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Compensation for Land when Landowners Communicate *

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In India, the extent of debate in the policy space regarding land acquisition for industrial usage is immense in the last few years. With an aim to achieve higher growth targets, increasingly efforts towards industrialization leads to higher amount of displacement and restatement of agricultural landowners. This has led to ever increasing unrest in the society leading to huge inefficiency both in terms of locked up values and loss of human lives and livelihoods. In this paper we propose a mechanism that addresses the issue of compensation during land acquisition. We propose the optimum amount of land that can be acquired as well as the mechanism allowing –(a) land as a private value and (b) landowners must be allowed to coordinate before the final offer is accepted or rejected. Our mechanism also helps in solving the hold up problem.

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1. Introduction

The extent of debate in the policy space regarding land acquisition for industrial usage is immense in the last few years. Both Acts (the one proposed earlier in 2013) and the modified one in 2015 has received support and criticisms from all over. Land acquisition Bill (LARR ACT 2013) proposed in 2013 by the then UPA government, has been modified by the NDA government.[4] This has drawn significant criticism as well as generated debate both in the two houses of the parliament. Ever since, its proposal in 2015, there has been significant discussions on the issue-among policy makers, academicians as well as media. LARR 2013 was passed to replace an act that was over 100 years old and aimed to give the farmers the fair remuneration for their Land which may have been acquired by the state or central government for the purpose of several projects. These projects were classified into two categories- one which were for greater public good (Defense and national security projects, affordable housing, infrastructure development and industrial corridors). The other category includes land acquisition for private enterprises. In order to safeguard wider public interest, procedural safeguards have also been introduced, including social impact assessment, adequate notification and consent of at least 80% of the affected community. The modified proposal proposes some key amendments to the LARR 2013. The more prominent ones are doing away with social impact assessments (SIA) in some cases and reducing the consent required by the landowners from 80% to 70%. The objective of the current study is not to evaluate which among the two proposals is better, instead, this paper tries to device a simple mechanism that can be implemented in ensuring a relatively smooth land acquisition process.

The major criticisms of land acquisition processes currently can be classified into two major categories-purpose and compensation. In certain cases the impasse following the controversy has lead to violence and a scenario where there is a tremendous loss both in terms of lives as well as sunk costs- Bhatta Parsaul, Nandigram, Singur etc. There is a growing concern that often land acquired for the stated purpose of eminent domain is subsequently reneged.[5]

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[4] For copies of the documents see http://www.prsindia.org/pages/land-acquisition-debate-139/

[5] Although the SIA is designed to verify the reasons for land acquistions, instances as in Hyderabad (TOI 2013) or NOIDA (Financial Express 2015) question the violation of the initial promise for which land was acquired. The CAG report also mentions a few additional instances where land acquired for SEZs have been later pit to different use (TOI 2014). Also see Singh (2012) for the legal breaches during Land Acqusition.

Closely related to the issue is the fact that land that has been acquired is more than what is "required". The CAG study, part of its performance audit report tabled in Parliament in 2014, said ever since the notification of the SEZ Act, land covering 60,375 hectares or roughly 600 sq km has been acquired, out of which only 28,488 hectares became operational till last year implying that 53% of the land so acquired has not been put to use starting 2006 (TOI 2015).

The more serious issue is that of compensation. The issues range from inadequate compensation to delays in payments to completely ignoring some of the most affected parties. The system currently followed involves an artificial 'markup' over a prevailing land price (the circle rate). Both the markup (2 to 4 times in the proposed amendment) as well as the circle rate is arbitrary. Agricultural land, unlike most other assets are extremely illiquid. This is mainly because such lands are put to more or less the same use irrespective of the owner[6] and hence, scope for too different a value creation is absent. This translates to the fact that the buyer of the land does not value it too highly than the seller of the land. Therefore, the predominant form of land transaction is "distress sale" thereby dampening the land price. Further, in order to save on the stamp duties, the circle rate is often artificially kept low (Chakravorty, 2011). The illiquidity therefore prevents a fair price that would make the existing landowners happy to accept it.[7] What indeed queers the pitch for a 'market determined price' (even if one can make the land liquid and have an efficient market for it) is the fact that, agricultural land are often seen as private values than common values. This is not difficult to see as the skill sets of households cultivating agricultural land are mostly tied to the land and hence they perceive 'future without the piece of land' as difficult. Thus the extent of compensation a household might demand to sell their land may not be related to the size of land holding or the family size. In other words, the compensation which a household demands is entirely 'private value'[8] which may not be objectively quantifiable.[9]

[6] The usage depends upon the soil quality, the cropping season and local logistics.
[7] There are reports of rural land prices that have increased manifold (even upto 100 times) between 2003-2013, however those dramatic rises happen only when land is put to alternate use and not involving a farmer to farmer transaction (ET 2013)
[8] Ofcourse, one can divide the compensation demanded by a household by his land holding to arrive at a 'per acre private compensation'. What we really mean is that this per acre compensation may not only depend upon the quality of land (Ghatak and Ghosh, 2011) but other intangible factors.
[9] There is yet another important issue regarding compensation and that pertains to who should receive the compensation? Is it the landowner alone or also the landless labour who work on those land? For a treatment on this see Ghatak and Mookherjee (2014)

In the literature, models of compensation crucially depend upon the ability of the government to prevent the landowners communicate with each other while agreeing or disagreeing to tender their plots. Under this assumption, a land auction attains desirable outcomes (Ghatak and Ghosh 2013). In a closely knit rural setting preventing landoners to communicate with each other

What we propose below is an alternate version based on non linear compensation based on how many landowners agree to land acquisition. Non linearity of compensation in our model will increase the chances that enough landowners consent for the land transfer. This is because, every landowner now knows that they can increase their compensation by voting in favour of the acquisition if they believe that others have a reasonable chance of voting in favour. With non linear compensation, it further improves the chances of voting "yes" when landowners are able to coordinate with each other. This is because, landowners who want to vote yes for sure can credibly communicate the same to others thereby increasing the chances for others to vote "yes'. We also compare the outcomes with coordination versus no coordination among landowners.

The remainder of the paper is as follows. In section 2 we briefly survey the literature. In section 3 we present the outcome when the landowners cannot coordinate while in section 4, we present the outcome when they can. In section 5 we compare the outcomes. Section 6 draws policy implications and concludes.

2. Existing Debates and Literature Review

The literature on land acquisition is extensive. The wide range of issues that are covered in the literature span the intent (*eminent domain*) (Paul, 1987), to objective criteria for qualifying land acquisition under such (Kalbro 2007) and the division of surplus in such cases (Epstein 2006). For a details on such discussion see Roy et al (2013). Our study is focused solely on the compensation mechanism in the event of such transfers. In other words, we make no attempt to question whether the land acquisition is at all efficient or necessary. Our underlying premise is that such acquisitions will add value and hence the only part we are interested in is how to enable such transfers with greater consent of the landowners.

One can perhaps never design a perfect compensation mechanism for land acquisition in India. Currently the formula that involves a certain multiple (2 to 4 times) of a base price (circle rate) is arbitrary- both in terms of the multiple as well as the base price.[10] Even the Supreme Court has accepted the difficulty in estimating "Fair market value" and has relied on the "guesstimate" as a process, based on all the available inputs. Apart from the basic rule of taking the cue from a transaction of similar land between a willing seller and a willing buyer, it has recommended that highest bona fide sale value rather than average sale value of the similar land transactions be considered while deciding the compensation amount. " The Court has also recommended considering the future (near term period) use of the land rather than only the current use of the land. This is over and above the solatium of 30% on the "Fair market value" which is provided in the Land Acquisition Act (Sec 23(2))" (Roy et al 2013)

The notion of fair market value is problematic. Epstein (1985) argues that fair market value contained a systematic bias that underestimated the use value, which was typically in excess of its exchange value. Existing owner usually do not sell at market price because selling would deprive him of the surplus he could obtain from the current use. Indeed land markets are far too illiquid implying that the "market value" is not the value at which usually landowners wish to transact. Indeed large part of transactions in the rural part are are in the form of distress sales (Chakravorty, 2011). Added to this is the common trend of lowering the transaction price in order to avoid high stamp duty. This means the market price is usually low. One way to solve the problem would be to use the notion of Economic value replacing market value (Chang, 2012). This may entail mapping the future gains from the land transfer to the current pricing. However, the more direct way of handling the issue of arbitrariness is basing the compensation on land auction.

It is here that Ghatak and Ghosh (2011) make an important contribution to the issue of land acquisition. They propose an interesting land auction mechanism involving the following steps. To acquire land of L units (involving say n) landowners, an area of (upto) $2L$ has to be identified. The required site of L units must be contained in the identified area. All the

[10] LARR 2013 prescribes four times the market value in the rural area and twice the market value in urban area have been proposed as compensation payable in case of acquisition.

landowners in the area will now submit a sealed bid indicating their selling price for their land holding. The bids can now be arranged in an ascending order. The lowest n bids will all receive an amount equal to the $n+1$th bid.

"The proposed factory was to occupy approximately 1,000 acres. Demarcate an area which is twice the size (say) of the project site, i e, 2,000 acres. This should include the project site itself (core) and a belt of additional farmland surrounding (periphery). All owners within this operational zone of 2,000 acres will be asked to submit tender bids for selling their land to the government. The 1,000 acres on which bids are the lowest will be procured against cash compensation, and all of them will be paid a uniform price equal to the bid on the 1,001th acre of land when they are arranged in ascending order of asking price."

The proposed mechanism solves three important problems. One, the landowners get more than what they wanted (guaranteed by the fact that every body gets a uniform price higher than what they asked for), implying that post the acquisition, they may not feel that the 'land was forcefully taken away'. The second problem it solves pertains to the fact that their private value is fully captured as it can be shown that the land owners 'bid truthfully' (Vickrey auction). Finally, the compensation paid to the landowners are not based on any artificial multiplier or an artificially determined market value. In the absence of a liquid market, such auctions are perhaps the best way to go.

However, the mechanism has another problem- the 1,000 acres acquired may not lie entirely in the core area implying that some land remains to be acquired in the core area while some surplus land has now be acquired from the periphery. They propose a simple solution.

"Note, however, that the area of land within the core that remains unsold in the auction must be exactly equal to the area of land procured in the periphery. The last step of the process is to take land from farmers in the core who have not sold for cash and compensate them with the plots of equal size procured in the periphery."

This now completes the acquiring process as well as solve the hold up problem by ensuring that anyone who has land holding in the core area either gets more than the compensation they had asked for or are compensated by an equivalent amount of land in the periphery.

However, the elegant solution above has few major shortcomings. The first involves the implicit assumption that all the land put up for auction is homogenous. This is important because the landowners whose lands remain unsold have to now settle for a different piece of land, most likely for an 'inferior' quality of land. This will most likely be the case with all the unsold lands because presumably, the lands that will attract the higher bids (1,001th onwards in the ascending order) are likely to be the ones which are 'superior'! This now has the potential to create social unrest with disgruntled landowners of unsold lands. Further, if the core area is known to all parties in advance, it is more likely that the adjacent farmlands (in the periphery) will be perceived of lesser value than the one inside the core. This is because, one can argue agricultural activity in the farmlands adjacent to factory sites may have lower yield (ground contamination) than they are right now. This would mean that these farmlands are more likely to have lower ask prices than the ones in the core. Therefore, it is likely that more of the land in the core remains unsold than the periphery implying more number of unsatisfied *relevant* landowners.[11] The authors themselves acknowledge the problem, "…A farmer who does not want to give up cultivation can quote a high enough bid, and then settle for compensation in land in the surrounding area. The process still contains a small degree of coercion, because farmers who insist on not merely holding land but holding particular plots (perhaps due to the sentimental value of ancestral property) have to be forcibly moved if their preferred plots fall in the core area." The issue of non-homogeneity has far more serious implications than intended. It in a way violates the Individual rationality Constraint for some. To put it differently, if the landowners were given an option to participate in the auction, not all of them would. Owners who value their lands higher than most others (based on the probability distribution they assign on others' valuations), would rightly infer that post the acquisition, most likely they will have to settle for a different piece of land which in all likelihood will be valued less than their current plot.[12] Although the paper mentions possible compensation in this case, unless the compensation is specified before the auction and internalized in the auction, such compensation will not ensure that their ex ante utility levels are protected. Moreover, with this new announced compensation, which applies only to those landowners who now have a land swap, they may no longer bid truthfully implying that they might inflate their bids. Thus, it is not clear that the land auction mechanism proposed will simultaneously satisfy truth full revealing as well as voluntary participation.

The second problem with the above mechanism is that amount of land that will undergo ownership change will be almost twice the amount of land that is originally required for setting up the industry. This is because, 1,000 acres have to be bought and almost another

[11] In the event that the lowest 1,000 acres fall in the core area, the problem of land swap will not have arisen under this mechanism.

[12] The fact that their asking bids are higher than the plot which is now assigned to them bears testimony to this.

1,000 acres of land will now have to be swapped implying change in ownership. Given that acquiring single unit of land has costs arising due to social unrest (difficult to monetize), acquiring more land (and later on redistributing the excess) will certainly increase such costs even further. It is reasonable to assume that acquiring additional land would be nonlinear and the marginal unit will cost more (social cost) as more land has to be acquired. This in turn will mean that any attempt to implement such mechanisms will face greater opposition on the ground.

The third problem is the cost of acquiring the core site may now be unusually high. This is because, all the landowners whose lands are now bought will have to be paid a much higher price than they demand (higher than the highest anyone had asked for). The amount that has to be paid will in generally be at least twice the amount they asked for. For example, if the ascending bids are as follows for the n plots are say 1,2,,.., n, then the total amount demanded for the n plots will be $\frac{n(n+1)}{2}$ while the amount required to acquire the plots under the mechanism will be $n(n+1)$. Whether, that will open windows for further negotiation will have to be explored. However, in the present context, this may not be the most binding constraint.[13] Ofcourse, they argue that whoever the buyer is—whether it is the government or the government acquiring the land on behalf of some other private party—a reserved price has to be submitted, that is the maximum the buyer is willing to pay which would be binding. If $n(n+1)$ is less than this maximum, the acquisition would go through. In fact, a simpler mechanism would be to ask all landowners to vote whether they are willing to sell their plots (at a price $n+1$). It can be shown that all those who votes "yes" are the ones whose plots were bought in the GG mechanism, and all those who say "no" are the ones who got a different piece of land in the mechanism. The only difference is that, in this case whenever land transfer takes place the firm has to pay $(n+1)$ in all while with the GG mechanism they may end up paying less.

The final problem with the mechanism is that it crucially depends upon the assumption that the landowners cannot coordinate among themselves. If coordination was allowed, landowners would have incentive to inflate their bids collectively thereby making to things- (a) the bids are no longer "truthful" and (b) they may be so highly inflated that the firm is unable to have enough

[13] There is a significant evidence that the land value post acquisition jumps up manifold implying that paying twice the asked amount may not be a deterrent for the acquirer.

money to pay the lowest 1000 bidders. Disallowing coordination is difficult to implement in a closely knit community especially involving an issue as crucial as land acquisition that affects the entire community. It is therefore, inconceivable that landowners will agree to not consult other land owners, ask, clarify and understand the mechanism from each other. Going a step further, they might want to collectively persuade or dissuade each other from tendering their respective plots.

One may not be able to rank order in terms of which of the above problems are more severe than the rest. The objective of this paper is to propose alternate mechanisms to the one currently is debated upon (LARR, 2013, 2015) or the GG mechanism. All mechanisms will have certain advantages (as well as disadvantages) vis a vis the rest, it is the prerogative of the State to choose the one that is most appropriate given the land acquisition environment. In spite of the above shortcomings, the mechanism is a novel one which allows the land acquisition to happen at a price demanded by the landowners and not set arbitrarily by the state.

In what we propose, we allow for coordination among landowners[14] and retain the consent clause. However, we propose a nonlinear compensation mechanism.

3. Non Linear Compensation without Coordination

In this section we propose the compensation amount per acre that must be paid to the landowners. The proposed compensation mechanism must address the following key concerns;

- The compensation must address the nature of private value landowners' have
- The compensation cannot therefore be based on an ad-hoc circle rate
- The compensation must me agreeable to at least a critical number of landowners

We propose a simple nonlinear mechanism $x(\phi;\alpha)$. The mechanism, is as follows:

"In the event of a land acquisition, a uniform price per acre will be paid to all the landowners for their holding. The price per acre is declared as follows

[14] We do not think that one can implement a mechanism where the landowners do not consult or communicate among themselves.

$$x(\phi;\alpha)=\begin{cases} 0 & \text{if less than } \phi \text{ proportion of lands are tended} \\ \underline{x} & \text{if exactly } \underline{\phi} \text{ proportion of lands are tended} \\ \underline{x}+\alpha(\phi - \underline{\phi}) & \text{if } \phi > \underline{\phi} \text{ proportion of lands are tended;} \end{cases}$$

$$\underline{x}, \phi, \underline{\phi}, \alpha > 0$$

The above compensation simply states that as more and more landowners vote "yes", the compensation to each landowners increase.

Define k as the critical number such that if less than k landowners vote "yes", then no land transfer takes place, while as long as greater than k landowners vote 'yes', transfer takes place. In other words, $\sum_{i=1}^{k} \phi_i = \underline{\phi}$.

Alternately, the same can be written as[15]:

$$x'(k;\alpha)=\begin{cases} 0 & \text{if less than } k \text{ landowners vote yes} \\ \underline{x} & \text{if exactly } k \text{ landowners vote yes} \\ \underline{x}+\alpha[n-k] & \text{if } n \text{ voters vote yes and } n>k \end{cases}$$

To consider an example. In the event of a land acquisition involving 1,000 acres held by 100 landowners, each holding 10 acres (say). The mechanism can read as follows;

The floor price (per acre) $\underline{x} = 100$ is paid to all the 100 landowners if exactly 70 landowners say "yes" (implying $k = 70$). For every additional acre of land that is tended (that is for every additional landowner who votes yes), the price increment is 0.1, (that is $\alpha = 0.1*10 = 1$). If all the landowners say 'yes" then the per acre compensation is 130. If the landowners saying "yes' has less than 700 acres of land, no land acquisition takes place.[16]

In this section we explore the possibility that individual landowners are unable to coordinate or communicate while voting for or against land acquisition.

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[15] For easier exposition, we will consider the mechanism $x'(k;\alpha)$ in this paper.

[16] Note that we do not need all landowners with uniform holdings. The mechanism holds true for differential holding, the critical number (k) will then depend upon how many landowners voting yes leads to 70% tendering.

Now consider a landowner with valuation, θ. No coordination is akin to a simultaneous move game. While voting "yes" or "no", she does not observe what others have voted. However, she correctly anticipates the voting strategies others will adopt. We therefore assume that the landowners vote independently.

The expected payoff to her in the event she votes 'no" is given by

$$
\begin{aligned}
E(N) &= \binom{n-1}{k} F(\underline{x})^k [1-F(\underline{x})]^{n-1-k} \{\underline{x}-\theta\} + \binom{n-1}{k+1} F(\underline{x}+\alpha)^{k+1} [1-F(\underline{x}+\alpha)]^{n-1-k-1} \{\underline{x}+\alpha-\theta\} \\
&\quad + \ldots\ldots\ldots + \binom{n-1}{n-1} F(\underline{x}+\alpha[n-1-k])^{n-1} \{\underline{x}+\alpha[n-1-k]-\theta\} \\
&= \sum_{r=k}^{n-1} \binom{n-1}{r} F(\underline{x}+\alpha[r-k])^r [1-F(\underline{x}+\alpha[r-k])]^{n-1-r} \{\underline{x}+\alpha[r-k]-\theta\}
\end{aligned}
$$

While voting "no", the calculations are as follows. She correctly infers if less than k other landowners are voting yes, then no land acquisition takes place. However, if exactly k other landowners vote yes, then acquisition takes place. Based on the compensation mechanism, she receives $\underline{x}$. Note that, she correctly infers that only those landowners will vote yes for whom their private valuation does not exceed $\underline{x}$. That would mean the probability of any individual j with valuation θ_j voting yes is $\Pr\{\theta_j \leq \underline{x}\} = F(\underline{x})$. Given that k landowners vote yes and the remaining $n-1-k$ voters vote no, the probability of this happening is

$\binom{n-1}{k} F(\underline{x})^k [1-F(\underline{x})]^{n-1-k}$. The net payoff in this case is $\underline{x}-\theta.$ This explains the first term.

All subsequent terms in the RHS can be explained as above.

If she votes "yes", there are two major changes she brings in the expected payoffs. First, now even if $k-1$others vote "yes" the land acquisition will go through as she is the pivotal voter. In other words, she makes up the shortfall with her vote. Secondly, given her vote, the expected payoff increases by α which also increases the probability that others will vote yes. The expected payoff in this case is given below

$$E(Y)=\binom{n-1}{k-1}F(\underline{x})^{k-1}[1-F(\underline{x})]^{n-k}\{\underline{x}-\theta\}+\binom{n-1}{k}F(\underline{x}+\alpha)^{k}[1-F(\underline{x}+\alpha)]^{n-k-1}\{\underline{x}+\alpha-\theta\}$$

$$+\ldots\ldots\ldots.+\binom{n-1}{n-1}F(\underline{x}+\alpha[n-k])^{n-1}\{\underline{x}+\alpha[n-k]-\theta\}$$

$$=\sum_{r=k-1}^{n-1}\binom{n-1}{r}F(\underline{x}+\alpha[r-k+1])^{r}[1-F(\underline{x}+\alpha[r-k+1])]^{n-1-r}\{\underline{x}+\alpha[r-k+1]-\theta\}$$

Proposition 1: *For any announced floor rate* $\underline{x}$, there will be landowners with valuation exceeding $\underline{x}$, who will vote "yes".

Proof:

For brevity, denote $p_r \equiv F(\underline{x}+\alpha[r-k])$ and $y_r = \underline{x}+\alpha[r-k]; r = 0,1,2,3...$

Thus $E(N)=\sum_{r=k}^{n-1}\binom{n-1}{r}p_{r-k}^{r}\left[1-p_{r-k}\right]^{n-1-r}\{y_{r-k}-\theta\}$ and

$$E(Y)=\sum_{r=k-1}^{n-1}\binom{n-1}{r}p_{r-k+1}^{r}\left[1-p_{r-k+1}\right]^{n-1-r}\{y_{r-k+1}-\theta\}$$

In equilibrium all landowners will vote yes *iff* $E(Y)\geq E(Y)$. Using the expressions in above, this means, all landowners with valuation θ will vote yes as long as $\theta \leq \underline{x}+G(x;\alpha)$.

Where

$$G(\underline{x},\alpha)\equiv\alpha\frac{\sum_{r=k-1}^{n-1}\binom{n-1}{r}.r.p_{r-k+1}^{r}\left[1-p_{r-k+1}\right]^{n-1-r}-\sum_{r=k}^{n-1}\binom{n-1}{r}.r.p_{r-k}^{r}\left[1-p_{r-k}\right]^{n-1-r}}{\sum_{r=k-1}^{n-1}\binom{n-1}{r}.p_{r-k+1}^{r}\left[1-p_{r-k+1}\right]^{n-1-r}-\sum_{r=k}^{n-1}\binom{n-1}{r}.p_{r-k}^{r}\left[1-p_{r-k}\right]^{n-1-r}}$$

Consider the denominator, D. This can be rewritten as

$$D \equiv \binom{n-1}{k-1} p_0^{k-1}[1-p_0]^{n-k} + \binom{n-1}{k}\left\{p_1^k[1-p_1]^{n-k-1} - p_0^k[1-p_0]^{n-k-1}\right\} + \ldots$$
$$+\binom{n-1}{k+1}\left\{p_2^{k+1}[1-p_2]^{n-k-2} - p_1^{k+1}[1-p_1]^{n-k-2}\right\} + \ldots.. + \binom{n-1}{n-1}\left\{p_{n-k}^{n-1} - p_{n-k-1}^{n-1}\right\}$$

Given that $p_{r+1} > p_r, \forall r$, all expressions within $\{\ \}$ are positive and hence, $D > 0$.

Similarly, the numerator, N can be written as

$$N \equiv \binom{n-1}{k} p_1^k[1-p_1]^{n-k-1} + \binom{n-1}{k+1}\left\{2p_2^{k+1}[1-p_2]^{n-k-2} - p_1^{k+1}[1-p_1]^{n-k-2}\right\} + \ldots$$
$$+\binom{n-1}{k+2}\left\{3p_3^{k+2}[1-p_3]^{n-k-3} - 2p_2^{k+2}[1-p_2]^{n-k-3}\right\} + \ldots..$$
$$+\binom{n-1}{n-1}\left\{[n-k]p_{n-k}^{n-1} - [n-k-1]p_{n-k-1}^{n-1}\right\}$$

Note that, given that $D > 0$, the numerator is automatically positive as the numerator attaches higher weights to the positive sign than the negative signs.

Thus, $G(x;\alpha) > 0$. This automatically implies, there exists landowners with valuation exceeding $\underline{x}$ who will vote yes. ■

What drives proposition 1 is the fact that every landowner can influence the payoff by voting "yes" than voting "no" in addition to the fact that the pivotal landowner can influence the outcome. This means, even when a landowner calculates that even when only k others are voting yes (say) and with exactly k yes votes it does not meet her valuations, she can vote yes if she calculates that with her vote, the new compensation will match or exceed her valuation. Interestingly, this result means that to get the landowner with the highest valuation (say $\bar{\theta}$), she can vote "yes" even though the compensation does not match her valuation. She realizes that if sufficient others vote yes, then land acquisition takes place, in which case voting no" will only lower her payoff.

We now explore the case when landowners coordinate with each other, trying to learn their private valuations and vote.

4. Compensation With Coordination

We will argue that, under this mechanism as long as the number landowners who demand a compensation less than $\underline{x}$ exceed the critical level k, entire land will get transferred where all landowners will consent to sell their land. We further argue that this outcome is unaffected by the case whether or not landowners can communicate among themselves.

Coordination among the landowners would mean two things-one, learn about what others are likely to vote and two, and credibly communicate to others each landowner is likely to do. Note that, the crucial aspect of communication is credibly committing to a strategy. A mere statement "I will vote yes" or "I will vote no" is not credible unless there is a commitment to it. The most credible way for a landowner to commit as to what she will do is to commit to a vote and deny herself the opportunity to change her vote at a later stage even when she learns new information about others. In other words, we can envisage the mechanism as a two stage process. Any landowner can vote at most once. We allow only "yes" votes meaning that if a landowner is voting "yes" she is consenting to land transfer. In the event a landowner does not want to vote "yes" can abstain from voting. The number of abstains will be counted as votes against land transfer. In the first stage (say $t = 0$) any landowner who wishes to vote "yes" can vote so. However, all landowners who say they will vote "yes' will not be allowed to vote at $t = 1$. However, their votes will be counted as "yes" in the final tally. At $t = 1$, only those who had not voted earlier can now vote "yes" or abstain. Before the voting takes place at $t = 1$, the results from first stage are known to all.

Denote $\bar{x} \equiv \underline{x} + \beta[n - k]$ as the maximum possible compensation that each landowner can receive. This happens when all of them agree to sell their plots.

Given this mechanism, all landowners will now vote according to the following strategy,

- At $t = 0$, every landowner, i with $\theta_i \leq \bar{x}$ will vote "yes" while all others will not. If the number of "yes" at $t = 0$ is at least as much as k, then at $t = 1$, everyone votes "yes" and the land is transferred. If the number of "yes" is less than k, then at $t = 1$ no one votes and land acquisition does not take place.

We will solve backwards. That is first we solve what will be the response of the landowners at $t = 1$ given the outcome of stage I voting. Next, we will argue what will be the strategy followed by them at $t = 0$.

Equilibrium strategy at $t = 1$***:***

Note that at this stage only those who have not voted earlier are eligible to vote. All these landowners

-have valuations exceeding $\bar{x}$

-know that only those who have valuations exceeding $\bar{x}$ are eligible to vote now

- know how many landowners have voted “yes”.

Suppose, the number of “yes” votes at the end of round 1 is less than k . Then, by voting “yes” they will improve the chances of land acquisition. However, they incur a net loss in the event of a land transfer while the net gains are zero in the event of land acquisition. Thus, they will have no reason to vote “yes”. The only reason someone can be tempted to vote “yes’ if she believes there are sufficient landowners who will now vote “yes” and make the transfer possible. However, given that all landowners who are eligible to vote not only have valuations exceeding $\bar{x}$, they also know that is the case with everyone, no one would want to vote yes. Given that these landowners can coordinate among themselves, they can readily agree to block land acquisition by not voting “yes” in which case none of them incur losses.

Suppose, the number of “yes” votes at the end of round 1 is greater than equal to k . Then, they know, that irrespective of what they vote now, the land transfer will go through. By voting “yes” they will improve their own payoffs rather than not doing so. Thus, all of them will vote “yes” now.

Equilibrium strategy at $t=0$***:***

First consider a landowner i such that $\theta_i \leq \underline{x}$. Then irrespective of what others do, she will always vote “yes” at $t=0$. This is because, with land acquisition her net gains are positive while it is zero without the acquisition. This is because, even the minimum compensation , $\underline{x}$ exceeds her valuation. Therefore, by voting “yes” she increases the probability of land acquisition. In other words, voting ‘yes” at $t=0$ is a Weakly dominant Strategy for her.

Next consider, any landowner j with $\underline{x} < \theta_j \leq \bar{x}$.

Suppose, while voting she has no credible way of knowing (even post communication) how many others are voting “yes”. If she thinks, apart from her, atmost $k-2$ landowners are going to vote yes, then irrespective of what she votes, there will be not critical number of “yes” votes at the first stage. In particular, if she votes “yes” there will be $k-1$ “yes” votes and given how the others will respond later, no land transfer will takes place. If she does not vote “yes”, there will be $k-2$ yes votes and again land transfer will not take place. However, if she believes that apart from her, there will be atleast k “yes” votes, then again irrespective of what she does, the land transfer takes place. However, if she votes “no” the compensation will be lower than if she votes ‘yes” by β . Thus, if she thinks there will be atleast k others will vote “yes” she is better off by voting “yes’. Finally, if he thinks exactly $k-1$ others will vote “yes’, then her vote can now influence the outcome. That is she becomes the pivotal landowner. If she votes “no”, then land transfer does not take place and her net gains are 0. However, if she votes “yes”, there are now just enough (k) “yes’ votes and the land acquisition will go through. Given the stage II strategies, this means she will earn a compensation of $\bar{x}$ implying her net gains are $\bar{x}-\theta_j > 0$. Thus she must, vote “yes” in this case.

The arguments given above shows that irrespective of what she thinks about what others will do, she is no worse off voting “yes’. Thus voting “yes” for her is a weakly dominant strategy.

Finally, consider a landowner, j with $\theta_j > \bar{x}$.

She knows that if the land acquisition takes place, irrespective of the compensation, she will be worse off than with no land acquisition. Therefore, her best chance of preventing such acquisition to take place is not voting "yes" now.

Notice that similar to the main result in the previous section, even with coordination, for a announced $\underline{x}$, there will be landowners who have much higher valuation than $\underline{x}$ who will vote "yes". This is because, for an announcement of $\underline{x}$, all those landowners with $\theta \leq \underline{x} + \beta[n-k]$will vote yes. What remains to establish is how does the response of land owners change from coordination to no coordination? In particular, we are interested in, for a given announcement of $x'(k;\alpha)$, whether number of landowners who vote 'yes" exceeds with coordination or without? We do that in the following section.

5. Coordination versus No coordination

In this section we illustrate the difference in outcomes using a simple example. Suppose there are 10 landowners each with private valuations $\theta_i; i = 1,..,10$. For simplicity, we will assume each have equal holdings.

Consider the mechanism $x'(\alpha;k)$where $k = 7.$ This implies, if less than 7 landowners agree to sell the land then no land is acquired, if exactly 7 owners agree then entire land is acquired with each owner receiving x and for each additional landowner who votes yes, all the landowners receive and additional unit of α .

Consider a landowner with valuation θ. Suppose he votes "no". Then his expected payoffs are:

$$E(N) = \binom{9}{7} F(x)^7 [1 - F(x)]^2 \{x - \theta\} + \binom{9}{8} F(x + \alpha)^8 \{x + \alpha - \theta\} + \binom{9}{9} F(x + 2\alpha)^9 \{x + 2\alpha - \theta\}$$

While a landowner votes, she does not observe what others are voting. However, she can correctly calculate the expected payoff in the event he votes "yes" or "no" Her calculations are as follows. If he says "no", the land transfer will not take place if atmost 6 other landowner says "yes". The net returns in this case is zero. An offer price of exactly x will prevail if exactly 7 landowners say "yes". Given that the landowners vote independently, this is given by the probability $\binom{9}{7}F(x)^7[1-F(x)]^2$. This is because, she calculates that only those landowners will vote "yes" whose valuations do not exceed x. In this case, the net payoff to her is $x-\theta$. Similarly, an offer price of $x+\alpha$ is applicable if exactly 8 other landowners vote yes, which happens with a probability $\binom{9}{8}F(x+\alpha)^8[1-F(x+\alpha)]$. The net payoff in this case is $x+\alpha-\theta$. Finally, if all the 9 landowners vote yes, which can happen with a probability, $\binom{9}{9}F(x+2\alpha)^9$, her net payoff is $x+2\alpha-\theta$.

The expected payoff to her if she votes "yes" is given by

$$\begin{aligned}E(Y)=&\binom{9}{6}F(x)^6[1-F(x)]^3\{x-\theta\}+\binom{9}{7}F(x+\alpha)^7[1-F(x+\alpha)]^2\{x+\alpha-\theta\}\\&+\binom{9}{8}F(x+2\alpha)^8[1-F(x+2\alpha)]\{x+2\alpha-\theta\}+\binom{9}{9}F(x+3\alpha)^9\{x+3\alpha-\theta\}\end{aligned}$$

Note that, if the landowner votes "yes", the land transfer will take place even if exactly one other landowner votes "yes" (as against two in the previous case). Thus the probability of the land transfer increases as our representative landowner votes 'yes'

The landowner will vote "yes" if and only if $E(Y)\geq E(N)$.

Denote, $p_r \equiv F(x+\alpha r); r=0,1,2$ This implies,

$$\theta \leq x+\alpha\frac{\left\{\binom{9}{7}\left[p_1^7(1-p_1)^2\right]+\binom{9}{8}\left[2p_2^8[1-p_2]-p_1^8[1-p_1]\right]+3p_3^9-2p_2^9\right\}}{\left\{\binom{9}{6}p_0^{\,6}[1-p_0]^3+\binom{9}{7}\left[p_1^7(1-p_1)^2-p_0^7(1-p_0)^2\right]+\binom{9}{8}\left[p_2^8[1-p_2]-p_1^8[1-p_1]\right]+p_3^9-p_2^9\right\}}$$

The above expression gives the landowner with the highest valuation who will vote yes for an announced x and α.

In what follows, we will compare the equilibrium outcomes with and without coordination among landowners under four different scenarios. The scenarios differ with respect to the distribution of the landowners' values. In table 1 we present the four scenarios

In table 1, we present four possible distribution of landowners' values. Case I depicts the scenario when the valuations are uniformly distributed. In reality, this case is equivalent to wide range of variation among plot yield (say). Danda et al (2015) documents parts of lower Sundarbans which often sees islands with wide variation in land quality. These heterogeneity is mostly brought about by frequent breach of embankments. Case II depicts a negative skewed distribution implying most landowners have high valuations. The lower Gangetic plains, are examples of areas where usually the land is very fertile. Case III depicts lands that are moderately fertile with very few extremities. Parts of agricultural land with access to decent irrigation facilities will correspond to this case. Finally, case IV will depict typical cases where the land is mostly infertile implying the valuations are low.

Case I will be depicted by assuming, $\theta \sim Uniform[0,1]$. While cases II, III and IV will be modelled assuming θ follows Beta distribution with parameters, a, b where, where the pdf is given by $B(a,b) = f(\theta) = \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)}\theta^{a-1}(1-\theta)^{b-1}; 0 \le \theta \le 1$ with $E(\theta) = \frac{a}{a+b}$. In case II $a > b$, in case III $a = b$ and case IV will be modelled using $a < b$. Finally, we will assume $\alpha = 0.05$ for the entire analysis.[17] Note that there are only two private valuations of interest. The first one is for the "marginal" landowner, that is the 7th landowner when all landowners are arranged in an ascending order based on their private valuations. The other landowner of interest is the one with the highest valuation. We will only focus on these two as getting the 7th landowner to vote "yes" would mean the transfer takes place while the 10th landowner voting "yes" means all the landowners consent to land acquisition.

In table 2 and figure 4, we identify landowners who will agree to land transfer for different floor prices. This is calculated for the scenario without coordination. Further, the calculations

[17] The analysis remains invariant to other values of α

are presented for $\alpha = 0.05$. To read table 2, consider the entries corresponding to $x = 0.3$. It says, with a floor level of 0.3, landowners who will agree to vote yes are all those with valuations not exceeding 0.329, 0.427, 0.376 and 0.506 for cases I-IV respectively. The same is plotted in figure 4. In figure 4, we plot the response function of the landowners for an announced x. The horizontal axis plots the possible values of x while the vertical axis plots the landowners' valuations. To read the graphs, consider plot correspond to Beta (3,10). This corresponds to Case IV. For an announced floor of 0.3, the graph identifies that all landowners with valuation not exceeding 0.506 will vote yes. In the remainder of this section we will use table 2 to make most of the inferences.

Case I : Valuations are Uniformly Distributed

In this case, the marginal landowner has $\theta = 0.8$ and the landowner with the highest valuation has $\theta = 0.9$.

Without coordination, a floor price of 0.63 will be sufficient to get enough consent for the land transfer, i.e., with $x = 0.63$ exactly seven landowners will vote "yes" and the transfer will take place. However, to get everyone to vote "yes", one has to offer a floor price of 0.8. These are calculated from table 2. In the event of coordination, note that in equilibrium either all of them vote "yes" and the land is transferred or not sufficient landowners vote "yes". Therefore, if the minimum offer price is 0.63, then in the first round all those who will vote yes are those with valuations not exceeding 0.63+ 3*0.05=0.78. This means only 7 landowners will vote "yes" in the first round and eventually the others will vote "yes" too. This implies that with a base compensation of 0.55 (0.55+ (10-7)*0.05=0.7) the land will get acquired where all the landowners will vote "yes".

Equilibrium Payments: With no coordination, for enough "yes" votes, the payment per acre would be 0.63 and for all landowners to agree it must be 0.95 (=0.8+3*0.05). With coordination, for enough (as well as all) landowners to vote "yes" the payment would be 0.7 (=0.55+3*0.05)

Case II: <u>Valuations are distributed with Negative Skew</u>

The actual frequency in this case can be approximated by beta distribution with parameters, $a = 10, b = 3$ where, the pdf is given by

$$B(a,b) = f(\theta) = \frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)}\theta^{a-1}(1-\theta)^{b-1}; 0 \le \theta \le 1 \text{ with } E(\theta) = \frac{a}{a+b} = \frac{10}{13}.$$

Figure 1 plots the observed frequency and those given by theoretical frequency with $B(10,3)$

Note that the marginal landowner has $\theta = 0.8$ and the landowner with the highest valuation has $\theta = 0.9$.

From table 2, we obtain that without coordination, a floor price of little under 0.7 will be sufficient to get the marginal landowner to vote yes. However, to get everyone to vote "yes", one has to offer a floor price of 0.77. With coordination, for enough "yes" votes as well as full consent, floor price of 0.65 will suffice.

The compensation that needs to be paid in the event of no coordination is 0.7 for land transfer and .92 for full consent, with coordination, getting the minimum requisite votes and full consent would mean each landowners are paid 0.8.

Case III: <u>Valuations are Unimodal and Symmetric</u>

This case corresponds to θ following Beta distribution, $B(4,4)$. Figure 2 plots the observed frequency and those given by theoretical frequency with $B(4,4)$ with $E(\theta) = 0.5$.

In this case, the marginal landowner has $\theta = 0.6$ and the landowner with highest valuation has $\theta = 0.8$.

Without coordination, a floor price of little under 0.52 will be sufficient to get her to vote yes. However, to get everyone to vote "yes", one has to offer a floor price of 0.62. With coordination, for enough "yes" votes as well as full consent, floor price of 0.45 will suffice.

The compensation that needs to be paid in the event of no coordination is 0.52 for land transfer and 0.77 for full consent, with coordination, getting the minimum requisite votes and full consent would mean each landowners are paid 0.6.

Case IV: Valuations are distributed with Positive Skew

This case corresponds to θ following Beta distribution, $B(3,10)$. Figure 3 plots the observed frequency and those given by theoretical frequency with $B(3,10)$ with $E(\theta) = \frac{a}{a+b} = \frac{3}{13}$.

In this case, the marginal landowner has $\theta = 0.2$ and the landowner with highest valuation has $\theta = 0.4$.

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Without coordination, a floor price of little under 0.07 will be sufficient to get her to vote yes. However, to get everyone to vote "yes", one has to offer a floor price of 0.27. With coordination, for enough "yes" votes as well as full consent, floor price of 0.05 will suffice.

The compensation that needs to be paid in the event of no coordination is 0.22 for land transfer and 0.42 for full consent, with coordination, getting the minimum requisite votes and full consent would mean each landowners are paid 0.2.

How does the equilibrium compensation levels compare across the different scenarios? In table 3, we present the compensation levels based on the discussions in the four cases above. The same can now be summarized as:

Proposition 3: Irrespective of the distribution of landowners' values,

(a) the floor price that needs to be announced to get the minimum consenting number for land acquisition is lower when landowners can coordinate than the case when they cannot

(b) the payment that has to be made in order to get just the minimum number of required landowners to consent for a land acquisition is higher with coordination than without

(c) the payment that has to be made in order to get all the landowners to consent for a land acquisition is lower with coordination than without

The above result follows from the fact that coordination involves a discontinuity in payments. In other words, either the land transfer does not happen (less than the critical number votes yes) or the transfer happens where the entire community votes yes. Therefore, the compensation that has to be paid in the event of a land owner is the one where all landowners vote yes and just not a subset of them. With no coordination on the other hand, it is entirely possible that exactly the critical number votes yes and the transfer takes place.

6. Conclusion and Policy

Land acquisition mechanism where the landowners are not allowed to communicate among themselves, in our opinion cannot work. Once, the landowners communicate, the usual land auction mechanisms will not achieve the desired result. In this paper, we propose a compensation based on how many landowners agree to land acquisition. Non linearity of compensation in our model will increase the chances that enough landowners consent for the land transfer. This is because, every landowner now knows that they can increase their compensation by voting in favour of the acquisition if they believe that others have a reasonable chance of voting in favour. With non linear compensation, it further improves the chances of voting "yes" when landowners are able to coordinate with each other. This is because, landowners who want to vote yes for sure can credibly communicate the same to others thereby increasing the chances for others to vote "yes'. We also compare the outcomes with coordination versus no coordination among landowners.

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Appendix

Table 1: Possible Distribution of Landowners' values

	Case I	Case II	Case III	Case IV
θ	Actual Freq	Actual Freq	Actual Freq	Actual Freq
0.1	1	0	0	3
0.2	1	0	1	4
0.3	1	0	1	2
0.4	1	0	2	1
0.5	1	0	2	0
0.6	1	1	2	0
0.7	1	2	1	0
0.8	1	4	1	0
0.9	1	3	0	0
1	1	0	0	0

Table 2: Landowners with maximum private valuation who will vote "yes"

	Case I	**Case II**	**Case III**	**Case IV**
x	θ(0.05)	θ(0.05)	θ(0.05)	θ(0.05)
0.01	0.107	0.16	0.159	0.158
0.05	0.114	0.2	0.196	0.19
0.1	0.137	0.249	0.236	0.225
0.15	0.178	0.297	0.27	0.257
0.2	0.227	0.342	0.301	0.298
0.25	0.277	0.385	0.336	0.364
0.3	0.329	0.427	0.376	0.506
0.35	0.382	0.472	0.421	1
0.4	0.437	0.519	0.471	1
0.45	0.492	0.568	0.524	1
0.5	0.55	0.618	0.583	1
0.55	0.609	0.667	0.651	1
0.6	0.672	0.716	0.746	1
0.65	0.74	0.765	0.953	1
0.7	0.816	0.813	1	1
0.75	0.907	0.864	1	1
0.8	1	0.926	1	1
0.85	1	1	1	1
0.9	1	1	1	1
0.95	1	1	1	1
0.99	1	1	1	1

Table 3: Equilibrium Compensation Levels

Cases	Landowners' Valuations	Announced x		Payment per acre	
		C	NC	C	NC
Case I	Min Offer (θ=0.7)	0.55	0.63	0.7	0.63
	Full Tender Offer(θ=1)	0.55	0.8	0.7	0.95
Case II	Min Offer (θ=0.8)	0.65	0.7	0.8	0.7
	Full Tender Offer(θ=0.9)	0.65	0.77	0.8	0.92
Case III	Min Offer (θ=0.6)	0.45	0.52	0.6	0.52
	Full Tender Offer(θ=0.8)	0.45	0.62	0.6	0.77
Cae IV	Min Offer (θ=0.2)	0.05	0.07	0.2	0.07
	Full Tender Offer(θ=0.4)	0.05	0.27	0.2	0.42

Figure 1: Actual versus Expected Frequency (Case II)

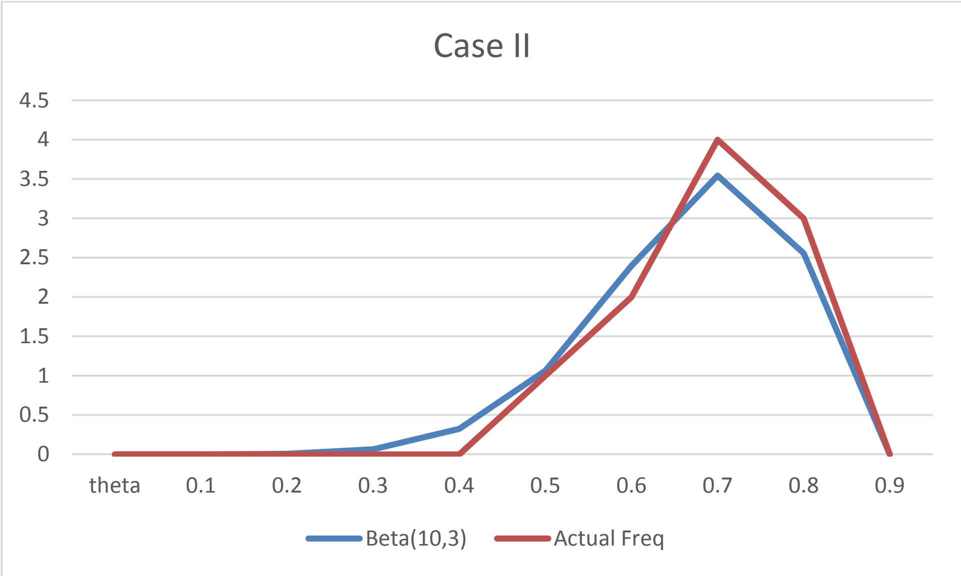

Figure 2: Actual versus Expected Frequency (Case III)

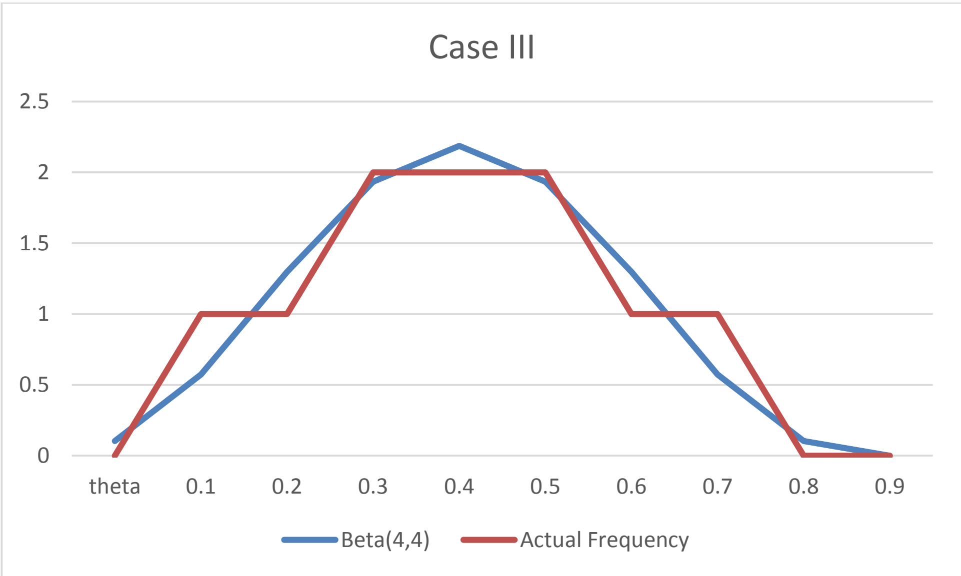

Figure 3: Actual versus Expected Frequency (Case IV)

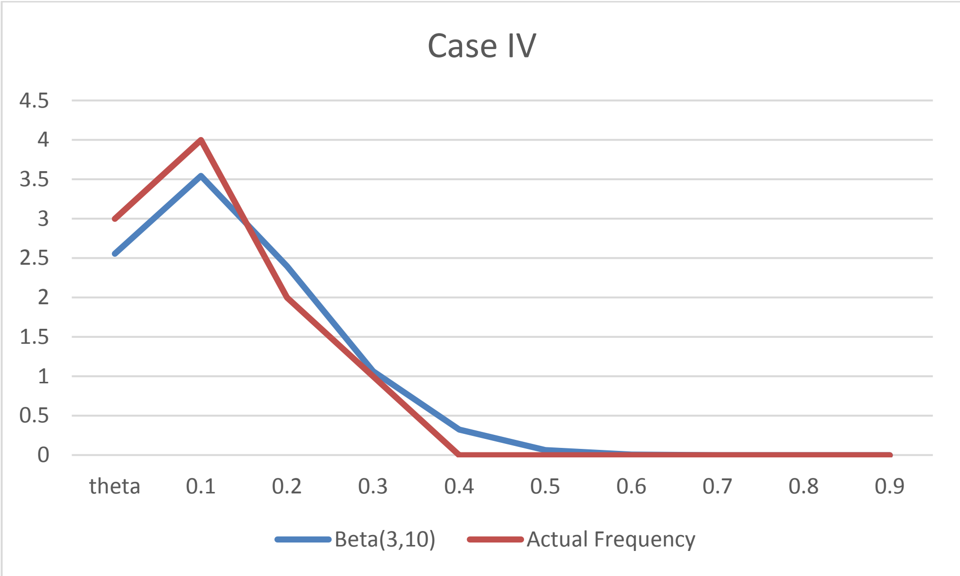

Figure 4: Landowners who will vote yes for a given x