Inefficiency in the Shadow of Unobservable Reservation Payoffs

Madhav S. Aney

December 11, 2013

Motivation

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?
- Myerson and Satterthwaite (1983) show that all efficient trades do not take place when the following are imposed:

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?
- Myerson and Satterthwaite (1983) show that all efficient trades do not take place when the following are imposed:
  1. Two sided asymmetric information.

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?
- Myerson and Satterthwaite (1983) show that all efficient trades do not take place when the following are imposed:
    1. Two sided asymmetric information.
    2. Distributions of valuations for buyer and seller intersect (uncertainty about the gains from trade).

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?
- Myerson and Satterthwaite (1983) show that all efficient trades do not take place when the following are imposed:
    1. Two sided asymmetric information.
    2. Distributions of valuations for buyer and seller intersect (uncertainty about the gains from trade).
    3. Distributions are continuous.

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?
- Myerson and Satterthwaite (1983) show that all efficient trades do not take place when the following are imposed:
    1. Two sided asymmetric information.
    2. Distributions of valuations for buyer and seller intersect (uncertainty about the gains from trade).
    3. Distributions are continuous.
    4. Budget balance.

Motivation

- How does the problem of optimally allocating an object between two players change when reservation payoffs are type dependent?
- Myerson and Satterthwaite (1983) show that all efficient trades do not take place when the following are imposed:
  1. Two sided asymmetric information.
  2. Distributions of valuations for buyer and seller intersect (uncertainty about the gains from trade).
  3. Distributions are continuous.
  4. Budget balance.
- Relax the first three.

Motivation

Motivation

- To explore whether the assumptions of Myerson and Satterthwaite (1983) can be significantly relaxed when the reservation payoff of a player depends not only on her own type but also on the type of the other player.

Motivation

- To explore whether the assumptions of Myerson and Satterthwaite (1983) can be significantly relaxed when the reservation payoff of a player depends not only on her own type but also on the type of the other player.
- In the Myerson and Satterthwaite (1983) world if there is no trade, the seller walks away with undisputed ownership of the object. Consequently the reservation payoff of the buyer is always 0 and that of the seller is his valuation.

Example

Consider the problem of allocating some benefit to one of two players – player 1 and 2.

$$\theta_1 P(x_1, x_2) - x_1 \qquad \text{and} \qquad \theta_2(1 - P(x_1, x_2)) - x_2$$

where

$$P(x_1, x_2) = \frac{x_1^\lambda}{x_1^\lambda + x_2^\lambda} \qquad \lambda \in (0, 1).$$

Example

Consider the problem of allocating some benefit to one of two players – player 1 and 2.

$$\theta_1 P(x_1, x_2) - x_1 \qquad \text{and} \qquad \theta_2(1 - P(x_1, x_2)) - x_2$$

where

$$P(x_1, x_2) = \frac{x_1^\lambda}{x_1^\lambda + x_2^\lambda} \qquad \lambda \in (0, 1).$$

Here the equilibrium payoff of each player would depend not only on her own type but also the type of the other player.

Motivation

Motivation

- Here the reservation payoff of each player depends on the type of both players. Since the type of one of the two players is unobservable, the reservation payoff of the uninformed player becomes unobservable to her.

Motivation

- Here the reservation payoff of each player depends on the type of both players. Since the type of one of the two players is unobservable, the reservation payoff of the uninformed player becomes unobservable to her.
- Such type dependence arises naturally when players have partial claims over the object and the claims are subject to enforcement through playing an inefficient default game such as a contest.

Literature

Literature

- Myerson and Satterthwaite (1983) has been explored in different ways. Cramton et. al. (1987), McKelvey and Page (2002), Compte and Jehiel (2009).

Literature

- Myerson and Satterthwaite (1983) has been explored in different ways. Cramton et. al. (1987), McKelvey and Page (2002), Compte and Jehiel (2009).
- Literature on mechanism design with externalities where the payoff of players is not solely determined by whether or not they are allocated the good. Jehiel and Moldovanu (1999), Figueroa and Skreta (2009).

Literature

- Myerson and Satterthwaite (1983) has been explored in different ways. Cramton et. al. (1987), McKelvey and Page (2002), Compte and Jehiel (2009).
- Literature on mechanism design with externalities where the payoff of players is not solely determined by whether or not they are allocated the good. Jehiel and Moldovanu (1999), Figueroa and Skreta (2009).
- Large literature on conflict. Skarperdas (2006) has a good survey.

Model

The problem is one of allocating an object to one of two players with the possibility of transfers.

Model

The problem is one of allocating an object to one of two players with the possibility of transfers.

- player 1's valuation of the object is θ_1 which is observable.

Model

The problem is one of allocating an object to one of two players with the possibility of transfers.

- player 1's valuation of the object is θ_1 which is observable.
- player 2's valuation θ is private information and bounded between $\underline{\theta}$ and $\overline{\theta}$. For now we can leave the distribution unspecified.

Model

The problem is one of allocating an object to one of two players with the possibility of transfers.

- player 1's valuation of the object is θ_1 which is observable.
- player 2's valuation θ is private information and bounded between $\underline{\theta}$ and $\overline{\theta}$. For now we can leave the distribution unspecified.
- Assumption: $\theta_1 > \overline{\theta} > \underline{\theta} \geq 0$.

Model

The problem is one of allocating an object to one of two players with the possibility of transfers.

- player 1's valuation of the object is θ_1 which is observable.
- player 2's valuation θ is private information and bounded between $\underline{\theta}$ and $\overline{\theta}$. For now we can leave the distribution unspecified.
- Assumption: $\theta_1 > \overline{\theta} > \underline{\theta} \geq 0$.
- Since player 1 does not observe θ, she treats the type of player 2 as a random variable Θ.

Reservation Payoffs

To participate, the expected payoffs must be weakly greater than the reservation payoffs which are

$$\mathbb{E}(v_1(\Theta)) \qquad \text{and} \qquad v_2(\theta)$$

for player 1 and 2.

Reservation Payoffs

To participate, the expected payoffs must be weakly greater than the reservation payoffs which are

$$\mathbb{E}(v_1(\Theta)) \qquad \text{and} \qquad v_2(\theta)$$

for player 1 and 2.

- We see that both players' reservation payoffs depend on the type of player 2. Since player 1 does not observe player 2's type, her reservation payoff is an expectation over Θ.

Reservation Payoffs

To participate, the expected payoffs must be weakly greater than the reservation payoffs which are

$$\mathbb{E}(v_1(\Theta)) \qquad \text{and} \qquad v_2(\theta)$$

for player 1 and 2.

- We see that both players' reservation payoffs depend on the type of player 2. Since player 1 does not observe player 2's type, her reservation payoff is an expectation over Θ.
- These payoffs may also depend on θ_1 but since this is publicly observed we can drop it to ease notation.

Example

$$\theta_1 \mathbb{P}(\tilde{x}_1, \tilde{x}_2) - \tilde{x}_1 \qquad \text{and} \qquad \theta(1 - \mathbb{P}(\tilde{x}_1, \tilde{x}_2)) - \tilde{x}_2$$

where

$$\mathbb{P}(\tilde{x}_1, \tilde{x}_2) = \begin{cases} 1 & \text{if } \tilde{x}_1 = \tilde{x}_2 = 0 \\ \frac{\tilde{x}_1^\lambda}{\tilde{x}_1^\lambda + \tilde{x}_2^\lambda} & \text{otherwise, where } \lambda \in (0, 1) \end{cases}$$

- To simplify things assume that θ takes only 2 values; $\overline{\theta}$ with probability q and $\underline{\theta} = 0$ with $1 - q$.

Example

- We can solve out for the Bayesian-Nash equilibrium effort levels and payoffs.

$$x_1 := \underset{\tilde{x}_1}{\operatorname{argmax}} \left(\theta_1 \mathbb{E}(\mathbb{P}(\tilde{x}_1, x_2(\Theta))) - \tilde{x}_1\right)$$

$$x_2(\theta) := \underset{\tilde{x}_2}{\operatorname{argmax}} \left(\theta(1 - \mathbb{P}(x_1, \tilde{x}_2)) - \tilde{x}_2\right)$$

Example

- Plugging back x_1 and $x_2(\theta)$ into the objective functions we can derive

$$\mathbb{E}(v_1(\Theta)) = \theta_1 \mathbb{E}(\mathbb{P}(x_1, x_2(\Theta))) - x_1$$

and

$$v_2(\theta) = \theta(1 - \mathbb{P}(x_1, x_2(\theta))) - x_2(\theta)$$

Example

- Plugging back x_1 and $x_2(\theta)$ into the objective functions we can derive
$$\mathbb{E}(v_1(\Theta)) = \theta_1 \mathbb{E}(\mathbb{P}(x_1, x_2(\Theta))) - x_1$$
and
$$v_2(\theta) = \theta(1 - \mathbb{P}(x_1, x_2(\theta))) - x_2(\theta)$$

- Although player 1 perceives her reservation payoff to be $\mathbb{E}(v_1(\Theta))$, her ex-post payoff when she faces a type θ player 2 is
$$v_1(\theta) = \theta_1(\mathbb{P}(x_1, x_2(\theta))) - x_1$$

Inefficiency in the Reservation Payoffs

Inefficiency in the Reservation Payoffs

- To focus on the case where reservation payoffs are inefficient and players have an incentive to avoid them I assume

$$\forall\theta \qquad v_1(\theta) + v_2(\theta) < \theta_1 \tag{1}$$

Inefficiency in the Reservation Payoffs

- To focus on the case where reservation payoffs are inefficient and players have an incentive to avoid them I assume

$$\forall\theta \qquad v_1(\theta) + v_2(\theta) < \theta_1 \tag{1}$$

  This along with $\theta_1 > \overline{\theta}$ implies that ex-post efficiency requires that the object must always be allocated to player 1.

Inefficiency in the Reservation Payoffs

- To focus on the case where reservation payoffs are inefficient and players have an incentive to avoid them I assume

$$\forall\theta \qquad v_1(\theta) + v_2(\theta) < \theta_1 \tag{1}$$

  This along with $\theta_1 > \overline{\theta}$ implies that ex-post efficiency requires that the object must always be allocated to player 1.

- However since player 2 is privately informed of his type it is possible that

$$\exists\theta \qquad \mathbb{E}(v_1(\Theta)) + v_2(\theta) > \theta_1. \tag{2}$$

Inefficiency in the Reservation Payoffs (Example)

- In the contest example (1) is always true because of the standard inefficiency of all contests.

Inefficiency in the Reservation Payoffs (Example)

- In the contest example (1) is always true because of the standard inefficiency of all contests.
- However (2) is satisfied as long an q, the probability with which player 2 is a high type, is low enough.

Inefficiency in the Reservation Payoffs (Example)

- In the contest example (1) is always true because of the standard inefficiency of all contests.
- However (2) is satisfied as long an q, the probability with which player 2 is a high type, is low enough.
- This is because the unobservability of θ constrains player 1's payoff to be $\mathbb{E}(v_1(\Theta))$ without regard to the type of player 2. This will be the key to the inefficiency showcased in this model.

Direct Mechanism

Direct Mechanism

A direct mechanism yields payoffs μ_1 and $\mu_2(\theta)$ where

$$\mu_1 = \beta_1\theta_1 + t_1$$

Direct Mechanism

A direct mechanism yields payoffs μ_1 and $\mu_2(\theta)$ where

$$\mu_1 = \beta_1 \theta_1 + t_1$$

and

$$\mu_2(\theta) = \beta_2(\theta)\theta + t_2(\theta).$$

Direct Mechanism

A direct mechanism yields payoffs μ_1 and $\mu_2(\theta)$ where

$$\mu_1 = \beta_1\theta_1 + t_1$$

and

$$\mu_2(\theta) = \beta_2(\theta)\theta + t_2(\theta).$$

Feasibility and budget balance imply

$$\beta_1 + \mathbb{E}(\beta_2(\Theta)) \leq 1 \qquad \text{and} \qquad t_1 + \mathbb{E}(t_2(\Theta)) \leq 0$$

Direct Mechanism

A direct mechanism yields payoffs μ_1 and $\mu_2(\theta)$ where

$$\mu_1 = \beta_1\theta_1 + t_1$$

and

$$\mu_2(\theta) = \beta_2(\theta)\theta + t_2(\theta).$$

Feasibility and budget balance imply

$$\beta_1 + \mathbb{E}(\beta_2(\Theta)) \leq 1 \qquad \text{and} \qquad t_1 + \mathbb{E}(t_2(\Theta)) \leq 0$$

Since first best is attained only if the object is allocated to player 1, $\beta_2(\theta) = 0$ must hold for all θ.

Result

Proposition

Full efficiency under budget balance is attainable if and only if $\mathbb{E}(v_1(\Theta)) + v_2(\theta) \leq \theta_1$, *for all* $\theta \in [\overline{\theta}, \underline{\theta}]$.

Result

Proposition

Full efficiency under budget balance is attainable if and only if $\mathbb{E}(v_1(\Theta)) + v_2(\theta) \leq \theta_1$, *for all* $\theta \in [\overline{\theta}, \underline{\theta}]$.

Since $\beta_2(\theta) = 0$ for all θ, $t_2(\theta) = t$ to satisfy the IC constraints.

Result

Proposition

Full efficiency under budget balance is attainable if and only if $\mathbb{E}(v_1(\Theta)) + v_2(\theta) \leq \theta_1$, *for all* $\theta \in [\overline{\theta}, \underline{\theta}]$.

Since $\beta_2(\theta) = 0$ for all θ, $t_2(\theta) = t$ to satisfy the IC constraints.

- If –
  Set $t = \max\{v_2(\theta)\}$. This satisfies player 2's IR constraint. Since $\mathbb{E}(v_1(\Theta)) \leq \theta_1 - \max\{v_2(\theta)\}$ the IR constraint of player 1 is also satisfied.

Result

Proposition

Full efficiency under budget balance is attainable if and only if $\mathbb{E}(v_1(\Theta)) + v_2(\theta) \leq \theta_1$, *for all* $\theta \in [\overline{\theta}, \underline{\theta}]$.

Since $\beta_2(\theta) = 0$ for all θ, $t_2(\theta) = t$ to satisfy the IC constraints.

- **If** –
  Set $t = \max\{v_2(\theta)\}$. This satisfies player 2's IR constraint. Since $\mathbb{E}(v_1(\Theta)) \leq \theta_1 - \max\{v_2(\theta)\}$ the IR constraint of player 1 is also satisfied.
- **Only If** –
  Consider the case when there exists a θ such that $\mathbb{E}(v_1(\Theta)) + v_2(\theta) > \theta_1$. t must be at least $\max\{v_2(\theta)\}$ to satisfy the IR constraint of player 2. This however violates the IR constraint for player 1 since $\mathbb{E}(v_1(\Theta)) > \theta_1 - \max\{v_2(\theta)\}$.

Second Best

- If there exists a θ such that $\mathbb{E}(v_1(\Theta)) + v_2(\theta) > \theta_1$, first best is not implementable under budget balance.

Second Best

- If there exists a θ such that $\mathbb{E}(v_1(\Theta)) + v_2(\theta) > \theta_1$, first best is not implementable under budget balance.
- Even though the first best may not be implementable, it may be possible to implement an allocation that pareto dominates the reservation payoffs through a direct mechanism.

Second Best

- If there exists a θ such that $\mathbb{E}(v_1(\Theta)) + v_2(\theta) > \theta_1$, first best is not implementable under budget balance.
- Even though the first best may not be implementable, it may be possible to implement an allocation that pareto dominates the reservation payoffs through a direct mechanism.
- To proceed further I assume that θ is continuously distributed on the interval $[\underline{\theta}, \overline{\theta}]$.

Second Best

- If there exists a θ such that $\mathbb{E}(v_1(\Theta)) + v_2(\theta) > \theta_1$, first best is not implementable under budget balance.
- Even though the first best may not be implementable, it may be possible to implement an allocation that pareto dominates the reservation payoffs through a direct mechanism.
- To proceed further I assume that θ is continuously distributed on the interval $[\underline{\theta}, \overline{\theta}]$.
- Recall that payoffs from the mechanism μ_1 and $\mu_2(\theta)$ are composed of

$$\mu_1 = \beta_1\theta_1 + t_1 \qquad \text{and} \qquad \mu_2(\theta) = \beta_2(\theta)\theta + t_2(\theta).$$

Second Best – Constraints

- For player 1 we only need to satisfy the participation constraint $\mu_1 \geq \mathbb{E}(v_1(\Theta))$.

Second Best – Constraints

- For player 1 we only need to satisfy the participation constraint $\mu_1 \geq \mathbb{E}(v_1(\Theta))$.
- For player 2 in addition to $\mu_2(\theta) \geq v_2(\theta)$ we also need

$$\theta\beta_2'(\theta) + t_2'(\theta) = 0 \quad \Leftrightarrow \mu_2'(\theta) = \beta_2(\theta) \quad \text{– local incentive compatibility}$$

Second Best – Constraints

- For player 1 we only need to satisfy the participation constraint $\mu_1 \geq \mathbb{E}(v_1(\Theta))$.
- For player 2 in addition to $\mu_2(\theta) \geq v_2(\theta)$ we also need

$$\begin{array}{lll} \theta\beta_2'(\theta) + t_2'(\theta) = 0 & \Leftrightarrow \mu_2'(\theta) = \beta_2(\theta) & \text{– local incentive compatibility} \\ \beta_2'(\theta) \geq 0 & \Leftrightarrow \mu_2''(\theta) \geq 0 & \text{– monotonicity} \end{array}$$

Second Best – Constraints

- For player 1 we only need to satisfy the participation constraint $\mu_1 \geq \mathbb{E}(v_1(\Theta))$.
- For player 2 in addition to $\mu_2(\theta) \geq v_2(\theta)$ we also need

$$
\begin{array}{lll}
\theta\beta_2'(\theta) + t_2'(\theta) = 0 & \Leftrightarrow \mu_2'(\theta) = \beta_2(\theta) & \text{– local incentive compatibility} \\
\beta_2'(\theta) \geq 0 & \Leftrightarrow \mu_2''(\theta) \geq 0 & \text{– monotonicity} \\
1 \geq \beta_2(\theta) \geq 0 & \Leftrightarrow 1 \geq \mu_2'(\theta) \geq 0 & \text{– feasibility}
\end{array}
$$

Second Best – Optimization

- Solving for the surplus maximizing mechanism reduces to solving the following problem – for an exogenously given $\mathbb{E}(v_1(\Theta))$ and a function $v_2(\theta)$,

$$\min_{\beta_2(\theta)} \int_{\underline{\theta}}^{\overline{\theta}} (\theta_1 - \theta)\beta_2(\theta) f(\theta) d\theta$$

subject to the constraints described above.

Second Best – Optimization

- Solving for the surplus maximizing mechanism reduces to solving the following problem – for an exogenously given $\mathbb{E}(v_1(\Theta))$ and a function $v_2(\theta)$,

$$\min_{\beta_2(\theta)} \int_{\underline{\theta}}^{\overline{\theta}} (\theta_1 - \theta)\beta_2(\theta) f(\theta) d\theta$$

  subject to the constraints described above.
- If the reservation payoffs arise from a Bayesian game the solution to this problem is simple.

Bayesian Reservation Payoffs

Proposition

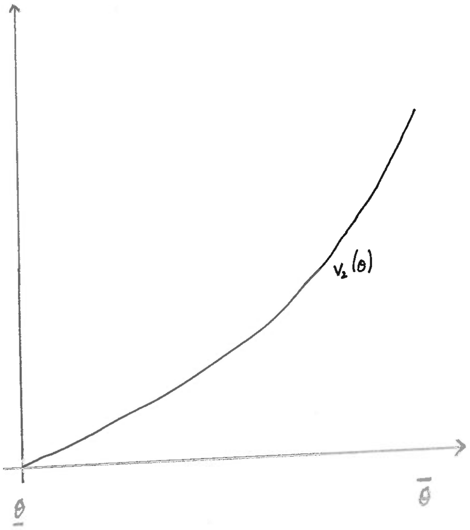
If $\mathbb{E}(v_1(\Theta))$ and $v_2(\theta)$ arise from a Bayesian game without third party subsidy, the surplus maximizing mechanism comprises of

$$
\begin{array}{llll}
\beta_2(\theta) = v_2'(\theta) & \text{and} & t_2(\theta) = v_2(\theta) - \theta v_2'(\theta) & \text{if } \overline{\theta} \geq \theta > \hat{\theta} \\
\beta_2(\theta) = 0 & \text{and} & t_2(\theta) = v_2(\hat{\theta}) & \text{if } \hat{\theta} \geq \theta \geq \underline{\theta} \\
\beta_1 = 1 - \mathbb{E}(\beta_2(\Theta)) & \text{and} & t_1 = -\mathbb{E}(t_2(\Theta)) &
\end{array}
$$

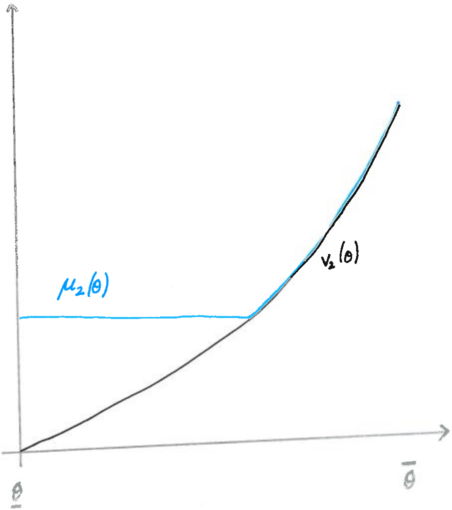
where $\hat{\theta} \in (\underline{\theta}, \overline{\theta})$ is the highest θ that satisfies

$$
\mathbb{E}(v_1(\Theta)) + v(\overline{\theta}) - \theta_1 = \int_{\hat{\theta}}^{\overline{\theta}} v'(\theta)\Big(F(\theta) - (\theta_1 - \theta)f(\theta)\Big)d\theta
$$

Bayesian Reservation Payoffs



Bayesian Reservation Payoffs



General Reservation Payoffs

- When reservation payoffs arise an equilibrium of a Bayesian game, they satisfy all the constraints that we require $\mu_2(\theta)$ to satisfy. In particular $v_2(\theta)$ is guaranteed to be non decreasing, weakly convex, and $1 \geq v_2'(\theta) \geq 0$.

General Reservation Payoffs

- When reservation payoffs arise an equilibrium of a Bayesian game, they satisfy all the constraints that we require $\mu_2(\theta)$ to satisfy. In particular $v_2(\theta)$ is guaranteed to be non decreasing, weakly convex, and $1 \geq v_2'(\theta) \geq 0$.
- Assume that $v_2(\theta)$ is twice differentiable and either concave or convex – this would subsume Bayesian reservation payoffs.

General Reservation Payoffs

- To make progress we need to define the notion of a proximate implementable mechanism.

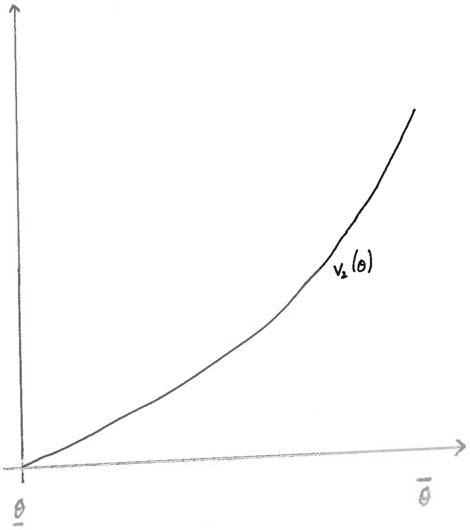
General Reservation Payoffs

- To make progress we need to define the notion of a proximate implementable mechanism.

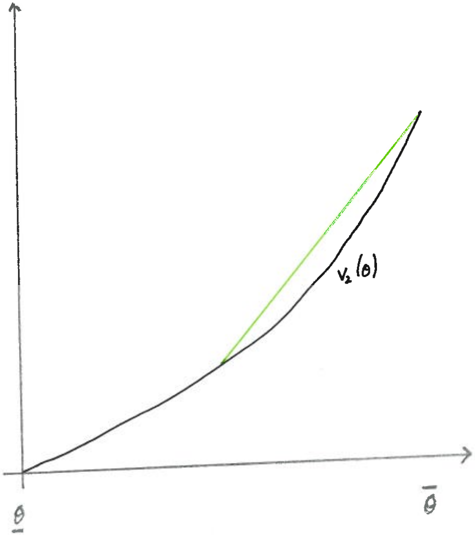
Definition

A proximate implementable mechanism $\eta(\theta)$ for $\theta \in [\underline{\theta}, \overline{\theta}]$ is continuous, weakly convex, non-decreasing, and differentiable except at finitely many points, with $1 \geq \eta'(\overline{\theta})$, satisfies $\eta(\theta) \geq v_2(\theta)$ and there does not exist another mechanism $\tilde{\eta}(\theta)$ satisfying the same constraints such that $\eta(\theta) \geq \tilde{\eta}(\theta)$ for all θ and $\eta(\theta) > \tilde{\eta}(\theta)$ for some θ.

$v_2'(\overline{\theta}) > 1, v_2''(\theta) > 0$



$v_2'(\overline{\theta}) > 1, v_2''(\theta) > 0$



General Reservation Payoffs

- Derive all possible $\eta(\theta)$ for a given $v_2(\theta)$.

General Reservation Payoffs

- Derive all possible $\eta(\theta)$ for a given $v_2(\theta)$. Let Ψ be the set of all $\eta(\theta)$ for a given $v_2(\theta)$.

General Reservation Payoffs

- Derive all possible $\eta(\theta)$ for a given $v_2(\theta)$. Let Ψ be the set of all $\eta(\theta)$ for a given $v_2(\theta)$.

  Proposition

  Let $\Psi' \subseteq \Psi$ be the subset of proximate implementable mechanisms that satisfy

$$\mathbb{E}(\eta(\Theta)) - \int_{\underline{\theta}}^{\overline{\theta}} (\theta_1 - \theta)\eta'(\theta) f(\theta) d\theta \leq \theta_1 - \mathbb{E}(v_1(\Theta)). \tag{3}$$

  A surplus maximizing mechanism exists if and only if Ψ' is non empty.

Characterizing the Surplus Maximizing Mechanism

Proposition

Assume $v_2(\theta)$ is twice differentiable and either concave or convex, $(\theta_1 - \theta)f(\theta)$ is non-increasing in θ, and there exists an $\eta(\theta)$ satisfying (3). The surplus maximizing mechanism must take the form

$$\begin{array}{lll l} \beta_2(\theta) = \mu_2'(\theta) & \textit{and} & t_2(\theta) = \mu_2(\theta) - \theta\mu_2'(\theta) & \textit{if } \overline{\theta} \geq \theta > \hat{\theta}, \\ \beta_2(\theta) = 0 & \textit{and} & t_2(\theta) = \mu_2(\hat{\theta}) & \textit{if } \hat{\theta} \geq \theta \geq \underline{\theta}, \\ \beta_1 = 1 - \mathbb{E}(\beta_2(\Theta)) & \textit{and} & t_1 = -\mathbb{E}(t_2(\Theta)). & \end{array} \tag{4}$$

where

$$\mu_2(\theta) = \underset{\eta(\theta)\in\Psi}{\operatorname{argmax}} \left(\int_{\hat{\theta}}^{\overline{\theta}} (\theta - \theta_1)\eta'(\theta)f(\theta)d\theta \right) \tag{5}$$

and $\hat{\theta}$ is the highest value of θ that satisfies

$$\mathbb{E}(v_1(\Theta)) = \theta_1 - F(\hat{\theta})\mu_2(\hat{\theta}) - \int_{\hat{\theta}}^{\overline{\theta}} (\theta_1 - \theta)\mu_2'(\theta)f(\theta)d\theta. \tag{6}$$

Features of the Surplus Maximizing Mechanism

- The uninformed player is always pushed down to her reservation payoff.

Features of the Surplus Maximizing Mechanism

- The uninformed player is always pushed down to her reservation payoff.
- The total surplus is decreasing in $\mathbb{E}(v_1(\Theta))$ – the more lower the reservation payoff (the more inefficient the default game), the closer we get to the first best.

Conclusion

- A simple condition turns out to be necessary and sufficient to guarantee that the first best is not attainable.

Conclusion

- A simple condition turns out to be necessary and sufficient to guarantee that the first best is not attainable.
- If the reservation payoffs arise from a Bayesian game, the second best is always implementable under budget balance

Conclusion

- A simple condition turns out to be necessary and sufficient to guarantee that the first best is not attainable.
- If the reservation payoffs arise from a Bayesian game, the second best is always implementable under budget balance – It is always possible to avoid an inefficient default game (but still not reach the first best)

Conclusion

- A simple condition turns out to be necessary and sufficient to guarantee that the first best is not attainable.
- If the reservation payoffs arise from a Bayesian game, the second best is always implementable under budget balance – It is always possible to avoid an inefficient default game (but still not reach the first best)
- An allocation that pareto dominates the reservation payoffs exists under general conditions.

Conclusion

- A simple condition turns out to be necessary and sufficient to guarantee that the first best is not attainable.
- If the reservation payoffs arise from a Bayesian game, the second best is always implementable under budget balance – It is always possible to avoid an inefficient default game (but still not reach the first best)
- An allocation that pareto dominates the reservation payoffs exists under general conditions.
- It is possible to characterize the second best under more assumptions.

Conclusion

- A simple condition turns out to be necessary and sufficient to guarantee that the first best is not attainable.
- If the reservation payoffs arise from a Bayesian game, the second best is always implementable under budget balance – It is always possible to avoid an inefficient default game (but still not reach the first best)
- An allocation that pareto dominates the reservation payoffs exists under general conditions.
- It is possible to characterize the second best under more assumptions.
- The inefficiency of the second best is increasing in the reservation payoffs.