POWER AND INEFFICIENT INSTITUTIONS

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ABSTRACT. This paper is concerned with the persistence of *inefficient* institutions. Why aren't inefficient institutions replaced by more efficient ones? What and/or who prevents this from happening? We develop a potential answer to such questions. Our explanation builds on two key ideas. The first is the presence of frictions (or transaction costs) of certain kinds, and the second is that institutional change on an issue may adversely affect the bargaining power of some agents on a different issue. A key insight obtained from our analysis is that, the greater is the degree of inequality in the players' bargaining powers the more likely it is that inefficient institutions will persist.

"Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction." DOUGLASS NORTH, *Institutions, Institutional Change and Economic Performance, 1990.*

"The ... stumbling blocks to beneficial institutional change in many poor countries may have more to do with distributive conflicts and asymmetries in bargaining power." PRANAB BARDHAN, *Distributive Conflicts, Collective Action, and Institutional Economics, 2001.*

1. INTRODUCTION

Institutions matter. Today this insight lies at the heart of mainstream economic thinking and research. That wasn't the case fifteen or so years ago when competitive equilibrium theory dominated the profession, before the developments in, and applications of, subjects such as game theory, information economics and contract theory. Furthermore, its an insight that today informs the development of policies and programmes of international organizations (such as the World Bank) who are in the business of promoting economic development in the poorer parts of the world. For a lucid and penetrating discussion

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and analysis of the importance of institutions for economic, political and social development, see the World Bank's 1997 and 2002 World Development Reports *The State in a Changing World* and *Building Institutions for Markets*; for a more formal and academic discussion, see Bardhan (2001) and Hoff and Stiglitz (2001).[1]

One key issue concerns the persistence of *inefficient* institutions. Why aren't inefficient institutions replaced by more efficient ones? What and/or who prevents this from happening? In this paper we develop a potential answer to such questions, an answer which uncovers a close and deep connection between *inequality in bargaining power* and the persistence of inefficient institutions.

An application of the Coase Theorem would however imply that, under *frictionless* conditions, Coasian bargaining would lead the relevant parties to choose efficient institutions. This point has been noted by several scholars — see, for example, the classic treatise by Douglas North, North (1990), where he develops the thesis that inefficient institutions persist due to the presence of various kinds of frictions (or transactions costs) such as those created by informational asymmetries. Not surprisingly, the explanation that we develop in this paper is also based upon the presence of certain kinds of frictions. Specifically, we consider situations in which parties are unable to make binding commitments, or, to put it differently, are unable to write enforceable (long-term) contracts. In addition, winners of an efficiency-enhancing institutional change are wealth-constrained and are unable to borrow the potentially large amounts of money required to compensate upfront the losers of such a change.

Our explanation builds on two key ideas. The first is the one just described, namely, the presence of the frictions stated above. The second idea is that institutional change on an issue may adversely affect the bargaining power of some agents on a different issue. Lets illustrate these two ideas, and their potential consequences, with a real-life example.

In villages in several poor countries (such as in India) there is a great inequality of land ownership; its concentrated in the hands of a relatively small number of landlords. This gives them much bargaining power when dealing with other village dwellers in the labour and credit

[1]These two articles are in a volume entitled *Frontiers of Development Economics* edited by Gerald Meier and Joseph Stiglitz. This volume contains articles by the great and good of development economics, and by the current leading scholars; they take stock of the current state of development economics, and discuss the main issues and problems of development. A central theme that is emphasized is the importance of institutions and institutional change.

markets. Indeed, as has been noted by scholars of rural economies (see, for example, Bardhan (1980), Braverman and Stiglitz (1982) and Basu (1998)), landlords in such villages not only provide employment to the poor villagers but are also their main source of credit. Such *inter-linked* transactions — whereby the same pair of agents trade in two different markets — are commonplace in many such villages.

An important consequence of this inequality is that the few landlords are significantly richer than the majority of the landless villagers. However, an important empirical observation is that, for a variety of reasons (including agency arguments) large farms tend to be less productive than small farms. As such it is argued that land redistribution, leading to greater equality of land ownership, would enhance productivity and hence the aggregate surplus that is generated. And yet such land redistribution has not taken place. There are several reasons for that which have been put forward in the literature; see, for example, Banerjee (1999). The theory developed in this paper provides an alternative explanation. To put it succinctly, land redistribution would significantly and adversely affect a landlord's bargaining power in the labour and credit markets; which, in turn, would adversely affect his overall welfare; and that is why landlords refuse to give up their large landholdings. The inability to make binding commitments (i.e., to write enforceable, long-term contracts) prevents the poor villagers from commiting not to exploit their increased bargaining power following land redistribution. Furthermore, being wealth-constrained and unable to borrow to the extent required, they cannot compensate the landlords upfront either. Hence the persistence of this (inefficient) institution, where ownership of land is concentrated in the hands of a small number of people.

It may be noted that our explanation, which is illustrated in the above example in an intuitive and informal manner, is not based on any informational asymmetry. We note this point in particular, since its commonplace in the economics literature to explain inefficient outcomes by appealing to some form of asymmetric information.

In the next section we lay down a model which in particular formalizes our two ideas mentioned above, in the context of a simple, but abstract setting concerned with efficiency-enhancing institutional change. The model has two players (individuals or organizations) who have the option to negotiate over an efficiency-enhancing institutional change. However, they know that if such a change is implemented then the players' respective bargaining powers over a different issue will be altered; which, in turn, will affect their *ex-ante* incentives to conduct the institutional change in the first place. Our analysis begins by characterising conditions such that the efficiency-enhancing institutional change does not take place if and only if these conditions hold. We then analyze these conditions to tease out some specific results and insights about the persistence (or otherwise) of inefficient institutions. A key insight that we obtain is that, a small degree of inequality in the players' bargaining powers is conducive for efficient institutional change, but not a large degree of such inequality; in that latter case, inefficient institutions are likely to persist. Several other results and insights are derived such as the insight that, the larger are the efficiency gains associated with the institutional change the more likely it is that such change takes place.

After we completed the first draft of this paper, the article by Pranab Bardhan, Bardhan (2001), was brought to our attention. This short article provides an insightful and lucid discussion of various issues concerned with the persistence of inefficient institutions. In particular, and to our pleasant surprise, in the section entitled "Dysfunctional Institutions", Bardhan makes several points which, in effect, lay the ground for the model and analysis in this paper (to which we shortly turn). Indeed, for further motivation of our model and analysis, we refer the reader to his article. In it he discusses and emphasizes the notion that a productivity-enhancing institutional change may create winners and losers, and that the former may be unable to compensate the latter; and thus the losers would resist the change that is potentially Pareto improving, in the sense that the gainers could compensate the losers. This notion lies at the heart of our analysis; we formally develop it, and explore its range of validity and implications.

Pranab Bardhan states in his article that, "... the obstruction by vested interests can be formalized as a simple Nash bargaining model." This, interestingly, is exactly the approach that underlies our model. Finally, we should like to mention that he (also) uses land redistribution as an illustrative example; his discussion is more detailed, and provides additional and insightful motivation for our model and analysis.

The remainder of this paper is organized as follows. In the next section we lay down our model — which, in formal terms, is a two player, two-stage game with perfect and complete information — and derive some preliminary results about it. Then in section 3, we characterize the unique subgame perfect equilibrium, derive our proposition that characterizes the conditions under which inefficient institutions will persist (in equilibrium), and tease out the implications of those conditions. In order to illustrate the breath of potential application of our ideas, model and results, in section 4 we analyze a simple example of a duopoly in which the firms end up maintaining an inefficient institutional arrangement. We conclude in section 5.

2. The Model

We consider a situation with two "players" and two "issues". A player can be either a single individual or a coalition (or group) of individuals. For example, in the context of a rural village in India, one player could be the single, wealthy landlord, while the other player comprises of the large number of poor and landless villagers. In this context, one issue could be land redistribution, while the second could be an issue concerning the conditions on which the poor are employed by the landlord or the conditions on which they are offered credit by him.

There is a *status quo* in place over both issues. This current state-of-affairs generates a per-period payoff to each player from each issue. In the language of bargaining theory, this payoff is a player's *inside option*.[2] A basic assumption is that this *status quo* is inefficient.

The two players first decide whether or not to commence negotiations over the first issue. If they choose not to do so, then the inefficient *status-quo* remains in place; otherwise negotiations proceed. The decision (on whether or not to begin negotiations) is made independently and non-cooperatively. In particular, we assume that both players are sufficiently wealth-constrained such that no player has enough funds to be able to make an upfront payment to the other player in order to get the negotiations going.

If however the players do proceed to negotiate, then bargaining over the first issue begins. When and if agreement is reached and implemented over the first issue, the parties then commence bargaining over the second issue. That second set of negotiations takes place under a *newly* established *status quo*. Each player's inside option from the first issue is now determined by the (presumably efficient) agreement just struck over it. A fundamental assumption that underlies our model — which is motivated by real-life situations (see, for example, Bardhan (2001)) — is that the inside option that each player obtains from the second issue is potentially influenced (altered) by the agreement just struck over the first issue.

[2]For a general discussion and analysis of "inside options" — and how they differ, for example, from "outside options" — see Muthoo (1999).

2.1. **The Formal Set-Up.** There are two players, 1 and 2, and two issues, X and Y. The size of the per-period cake (or surplus) created as a result of an agreement over issue k ($k = X, Y$) is $m^k > 0$. Bargaining over issue k is thus equivalent (in utility terms) to bargaining over the partition of this per-period cake. The agenda is fixed and given: negotiations (if they occur) over the two issues are to be conducted separately and sequentially. Without loss of generality, assume that the first set of negotiations would be over issue X. When and if agreement is reached over issue X (which is immediately implemented) the second set of negotiations over issue Y would begin. Failure to reach agreement over issue X means that the players cannot and/or will not proceed to negotiate over issue Y. Each player has the option to refuse to bargain (i.e., each player can choose not to start the negotiations over issue X).

The motivation behind the above bargaining agenda is as follows. We have in mind situations in which an agreement over issue Y is relatively easy to renegotiate, while that is not the case with issue X. Once agreement over issue X is reached and implemented, its too costly to renegotiate that agreement; its implementation implies changes in the *status quo* that are difficult to alter. After an agreement over issue X is reached, the players may have an incentive to renegotiate any *prior* agreement over issue Y. Since parties are unable to write enforceable (long-term) contracts, such renegotiation would take place. Hence our *modelling assumption* that parties first negotiate over issue X and then over issue Y. This agenda makes sense for example in those situations in which issue Y concerns the terms of trade (prices and quantities) while issue X concerns the ownership of, or property rights over, some assets (such as land and capital).

During the first set of negotiations, until agreement is reached over issue X, the players obtain their inside options. The per-period inside options from issue k ($k = X, Y$) obtained by players 1 and 2 respectively are z_1^k and z_2^k, where $z_1^k + z_2^k < m^k$. This implies that if the players fail to reach agreement over issue X, then player i's average (or per-period) payoff from this *impasse* is $d_i = z_i^X + z_i^Y$. The latter is also player i's average payoff from the *status-quo*.

If the players reach agreement over issue X giving players 1 and 2 respectively shares x and $m^X - x$ of the cake (where $x \in [0, m^X]$), then the agreement is immediately implemented. This means that from then onwards the per-period payoffs to players 1 and 2 respectively from issue X are x and $m^X - x$. Furthermore, and this is a key feature of our model, each player's inside option from issue Y may change. It is no longer necessary that player i continues to obtain the per-period payoff of z_i^Y from issue Y. This is because the particular agreement over issue

X, as captured by x, may strategically affect the players' inside options over issue Y. We capture this potential change as follows: player i's per-period inside option from issue Y immediately after agreement over issue X is struck with player 1 obtaining a share x (and player 2 a share $m^X - x$) is $f_i(x)$, where for any $x \in [0, m^X]$, $f_1(x) + f_2(x) < m^Y$. For the time being we make no (additional) assumptions about the nature of the functions f_1 and f_2.

We adopt the Nash bargaining solution to describe the outcome of the each set of negotiations, where the manner in which we apply this bargaining solution is informed from non-cooperative bargaining theory (as discussed, for example, in Muthoo, 1999). This completes the description of our model with two "players" and two "issues", in which the inside options over one of the issues can be strategically and endogenously affected. Notice that the model is a (two-stage) game with perfect information. It will be assumed that the game is one with complete information. The latter means, in particular, that all the parameters of the model are *common knowledge* between the players.

The key parameters of our model — which play an important role in our analysis on whether or not, in equilibrium, the inefficient institutions that underlie the inefficient *status quo* are replaced by efficient institutions — are as follows. Firstly, there are the players' inside options associated with the inefficient *status quo*, namely, z_1^X, z_1^Y, z_2^X and z_2^Y. These determine the players' absolute and relative bargaining powers in the *status quo*. Secondly, there are the players' (endogenously determined) *new* inside options over issue Y (following an agreement over issue X), namely, the functions f_1 and f_2. These determine the players' absolute and relative bargaining powers after an agreement over issue X is reached, but before agreement over issue Y is reached. Thirdly, and finally, there are the parameters that capture the magnitudes of the efficiency gains associated with the beneficial institutional changes, namely, m^X and m^Y.

By entertaining heterogeneity in the players' inside options, we shall be able to explore the impact that *inequality* in bargaining power has on the persistence (or otherwise) of inefficient institutions. It should be emphasized that this inequality in bargaining power can be *ex-ante* (i.e., in the inefficient *status quo*) and/or *ex-post* (i.e., after an agreement on issue X but before an agreement on issue Y). Perhaps not surprisingly, these two, different kinds of inequality can have potentially differing impacts.

2.2. **A Preliminary Result.** Using the "backward induction" method to characterize subgame perfect equilibria, we begin by characterizing the outcome of the second set of negotiations *conditional* on an arbitrary outcome in the first set. Thus, *suppose* that the players commence negotiations and agreement is struck over issue X with an arbitrary partition $(x, m^X - x)$ of the cake. And consider the second set of negotiations, over issue Y. If the players reach an agreement on an arbitrary partition $(y, m^Y - y)$, then the per-period payoffs thereafter to players 1 and 2 are $x + y$ and $m^X + m^Y - x - y$. But if the players fail to strike an agreement over issue Y, then the per-period payoffs to players 1 and 2 are $x + f_1(x)$ and $m^X - x + f_2(x)$. Applying the Nash bargaining solution, it follows that the players will reach agreement over issue Y, and the Nash bargained utility payoffs to players 1 and 2 can be written as follows:[3]

$$P_1(x) = x + \left[f_1(x) + \frac{1}{2}\big[m^Y - f_1(x) - f_2(x)\big] \right] \tag{1}$$

$$P_2(x) = [m^X - x] + \left[f_2(x) + \frac{1}{2}\big[m^Y - f_1(x) - f_2(x)\big] \right]. \tag{2}$$

While the first term in each of these expressions is a player's (arbitrary) per-period payoff from issue X, the term inside the big bracket is his per-period (Nash bargained) payoff from issue Y. The latter is the sum of the player's *new* inside option payoff from issue Y (following the implementation of the arbitrary agreement on issue X) and one-half of the net surplus from issue Y (where the latter is the gross surplus m^Y minus the sum of the new inside option payoffs).

It therefore follows that during the first set of negotiations conducted over issue X, the per-period *equilibrium* payoffs to players 1 and 2 from reaching agreement over an arbitrary partition $(x, m^X - x)$ are, of course, $P_1(x)$ and $P_2(x)$. As can be seen, an agreement x on issue X not only determines a player's payoff from issue X, but also has a strategic affect on the player's *Nash bargained* payoff from issue Y, by affecting the players' inside options on issue Y. It should be noted that if the players fail to reach an agreement on issue X, then the per-period payoffs to players 1 and 2 are respectively $z_1^X + z_1^Y$ and $z_2^X + z_2^Y$. Notice that the sum $P_1(x) + P_2(x) = m^X + m^Y$, which, by assumption, strictly exceeds the sum of the per-period inside option payoffs from

[3]The manner in which the Nash bargaining solution should be applied in a bargaining situation with inside options is discussed at great length in Muthoo (1999, chapter 6). As is well-known, the results are derived by studying an appropriately modified version of Rubinstein's alternating-offers bargaining game. In particular, it is shown that the inside options should be used to define the *threat (or disagreement) point* in Nash's bargaining solution.

disagreement over issue X (where the latter is the sum of the per-period payoffs from the *status-quo*).

3. Equilibrium Inefficient Institutions

We begin by first deriving our main proposition that characterizes conditions such that in equilibrium at least one player refuses to bargain if and only if the parameters satisfy these conditions. Thus, when these conditions hold, the inefficient *status quo* remains in place; but not otherwise. Then we analyze these conditions to tease out some specific results and insights about the persistence (or otherwise) of inefficient institutions.

3.1. **Characterization.** Notice that for issue X *in isolation* player preferences are monotonic in x: more x means more cake for player 1 and less cake for player 2. What about the equilibrium utility payoffs $P_1(x)$ and $P_2(x)$? Monotonicity of $P_1(x)$ in x requires that for any $x \in [0, m^X]$,

$$1 + f_1'(x) - \frac{1}{2}[f_1'(x) + f_2'(x)] > 0.$$

The interpretation of this inequality is that the utility gains from an increase in x (the 1) cannot be dominated by a potential loss in equilibrium payoff on issue Y that is caused by the change in the inside option payoffs. Similarly for player 2, monotonicity of $P_2(x)$ in x requires that for any $x \in [0, m^X]$,

$$-1 + f_2'(x) - \frac{1}{2}[f_1'(x) + f_2'(x)] < 0.$$

Hence, both players' equilibrium utility payoffs are *monotonic* if and only if

$$1 > \frac{1}{2}[f_2'(x) - f_1'(x)] \quad \text{for any } x \in [0, m^X]. \tag{3}$$

Under the monotonicity assumption (i.e., when inequality 3 holds), negotiations will not commence in equilibrium *if and only if* at least one player's per-period payoff from the *status quo* exceeds the *maximal* possible payoff he could get from the bargain; that is, either $P_1(m^X) < z_1^X + z_1^Y$ or $P_2(0) < z_2^X + z_2^Y$. Using (1) and (2), and re-arranging terms, it follows that these two inequalities are respectively:

$$(m^X - z_1^X) + \frac{1}{2}[m^Y - f_1(m^X) - f_2(m^X)] < z_1^Y - f_1(m^X) \tag{4}$$

$$(m^X - z_2^X) + \frac{1}{2}[m^Y - f_1(0) - f_2(0)] < z_2^Y - f_2(0). \tag{5}$$

Inequality 4 may be interpreted as follows (inequality 5 may be given a similar interpretation). The right-hand and left-hand sides respectively are the cost and benefit to player 1 under the *best possible scenario for him* (which, under the monotonocity assumption, occurs when he obtains *all* of the surplus on issue X). The cost is the loss in bargaining power when subsequently negotiating over issue Y, while the benefit is the total *net* gain. To summarize, we have established the following (characterization) result:

Proposition 1. *Assume that the functions f_1 and f_2 satisfy inequality 3. Then, in equilibrium, at least one of the players will refuse to bargain (and the inefficient status quo remains in place) if and only if either inequality 4 is satisfied or inequality 5 is satisfied.*

Thus, under the monotonicity assumption, if neither inequality 4 nor inequality 5 holds then the players will strike an agreement over issue X (and then over issue Y). But if either one of these two inequalities holds, then at least one player will refuse to bargain, and the inefficient *status quo* remains in place.

Notice that we don't really need monotonicity — all it does is to ensure that player 1's equilibrium utility payoff $P_1(x)$ is maximized at $x = m^X$ and player 2's equilibrium utility payoff $P_1(x)$ is maximized at $x = 0$. So, in the absence of monotonicity, define $\bar{x}$ and $\underline{x}$ respectively to be supremum and infimum of $\{x \in [0, m^X] : P_1(x)\}$ and $\{x \in [0, m^X] : P_2(x)\}$ — which exist since the functions P_1 and P_2 are bounded. At least one player will refuse to bargain *if and only if* either $P_1(\bar{x}) < z_1^X + z_1^Y$ or $P_2(\underline{x}) < z_2^X + z_2^Y$; that is, if and only if one of the following inequalities holds:

$$(\bar{x} - z_1^X) + \frac{1}{2}[m^Y - f_1(\bar{x}) - f_2(\bar{x})] < z_1^Y - f_1(\bar{x}) \tag{6}$$

$$(m^X - \underline{x} - z_2^X) + \frac{1}{2}[m^Y - f_1(\underline{x}) - f_2(\underline{x})] < z_2^Y - f_2(\underline{x}). \tag{7}$$

Hence, we have the following general characterization result:

Proposition 2. *In equilibrium, at least one of the players will refuse to bargain (and the inefficient status quo remains in place) if and only if either inequality 6 is satisfied or inequality 7 is satisfied.*

We now use Propositions 1 and 2 to derive some results and insights about the relationship between the parameters and the equilibrium outcome.

3.2. **Equal Bargaining Powers.** Consider, first, the benchmark case of perfect equality in both *ex-ante* and *ex-post* bargaining powers. That is, the case in which (i) for $k = X, Y$, $z_1^k = z_2^k$, and (ii) for any $x \in [0, m^X]$, $f_1(x) = f_2(x)$. Notice that under these parameter values, inequality 3 holds, and thus Proposition 1 is applicable. Letting the identical inside option over issue k be denoted by z^k, and the identical *new* inside option on issue Y be denoted by the function f, its easy to verify that both inequality 4 and inequality 5 collapse to the following inequality:

$$m^X + \frac{1}{2}m^Y < z^X + z^Y,$$

which cannot hold (since, by assumption, $m^k > 2z^k$ for $k = X, Y$). Hence, we have established the following result:

Corollary 1. *If the players have equal ex-ante bargaining powers and equal ex-post bargaining powers, then, in equilibrium, agreement is reached over both issues, and the inefficient status quo is replaced by an efficient outcome.*

Perhaps not surprisingly, in an environment in which players are symmetrically placed — that is, have equal bargaining power in the inefficient *status quo* and would continue to have equal bargaining power after reaching agreement over issue X but before reaching agreement over issue Y — each of them has an incentive to get rid of the inefficient *status quo* and benefit from the efficiency-enhancing institutional change. Notice that this conclusion holds even if the players' *ex-post* bargaining powers are adversely (or positively) affected, provided that they are affected in an identical manner. Furthermore, note that the presence of the transaction costs are immaterial here.

An important implication of Corollary 1 is that, *inequality* in the players' bargaining powers is *necessary* for the persistence of inefficient institutions, an insight that we now explore in some depth.

3.3. **Unequal Bargaining Powers.** We begin the analysis of the general case of unequal bargaining powers by first studying the special case in which the players' *ex-ante* bargaining powers are unequal, but their *ex-post* bargaining powers are equal. That is, the case in which for any $x \in [0, m^X]$, $f_1(x) = f_2(x) = f(x)$. This special case is the (approximately) relevant case for many real-life situations (such as the land redistribution situation) in which (i) there is a relatively large degree of inequality in the players' *ex-ante* bargaining powers, and (ii) the institutional change implied by an agreement over issue X eliminates (or significantly reduces) the inequality in bargaining power over issue Y. As such this special case may be of some interest in its own right, besides being instructive. In fact, as we shall show, the main qualitative results and insights obtained in this special case carry over to the general case of unequal *ex-ante* and unequal *ex-post* bargaining powers.

3.3.1. *Equal Ex-Post, But Unequal Ex-Ante Bargaining Powers.* To restate, here we consider the case in which for any $x \in [0, m^X]$, $f_1(x) = f_2(x) = f(x)$. Recall that we defined, for each $i = 1, 2$,

$$d_i = z_i^X + z_i^Y,$$

which can be interpreted as a measure of player i's "aggregate" *ex-ante* bargaining power. Inequality in the players' aggregate *ex-ante* bargaining powers can be plausibly measured by, or interpreted as, the "distance" between d_1 and d_2 — defined, for example, by the absolute value of the difference between d_1 and d_2.

In this special case under consideration, inequality 3 holds, and thus Proposition 1 is applicable. Its easy to verify that inequality 4 and inequality 5 respectively become:

$$m^X + \frac{1}{2}m^Y < d_1 \tag{8}$$

$$m^X + \frac{1}{2}m^Y < d_2. \tag{9}$$

Since the sum of the left-hand sides of these two inequalities exceeds (by assumption) the sum of their right-hand sides, both of them cannot hold. This implies that in equilibrium *at most* one player would refuse to bargain. Denoting, for notational convenience, $\widehat{d} = m^X + m^Y/2$, we have established that *if*, for some $i = 1, 2$, $d_i > \widehat{d}$, then player i would refuse to bargain; and moreover, $d_j < m^Y/2$ ($j \neq i$) — since (by assumption) $d_1 + d_2 < m^X + m^Y$. This analysis implies that for any pair $d = (d_1, d_2)$ in the indicated regions of Figure 1, there will be no negotiations in equilibrium (and the inefficient *status quo* remains in place). In summary, we have established the following result:

Corollary 2. *Assume that the players have equal ex-post bargaining powers, but have unequal ex-ante bargaining powers. Then, in equilibrium, negotiations don't commence and the inefficient status quo remains in place if and only if the degree of inequality in the players' aggregate ex-ante bargaining powers is sufficiently large.*

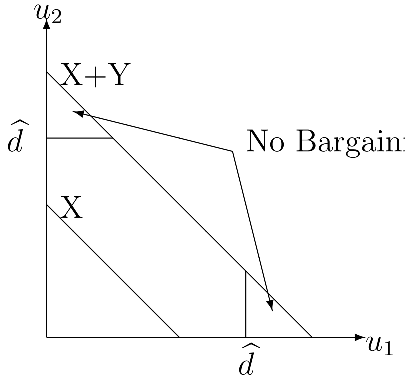

FIGURE 1. Illustration of Corollary 2

The intuition behind this result comes from noting that when there is a sufficiently large degree of inequality in the players' aggregate *ex-ante* bargaining powers, an agreement on issue X would destroy the *ex-ante* bargaining power advantage of one player (given the hypothesis of Corollary 2 of equal *ex-post* bargaining powers), and thus that player has an incentive to refuse to bargain.

It should be noted that Corollary 2 shows that what matters for the question at stake are the players' "aggregate" *ex-ante* bargaining powers (as defined by d_1 and d_2). A player's *ex-ante* bargaining powers over *individual* issues matter only to the extent that they determine his aggregate *ex-ante* bargaining power. For example, if player 1 has most of the *ex-ante* bargaining power over issue X (i.e., $z_1^X >> z_2^X$), while the opposite is the case over issue Y (i.e., $z_1^Y << z_2^Y$), then whether or not the efficient outcome obtains depends on the relative magnitudes of their aggregate *ex-ante* bargaining powers. If d_1 and d_2 are close to each other (which may happen in this example), then it follows from Corollary 2 that the players would negotiate, and the inefficient *status quo* would be replaced by an efficient outcome.

However, in some situations (such as in the land redistribution situation), a player who has most of the bargaining power over one issue may well have most of the bargaining power on the other issue as well. In that situation, the degree of inequality in the players' aggregate *ex-ante* bargaining powers will be large, and may well be large enough to induce the inefficient outcome.

A key message of Corollary 2 is as follows: *a small degree of inequality in the players' aggregate ex-ante bargaining powers is conducive for efficient institutional change, but not a large degree of such inequality; in that case, inefficient institutions are likely to persist.*

What role, if any, do the other parameters have? First, notice that the players' equal (by hypothesis) *ex-post* bargaining powers have no role to play on whether or not, in equilibrium, negotiations would commence. This is formally implied by the fact that the function f does not appear in inequalities 8 and 9. The intuition for this result comes from the observation that, the players' incentives on whether or not to negotiate is influenced by the *relative* magnitudes of their respective *ex-post* bargaining powers. If they are equal, then, irrespective of the *absolute* magnitude of this common *ex-post* bargaining power, it has no role on incentives to bargain.

Finally, note the fairly intuitive but important result — which is immediate from the above analysis — that, the larger are the efficiency gains associated with institutional change (as captured here by the parameters m^X and m^Y) the more likely it is that such change will take place. This suggests, for example, that in order to promote efficiency-enhancing institutional change, ways should be found to enhance the associated gains from such change.

We now explore the robustness (or otherwise) of the results and insights obtained above to the extension in which the players' *ex-post* bargaining powers are also potentially unequal.

3.3.2. *Unequal Ex-Post and Unequal Ex-Ante Bargaining Powers.* Here we impose no restrictions on the parameters. As such we apply the characterization result stated in Proposition 2. First, however, define, for each $x \in [0, m^X]$, $\Delta(x) = [f_2(x) - f_1(x)]/2$. The absolute value of $\Delta(x)$ is a measure of the degree of inequality in the players' *ex-post* bargaining powers, which depends on the value of x (i.e., on the agreement struck over issue X). Notice that if $\Delta(x) > 0$ then player 2 has relatively greater *ex-post* bargaining power than player 1; while the opposite is the case if $\Delta(x) < 0$. Given this definition, and after rearranging some terms, it follows that inequalities 6 and 7 respectively become:[4]

$$\bar{x} + \frac{1}{2}m^Y < d_1 + \Delta(\bar{x}) \tag{10}$$

$$(m^X - \underline{x}) + \frac{1}{2}m^Y < d_2 - \Delta(\underline{x}). \tag{11}$$

It follows immediately from these inequalities that, if $\Delta(\bar{x})$ is sufficiently large then player 1 would refuse to bargain, and if $\Delta(\underline{x})$ is

[4]It may be noted, in passing, that under the monotonicity assumption (i.e., when the parameters satisfy inequality 3), $\bar{x} = m^X$ and $\underline{x} = 0$, and so the left-hand sides of these two inequalities become equal to the left-hand sides of inequalities 8 and 9.

sufficiently small then player 2 would refuse to bargain. This is not surprising. If under the best possible scenario for player 1 (namely, when $x = \bar{x}$) his *ex-post* bargaining power is significantly smaller than that of player 2 (i.e., $\Delta(\bar{x})$ sufficiently large), then he would have no incentive to bargain. Symmetrically for player 2. An implication of these observations is that if for all $x \in [0, m^X]$, the absolute value of $\Delta(x)$ is sufficiently large, then at least one of the above inequalities would hold, and thus at least one of the players would refuse to bargain. We state this result in the following corollary:

Corollary 3. *Fix the players' (potentially unequal) ex-ante bargaining powers. If the degree of inequality in the players' ex-post bargaining powers is sufficiently large, then, in equilibrium, negotiations don't commence and the inefficient status quo remains in place.*

On the other hand, if the degree of inequality in the players' *ex-post* bargaining powers is sufficiently small, then Corollary 2 applies.

A central message of our analysis can be put as follows (which extends the message derived from Corollary 2): *a small degree of inequality in the players' bargaining powers — both ex-ante and ex-post — is conducive for efficient institutional change, but not a large degree of such inequality; if the degree of inequality of either their ex-ante or their ex-post bargaining powers is sufficiently large, then inefficient institutions are likely to persist.*

4. An Example from Industrial Organization

In order to illustrate the breath of potential application of our ideas, model and results, we now consider a fairly standard problem studied in the *Industrial Organization* literature, namely, that of two firms involved in a two stage game, in which they first invest in some R&D effort and then compete in a product market (see, for example, Tirole (1989)). In the *status quo*, the firms conduct R&D independently and non-cooperatively, which is inefficient. As has been argued in the literature, cooperation in R&D saves on cost. However, we shall show that, in equilibrium, at least one of the firms refuses to establish such an efficiency-enhancing "research joint venture".

The second (product market competition) stage is as follows. Two firms with constant marginal cost technologies are competing in a homogeneous goods market according to Bertrand price competition. The firms have the option to collude, but since explicit collusion is illegal no side-payments are possible, and thus the collusive outcome must be achieved by sharing the market. We allow the firms to do so probabilistically, that is, for each firm to be the monopolist with some probability.[5] As is well known, there exists a surplus from collusion compared with the Nash equilibrium outcome in this setting.[6] It is assumed that the firms bargain over the allocation of this surplus, and, as in our model above, we employ the Nash Bargaining Solution (NBS, for short) to describe the outcome of those negotiations.[7]

To have a concrete example, suppose that market demand is linear, and that inverse demand is given by $P = 1 - Q$. The firms' marginal costs are $c_1, c_2 \in [0, 1)$. The monopoly prices for the firms are thus $p_i^m = (1 + c_i)/2$, with monopoly profits of $\pi_i^m = (1 - c_i)^2/4$. There are two cases to consider: equal marginal costs, and unequal marginal costs. In the first case the Bertrand Nash equilibrium will have each firm sell at the common marginal cost, and thus both firms have zero profits. The NBS for the collusion game then allocates the monopoly profits equally, and each firm will obtain a profit of $(1 - c_i)^2/8$.

In the second case the low cost firm will serve all the market. Call the low cost firm, Firm 1. Firm 2's cost are either above Firm 1's monopoly price, in which case Firm 1 simply is a monopolist, or below, in which case Firm 1 sells $1 - c_2$ units at a price of c_2. The Bertrand Nash equilibrium therefore has payoffs for Firm 1 of $\min\{(1 - c_1)^2/4, (c_2 - c_1)(1 - c_2)\}$. Firm 2 obtains zero in either case. As mentioned above, the payoff frontier for collusion is convexified by allowing each firm to become the monopolist with some probability. The payoff frontier thus is

$$\pi_2(\pi_1) = \frac{(1 - c_2)^2}{4} - \frac{(1 - c_2)^2}{(1 - c_1)^2}\pi_1.$$

In the NBS each player receives half of the surplus in excess of his disagreement payoff (inside option). It follows that the NBS for the collusion game has payoffs of:

$$(\pi_1, \pi_2) = \begin{cases} \left(\frac{(1-c_1)^2}{4}, 0\right) \text{ if } \quad 2c_2 > 1 - c_1, \\ \left(\frac{(1-c_1)^2}{8} + \frac{(c_2-c_1)(1-c_2)}{2}, \frac{(1-c_2)^2}{8} - \frac{(c_2-c_1)(1-c_2)^3}{2(1-c_1)^2}\right) \text{ otherwise.} \end{cases}$$

[5]This assumption serves to convexify the payoff frontier.

[6]We make the usual assumption that the Nash equilibrium of the Bertrand game with constant marginal costs involves the firms sharing the market at a price equal to their marginal costs, if marginal costs are equal. If marginal costs are unequal, the low cost firm will serve all of the market at the lower of its monopoly price or the high cost firm's marginal cost.

[7]In computing the NBS we treat the Bertrand Nash equilibrium payoffs as the disagreement (or threat) point, since they would correspond to the inside option point in the alternating-offers Rubinstein bargaining game.

In what follows we ignore the first case, in which the low cost firm is a monopoly, since there is no surplus from collusion in that case.

In the first stage of the game the firms may invest in R&D which can lead to an innovation that reduces the marginal cost of production. The innovation is *drastic*: if successful, the marginal cost will be lower than the current lowest marginal cost. The probability of achieving this breakthrough is independent of the initial marginal cost of the firm. Research comes in discrete lumps, so that only fixed increments of effort are possible, each at a fixed cost of k. One may think of these as research laboratories. The success of any given laboratory is independent of the success of any other laboratory. Furthermore, the technology exhibits dis-economies, so that the probability of a successful innovation by any given laboratory is declining in the total number of laboratories in operation.[8]

In this first stage of the game the firms can either operate independently or cooperate on R&D. If they operate independently each firm may invest in R&D, and if both do then both, either, or neither will be successful in innovating. Cooperation on R&D saves on the duplication of effort (investment cost). Suppose first that the firms do not cooperate. They then need to decide if to invest in R&D, and how much to invest. We will focus on an equilibrium in which both firms operate one lab. Let p_2 denote the probability of success for a lab if two labs are in operation, and let c denote the new marginal cost, where $c < c_1 < c_2$. In order for the Bertrand equilibrium not to occur at the monopoly price in all situations we require that $2c_2 > 1 - c$, i.e., $c > 1 - 2c_2$. By computing the payoffs for both firms if they do invest, and comparing them to the payoff if they don't, we can find restrictions on the investment cost k for which it is an equilibrium for both firms to invest in one lab. For example, if $c = 0.25$, $c_1 = 0.3$, $c_2 = 0.4$, $k = 0.002$, and $p_2 = 0.2$ we get expected firm profits of 0.0850234 for the low cost firm and 0.0321484 for the high cost firm. Total expected industry profits in this equilibrium are therefore 0.117172.[9]

Now suppose the firms cooperate on investment. In that case, they cannot write binding contracts on output levels or prices in stage 2, since output market collusion continues to be prohibited. This means that the Nash Bargaining Solution in stage 2 will be based on the Nash equilibrium of the Bertrand game, as before. Under the above

[8]We are thinking here of an unmodelled limited supply of suitable scientists.

[9]All derivations and computations are in the Appendix.

parameters the equilibrium for the collusive R&D game will involve investment in one laboratory if $p_1 = 0.3$.[10]

The expected payoffs *before* investment costs are then 0.0849688 for the low cost firm and 0.0371652 for the high cost firm. Note that the sum of these is 0.122134, and deducting the investment cost of $k = 0.002$ we get total joint expected profits of 0.120134, which exceeds those in the non-cooperative equilibrium. Cooperation thus is indeed joint profit maximizing.

However, no matter how the R&D expenditures are allocated, the firm with the initial low costs (Firm 1) will not find it in its interest to engage in joint R&D since its maximal expected profit of 0.0849688 is less than the 0.0850234 it can achieve by refusing to cooperate.[11]

5. Concluding Remarks

A main, general insight of our analysis is that, there is a close and deep connection between inequality in bargaining power and the persistence of inefficient institutions.[12] In particular, we unearthed a positive relationship between the degree of such inequality and the likelihood of the persistence of inefficient institutions. Our analysis drew out the distinction between *ex-ante* and *ex-post* bargaining power. This is important and fundamental. An inefficient institution may persist, for example, precisely because some agents possess enormous bargaining power in the *status quo* which they would loose after an efficiency-enhancing institutional change is implemented. Such agents therefore have a vested interest in maintaining the inefficient institutions that underlie the inefficient *status quo*. As we discussed above, the persistence of the inefficient property rights over landholdings in rural India is a case in point.

In fact, our model, results and insights are potentially applicable to help explain the persistence (or elimination, as the case may be) of

[10]Of course, p_3 must be suitably chosen to make it optimal for there not to be three labs.

[11]Note that we need to assume that no side payments are possible at this stage. This is implied by our "transaction cost" assumption — discussed in Sections 1 and 2 — that players are wealth-constrained and unable to borrow the required funds. Indeed, if, for example, firm 1 could charge firm 2 a licensing fee or some other device to transfer cash in the initial stage, an equilibrium in which both firms agree to cooperate will exist.

[12]Of course, as we discussed and as is captured in our model, this connection is possible by the presence of various kinds of frictions (or transaction costs); for otherwise Coase's Theorem applies, and efficiency would be compatible with unequal bargaining powers.

inefficient institutions in the context of a great variety of economic, political and social situations.

To take just one other example, consider the conflict between Israel and the Palestinians. There is a *status quo* in place, which is inefficient (due in part to the costs and consequences of terrorism and military engagements), and in which there is a great degree of inequality in bargaining power; Israel possesses most of it. The conflict is over many issues. However, some of these issues such as the future of Jerusalem and property rights over certain lands are such that once agreements over them are struck and implemented, they would be difficult to alter (since, for example, the Palestinian people would physically move into such lands). Thats not the case, relatively speaking, with other issues such as the elimination of terrorism. Notice, moreover, that agreements over the former set of issues would significantly reduce Israel's bargaining power over the other set of issues. An application of our argument and insights would suggest that the persistence of this costly conflict is due (at least in part) to the large degree of inequality in *ex-ante* bargaining power.

The immediate, main "policy" consequences of our insights that would help engender efficiency-enhancing institutional change are self-evident: reduce inequality in bargaining power and/or enhance the efficiency gains associated with institutional change. Such conclusions should guide policy makers in the right direction. But the matter of exactly how one does such things depends on the particular situation in question.

Institutions — be they economic, political or social — lie at the very heart of modern societies. Some are explicit, while others are only implicit. Some are formalized in laws and regulations, while others are part of the culture and norms. They shape human behaviour, and determine economic performance and individual well-being. As such the importance of exploring ways to promote and induce efficient institutional change is crucial, especially for the benefit of the poorer parts of the world. Our analysis has only just touched the surface of the burning issues and questions. We hope others will take-off from where we have left.

Appendix to Section 4: Omitted Computations

The low cost firm's expected payoffs in the non-cooperative R&D game with both firms investing in one laboratory are

$$\begin{aligned} -k &+ p_2^2\frac{(1-c)^2}{8} + (1-p_2)^2\left(\frac{(1-c_1)^2}{8} + \frac{(c_2-c_1)(1-c_2)}{2}\right) \\ &+ p_2(1-p_2)\left(\frac{(1-c)^2}{8} + \frac{(c_2-c)(1-c_2)}{2}\right) \\ &+ p_2(1-p_2)\left(\frac{(1-c_1)^2}{8} - \frac{(c_1-c)(1-c_1)^3}{2(1-c)^2}\right) \end{aligned}$$

Note that no investment in R&D by the low cost firm would lead to expected profits of

$$\begin{aligned} &(1-p_2)\left(\frac{(1-c_1)^2}{8} + \frac{(c_2-c_1)(1-c_2)}{2}\right) \\ &+p_2\left(\frac{(1-c_1)^2}{8} - \frac{(c_1-c)(1-c_1)^3}{2(1-c)^2}\right) \end{aligned}$$

so that investing is optimal if

$$\begin{aligned} k &< p_2^2\frac{(1-c)^2}{8} - p_2(1-p_2)\left(\frac{(1-c_1)^2}{8} + \frac{(c_2-c_1)(1-c_2)}{2}\right) \\ &+ p_2(1-p_2)\left(\frac{(1-c)^2}{8} + \frac{(c_2-c)(1-c_2)}{2}\right) \\ &- p_2^2\left(\frac{(1-c_1)^2}{8} - \frac{(c_1-c)(1-c_1)^3}{2(1-c)^2}\right) \end{aligned}$$

or

$$\begin{aligned} k &< p_2\frac{(1-c)^2}{8} - p_2\frac{(1-c_1)^2}{8} - p_2(1-p_2)\frac{(c_2-c_1)(1-c_2)}{2} \\ &+ p_2(1-p_2)\frac{(c_2-c)(1-c_2)}{2} + p_2^2\frac{(c_1-c)(1-c_1)^3}{2(1-c)^2}. \end{aligned}$$

Similarly, the high cost firm will have payoffs of

$$\begin{aligned} -k &+ p_2^2\frac{(1-c)^2}{8} + (1-p_2)^2\left(\frac{(1-c_2)^2}{8} - \frac{(c_2-c_1)(1-c_2)^3}{2(1-c_1)^2}\right) \\ &+ p_2(1-p_2)\left(\frac{(1-c)^2}{8} + \frac{(c_1-c)(1-c_1)}{2}\right) \\ &+ p_2(1-p_2)\left(\frac{(1-c_2)^2}{8} - \frac{(c_2-c)(1-c_2)^3}{2(1-c)^2}\right) \end{aligned}$$

if investing, and

$$(1-p_2)\left(\frac{(1-c_2)^2}{8}-\frac{(c_2-c_1)(1-c_2)^3}{2(1-c_1)^2}\right)$$
$$+p_2\left(\frac{(1-c_2)^2}{8}-\frac{(c_2-c)(1-c_2)^3}{2(1-c)^2}\right)$$

if not. Thus investment requires that

$$\begin{aligned} k &< p_2^2\frac{(1-c)^2}{8}-p_2(1-p_2)\left(\frac{(1-c_2)^2}{8}-\frac{(c_2-c_1)(1-c_2)^3}{2(1-c_1)^2}\right) \\ &+ p_2(1-p_2)\left(\frac{(1-c)^2}{8}+\frac{(c_1-c)(1-c_1)}{2}\right) \\ &- p_2^2\left(\frac{(1-c_2)^2}{8}-\frac{(c_2-c)(1-c_2)^3}{2(1-c)^2}\right) \end{aligned}$$

or

$$\begin{aligned} k &< p_2\frac{(1-c)^2}{8}-p_2\frac{(1-c_2)^2}{8}+p_2(1-p_2)\frac{(c_2-c_1)(1-c_2)^3}{2(1-c_1)^2} \\ &+ p_2(1-p_2)\frac{(c_1-c)(1-c_1)}{2}+p_2^2\frac{(c_2-c)(1-c_2)^3}{2(1-c)^2}. \end{aligned}$$

Now consider the cooperative investment game. If they operate n labs they will fail to get the innovation with probability $(1-p(n))^n$. Otherwise they get it. Expected payoffs before allocation of costs then are

$$(1-(1-p(n))^n)\frac{(1-c)^2}{8}+(1-p(n))^n\left(\frac{(1-c_1)^2}{8}+\frac{(c_2-c_1)(1-c_2)}{2}\right)$$

for the low cost firm and

$$(1-(1-p(n))^n)\frac{(1-c)^2}{8}+(1-p(n))^n\left(\frac{(1-c_2)^2}{8}-\frac{(c_2-c_1)(1-c_2)^2}{2(1-c_1)^2}\right)$$

for the high cost firm.

Suppose for the moment that it is optimal to invest in only one lab jointly. That means that parameters are such that

$$\begin{aligned} &(1-p(1)-(1-p_2)^2)\frac{(1-c)^2}{4} \\ &+ ((1-p_2)^2-(1-p(1)))\left(\frac{(1-c_1)^2}{8}+\frac{(c_2-c_1)(1-c_2)}{2}\right) \\ &+ ((1-p_2)^2-(1-p(1)))\left(\frac{(1-c_2)^2}{8}-\frac{(c_2-c_1)(1-c_2)^2}{2(1-c_1)^2}\right) < k. \end{aligned}$$

The low cost firm would never agree to a joint investment if, even if the high cost firm were to pay all costs, the low cost firm's payoff is lower than without cooperation, that is,

$$p(1)\frac{(1-c)^2}{8} + (1-p(1))\left(\frac{(1-c_1)^2}{8} + \frac{(c_2-c_1)(1-c_2)}{2}\right)$$

less than

$$\begin{aligned} -k \quad + \quad & p_2^2\frac{(1-c)^2}{8} + (1-p_2)^2\left(\frac{(1-c_1)^2}{8} + \frac{(c_2-c_1)(1-c_2)}{2}\right) \\ + \quad & p_2(1-p_2)\left(\frac{(1-c)^2}{8} + \frac{(c_2-c)(1-c_2)}{2}\right) \\ + \quad & p_2(1-p_2)\left(\frac{(1-c_1)^2}{8} - \frac{(c_1-c)(1-c_1)^3}{2(1-c)^2}\right) \end{aligned}$$

This requires that

$$\begin{aligned} k < (p(1)-p_2) & \frac{4c_2 - 6c_1 + 2c + c_1^2 - c^2 - 4c_2^2 + 4c_1c_2}{8} \\ - \quad p_2(1-p_2) & \frac{(c_1-c)(1-c_1)^3}{2(1-c)^2}. \end{aligned}$$

The question now is if we can find a parametrization for which all these conditions hold, so that it is an equilibrium for both firms to invest if they do not cooperate, that it is efficient to invest in one lab jointly, but that Firm 1 will refuse to bargain on this.

The following values will work: $c = 0.25$, $c_1 = 0.3$, $c_2 = 0.4$, $k = 0.002$, $p(1) = 0.3$, $p_2 = 0.2$, and $p(3)$ can be determined to make it optimal for firms to only choose 1 lab.

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