $z_j < \kappa_i$. Thus, his expected utility from participating in the auction is

$$\kappa_i F(\kappa_i) < \kappa_i \ . \qquad (1)$$

Thus, such a bidder prefers to drop out of the auction if doing so would get it cancelled, rather than participate in the auction.

If the bidder has positive v_i, the LHS of (1) would change to $(\kappa_i + v_i)F(\kappa_i + v_i)$ while the RHS would remain the same. By continuity, the inequality would continue to be satisfied for small enough v_i.[3] **QED**

2.1 A contrast with spiteful preferences

It would be interesting to compare malicious bidders who play *G* with the case where *G* is played by bidders with spiteful preferences. A bidder i in a two-bidder auction (where the other bidder is denoted by j) is defined to have spiteful preferences with a spite parameter α if his expected payoff from an auction is

$$U_i(A) = \Pr[b_i > b_j]\,(v_i - b_j) - \alpha \Pr[b_j > b_i]\,(v_j - b_i).$$

Here, v_i and v_j represent the intrinsic valuations of bidders i and j, respectively, while b_i and b_j represent their bids. Thus, a spiteful bidder derives utility if the other bidder gets a negative surplus (which is possible if the other bidder wins the auction but has to pay a bid higher than her valuation), and suffers a loss if the other bidder gets a positive surplus.

We show below that whether the behavior of spiteful bidders differs significantly from that of malicious bidders depends crucially on whether valuations are private or common knowledge.

In their analysis of a second price sealed bid auction with two spiteful bidders (where valuations are private knowledge), Morgan et al (2003) showed that bidders overbid, with bid functions solving

$$b(v) = v + \frac{\int_v^1 (1-F(t))^{(1+\alpha)/\alpha} dt}{(1-F(v))^{(1+\alpha)/\alpha}} \ . \qquad (2)$$

Here, v is the bidder's intrinsic valuation, α denotes a common spite parameter, b is the bid, and F, the distribution function of intrinsic valuation, has support [0,1].

The proof of Proposition 1 starts by considering a bidder whose intrinsic valuation is zero. Consider a spiteful bidder i whose intrinsic valuation v is zero, and suppose this bidder plays *G.* If the auction is cancelled, this bidder obtains 0; he does not obtain the object, and as bidder j does not obtain the object either, there is no positive or negative surplus term to

[3] The LHS of (1) does not account for the price that has to be paid by a winner. Accounting for this would further lower the LHS and increase the range of intrinsic valuations over which malicious bidders drop out.

contribute to the "spite" portion of bidder i's utility. Thus, opting out yields this spiteful bidder a utility of 0. If he participated in the auction, he would bid, from (2),

$$b(0) = \int_0^1 (1 - F(t))^{(1+\alpha)/\alpha} \, dt \ . \tag{3}$$

Since bids are increasing in valuation, and bidder i has the lowest possible valuation, he loses the auction: bidder j wins and has to pay b(0), the losing bid. Thus, bidder i's utility from the auction is the negative of the product of his spite parameter and bidder j's surplus:

$$-\alpha \left(v_j - b(0) \right) = U_i(A) \ . \tag{4}$$

Now, note that it is possible that the winning bidder's surplus may be negative: we can have $v_j<b(0)$. Nonetheless, as the spiteful bidder does not know bidder j's valuation, he has to compare $b(0)$ with $E(v_j) = \int_0^1 v dF(v)$. It is easy to verify that for the uniform distribution, $b(0) = \frac{1}{2+{}^1/_\alpha} < \frac{1}{2} = E(v_j)$. Similarly, for the Kumaraswamy K(1,2) distribution, $b(0) = \frac{1}{3+{}^2/_\alpha} < \frac{1}{3} = E(v_j)$. In both these cases, the spiteful bidder i gets negative expected utility from participating in the auction, and would rather drop out and get the auction cancelled, obtaining 0. Thus, for many common distributions of valuations, a spiteful bidder with zero intrinsic valuation would behave similarly to a malicious bidder with zero intrinsic valuation if *G* were played and valuations were private knowledge.[4]

Next, consider the case where valuations are common knowledge. Let the intrinsic valuations of the bidders be v_1 and v_2, where $v_1>v_2$. From Brandt et al (2007), if both bidders are spiteful, and valuations are known, the equilibrium strategy is for both bidders to bid b = $\frac{v_2+\alpha v_1}{1+\alpha}$ (in terms of Morgan et al's notation). This makes the lower value bidder exactly indifferent between winning and losing: in either case, his payoff is $-\frac{\alpha(v_1-v_2)}{1+\alpha}$. The high value bidder's payoff from winning is $\frac{v_1-v_2}{1+\alpha}$, while his payoff from losing is $\frac{\alpha^2(v_1-v_2)}{1+\alpha}$, which is also positive (since the low value bidder gets a negative surplus if he wins, the high value bidder gets positive utility from spite).[5]

Proposition 2. *Suppose valuations are common knowledge. If two spiteful bidders play G, the higher intrinsic value bidder never drops out. However, if two malicious bidders play G, both bidders might drop out.*

Proof. From the above discussion, the high value spiteful bidder always obtains a positive payoff if he participates in the auction. If he drops out, the auction gets cancelled and the bidder gets 0 as he neither wins the object nor does the other bidder get a surplus, whether positive or negative. Thus, the high value bidder always prefers to participate and never exercises the option to drop out. Now, consider two malicious bidders i and j, where $z_i>z_j>v_i$. It is easy to see that bidder j prefers the auction to be cancelled. If the auction happens, he will lose (from the first inequality) and get zero. As opposed to this, if the auction is cancelled, he could guarantee himself his malice utility, κ_j. Next, note that if the auction were to happen, bidder i would win

---

[4] In the examples given, an infinitely spiteful bidder with zero intrinsic valuation has zero expected utility from participating in the auction and is therefore indifferent between participation and dropping out.

[5] The high value bidder's payoffs remain positive if we allow for asymmetric spite.

and get $z_i - z_j = (v_i + \kappa_i) - z_j$, while if the auction is cancelled, he gets his malice utility, κ_i. From the second inequality, $v_i < z_j$ so bidder i also prefers the auction to be cancelled. If both bidders prefer the auction to be cancelled, there always exists an equilibrium for this parameter range where both drop out. Hence, with malice, both bidders might drop out, while this will never happen with spite. **QED**

Proposition 2 identifies a parameter range for which both malicious bidders will prefer the auction to be cancelled, with common knowledge. While, in such circumstances, both bidders dropping out is always an equilibrium, the possibility of multiple Nash equilibria exists where one bidder drops out and the other, correctly anticipating this, does not (since one bidder dropping out is enough to get the auction cancelled). However, Proposition 2 remains true despite this: while both bidders never drop out if both are spiteful, they might if they are both malicious. To rule out equilibria in which only one malicious bidder drops out though both prefer the auction to be cancelled, we would need further refinements, for instance, risk dominance.[6]

2.2 Implications for experimenters

Propositions 1 and 2 imply that experimenters might be able to distinguish between (a) standard bidders and those motivated by malice or spite, and (b) between malicious and spiteful bidders.

In the first experiment, the experimenter could auction a single object whose resale value (corresponding to intrinsic valuation) is drawn by the subjects from a known distribution (so that they know their own intrinsic valuations but only know the distribution from which the other's intrinsic valuation is drawn), committing (before the auction) that the auction will be cancelled if either bidder of a pair drops out. If a bidder drops out, the experimenter could infer the presence of malice or spite, as a bidder with standard preferences never drops out.

If some bidders drop out in the first experiment, the second experiment can be performed on them. In the second experiment, the experimenter would specify that the resale value (corresponding to intrinsic valuation) could take on one of two possible values. Moreover, the values are drawn without replacement, so that if one of a pair learned his intrinsic valuation, he could thereby infer that his match has the other possible intrinsic valuation. After intrinsic valuations are learned, the experimenter again offers to cancel the auction if either bidder drops out. If both bidders in a pair drop out, the experimenter can infer the presence of malice rather than spite. For both experiments, random matching can be used to rule out repeated game effects from fixed pairings.

3.Specific distribution functions and malice

Consider the case where v_i is drawn from a uniform [0,1] distribution. Simultaneously, κ_i is drawn from an independent uniform [0,1] distribution. The independence of malice and intrinsic valuation reflects the fact that malice is a component of an individual's personality (measuring his pleasure from depriving others) which has nothing to do with how much he likes the object being auctioned.

---

[6] If both bidders prefer the auction to be cancelled but have some uncertainty about whether the other bidder will drop out, they both unambiguously prefer to drop out. Thus, equilibria in which only one drops out do not survive the criterion of risk dominance.

As before, $z = v + \kappa$. $z \sim F[0,2]$ and

$f(z) = z, 0 \leq z \leq 1$.

$$f(z) = 2 - z, 1 < z \leq 2\ . \tag{5}$$

This is a non-uniform distribution with a peak at 1.

Proposition 3. *When G is played, the propensity to drop out of the auction monotonically increases in the bidder's malice, holding other parameters fixed.*

Proof. We analyze bidder i's decision to participate or drop out. We consider two cases.

Case 1: $0 < z_i \leq 1$.

The probability that bidder i assigns to winning the auction (knowing that bidder j will bid his true valuation, z_j) is

$P(z_j < z_i) = F(z_i) = \int_0^{z_i} z dz$. (from (5))

Or

$$P(z_j < z_i) = \frac{z_i^2}{2}\ . \tag{6}$$

The payment that bidder i will have to make conditional on winning, is bidder j's expected bid, given by

$$E[z_j | z_j < z_i] = \frac{\int_0^{z_i} z f(z) dz}{\int_0^{z_i} z dz} = \frac{\int_0^{z_i} z^2 dz}{\int_0^{z_i} z dz} = \frac{2z_i}{3}\ . \tag{7}$$

Bidder i's expected payoff from participating in the auction is thus

$$P(z_j < z_i)\left[z_i - E[z_j | z_j < z_i]\right] = \frac{z_i^3}{6}\ . \tag{8}$$

Here we have used (6) and (7) to arrive at the RHS of (8). If bidder i refuses to participate, he knows that the auction will be cancelled, yielding him a payoff of κ_i. Thus, he refuses to participate if and only if

$$\frac{z_i^3}{6} < \kappa_i\ . \tag{9}$$

Given z_i<1, $\kappa_i > 1/6$ is a sufficient condition for (9) to hold and thus for bidder i to drop out. However, this is not a necessary condition. Observe that

$$\frac{\partial z_i^3/6}{\partial \kappa_i} = \frac{z_i^2}{2} < \frac{1}{2}$$

while $\frac{\partial \kappa_i}{\partial \kappa_i} = 1$.

Thus, the LHS of inequality (9) increases at a slower rate in κ_i than the RHS does. Holding other parameters constant, an increase in a bidder's malice increases the likelihood that he drops out, resulting in a cancelled auction.

Case 2: $1 < z_i \leq 2$.

Now, (6), (7), (8) and (9) are replaced by

$$P(z_j < z_i) = \int_0^1 z dz + \int_1^{z_i}(2 - z)dz = 2z_i - 1 - \frac{z_i^2}{2} \ . \qquad (10)$$

$$E[z_j|z_j < z_i] = \frac{\int_0^1 z^2 dz + \int_1^{z_i}(2z - z^2)dz}{2z_i - 1 - \frac{z_i^2}{2}} = \frac{z_i^2 - \frac{z_i^3}{3} - \frac{1}{3}}{2z_i - 1 - \frac{z_i^2}{2}} \ . \qquad (11)$$

$$P(z_j < z_i)\left[z_i - E[z_j|z_j < z_i]\right] = z_i^2 - z_i - \frac{z_i^3}{6} + \frac{1}{3} \ . \qquad (12)$$

$$z_i^2 - z_i - \frac{z_i^3}{6} + \frac{1}{3} < \kappa_i \ . \qquad (13)$$

Now, the LHS of inequality (13) increases in κ_i at a rate $\left[2z_i - 1 - \frac{z_i^2}{2}\right]$. This is less than 1 (the rate of increase of the RHS of (8) with respect to κ_i).[7] Thus, the propensity of a bidder to drop out, cancelling the auction, is increasing in his malice. **QED**

Example 1: Consider $\kappa_i = \frac{1}{3}$. Then the cutoff value of v_i below which bidder i drops out when G is played is $v^*(1/3) = (2)^{1/3} - 1/3 = .927$. This is the value of v_i for which the two sides of (9) are equal.

Example 2: Consider $\kappa_i = 1$. Then $v^*(1)=1$. (13) holds as an equality for $v_i = 1$ and holds as an inequality for all smaller values of v_i.

4. Discussion

Due to the general perception (Bulow and Klemperer 1996) that auctions with too few bidders are not competitive and are harmful to the seller's interests, sellers might consider committing to cancel an auction if it failed to attract sufficiently many bidders. Indeed, some sellers have cancelled auctions under such circumstances. My results show that such a commitment is counter-productive for the seller's revenues given the possibility of malice. Had the seller not made such a commitment, both bidders would have competed and bid their true valuations inclusive of malice, so that the seller would have made a sale at the overall valuation of the lower bidder. This assumes that the seller does not derive an intrinsic utility from keeping the object for himself. With such a utility, reserve prices would be logical, providing a conventional reason why an auction might not occur. We have shown that malice introduces an additional reason for auctions not happening, even if the seller had no intrinsic utility for the object and therefore did not set reserve prices.

---

[7] Note that $(2 - z_i)^2 > 0$ implies $4z_i - z_i^2 < 4$ or $2z_i - 1 - \frac{z_i^2}{2} < 1$.

There are however two circumstances in which such a commitment may be useful. First, instead of a seller, this game could be played by an experimenter who takes on the seller's role. As explained in section 2.2, this could allow the experimenter to infer the presence of malice or spite and even to distinguish some malicious bidders from spiteful ones.

Secondly, the "seller" could be a mechanism designer instead of a profit-maximizing seller. Suppose this designer does not want the object to be allotted to buyers who want it due to malicious considerations. For example, consider the case of patent shelving. The "designer" might want to allocate a patent to one of two competing claimants. However, suppose one claimant wants to use the patent to actually develop a product, for which his intrinsic valuation is V. The other wants the patent to block the first claimant (which would give him malice utility κ) and does not really intend to develop the product himself (so that his intrinsic valuation for the patent is 0). Then, the designer might not wish the second claimant to obtain the patent. If the designer allowed the two claimants to bid for the patent in a second price auction, the second claimant could win the auction and obtain a patent if $\kappa > V$. By committing to cancel this auction if either bidder drops out, the designer weeds out the malicious bidder, who drops out. Thus, strikingly, the malicious bidder drops out even if he could have won the auction. While the auction itself has to be cancelled, the designer can then hold on to the object and repeat the game when two new potential bidders appear, until neither bidder drops out. (Repeated game effects are not important here, since new bidders are used). While this does not rule out the possibility of a malicious bidder obtaining the object, it does weed out malicious bidders whose intrinsic valuation is low. For specific distributions, it also weeds out bidders whose malice exceeds a threshold level.

References

Abbink, K and B. Herrmann (2011) "The Moral Costs of Nastiness", *Economic Inquiry* 49: 631-633.

Abbink, K and A Sadrieh (2008) "The Pleasure of Being Nasty", *Economics Letters* 105: 306-308.

Albert, M and V Mertins (2008) "Participation and decision making: a three-person power-to-take experiment". Joint Discussion Paper Series in Economics Working Paper No 05-2008.

Beckman, S.R, J.P Formby, W. James Smith and B. Zheng (2002) "Envy, malice and Pareto efficiency: an experimental examination", *Social Choice and Welfare* 19: 349-367.

Bosman, R and F. van Winden (2002) "Emotional hazard in a power-to-take experiment", *Economic Journal* 112: 146-169.

Bosman, R., H. Hennig-Schmidt and F. van Winden (2006) "Exploring group decision-making in a power-to-take experiment", *Experimental Economics* 9: 35-51.

Brandt, F., T. Sandholm and Y. Shoham (2007) "Spiteful bidding in sealed-bid auctions", *IJCAI* 7: 1207-1214.

Bulow, J. and P. Klemperer (1996) "Auctions versus negotiations", *American Economic Review* 86: 180-194.

Engelbrecht-Wiggans, R. (1989) "The effect of regret on optimal bidding in auctions", *Management Science* 35:685-692.

Guha, B. (2014) "Reinterpreting King Solomon's Problem: Malice and Mechanism Design", *Journal of Economic Behavior and Organization* 98: 125-132.

Guha, B. (2016) "Malicious Litigation", *International Review of Law and Economics* 47: 24-32.

Guha, B. (2018) “Malice in the Rubinstein bargaining game”, *Mathematical Social Sciences* 94:82-86.

Jeffreys, A., P. Kunsinas, and P. Grimsditch (2013): *The Report: Indonesia, 2013.* Oxford Business Group.

Kaplan, T.R. and S. Zamir (2015) “Advances in Auctions” in *Handbook of Game Theory Volume 4* (H. Peyton Young and S. Zamir, eds). Elsevier, Amsterdam, Oxford.

Klemperer, P. (2004) *Auctions: Theory and Practice.* Princeton University Press, Princeton.

Morgan, J., K. Steiglitz, and G. Reis (2003) “The spite motive and equilibrium behavior in auctions”, *B.E Journal of Economic Analysis and Policy* 2(1): Article 5.

Nishimura, N., T.N. Cason, T. Saijo, and Y. Ikeda (2011) “Spite and reciprocity in auctions”, *Games* 2:365-411.

Tietze, F. (2012) *Technology Market Transactions: Auctions, Intermediaries and Innovation.* Edward Elgar, Cheltenham.

Zizzo, D.J and A.J Oswald (2001) “Are people willing to pay to reduce others’ incomes?” *Annales d’ Economieet de Statistique*63: 39-65.