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Benefit Sharing Among Local Resource Users: The Role of Property Rights

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HIGHLIGHTS

- Extreme inequalities within resource user groups pose a threat to sustainability
- Ethnically diverse groups experience more unequal sharing of forest harvests
- Under certain conditions, groups with property rights share harvests more equally
- Ignoring existing intragroup heterogeneities, REDD+ may deepen income inequalities

ABSTRACT

Skewed distributions of benefits from natural resources can fuel social exclusion and conflict, threatening sustainability. This paper analyzes how user-group property rights to harvest forest products affect the distribution of benefits from those products within user groups. We argue that groups with recognized harvesting rights share benefits more equally among group members than groups without such rights. We test this argument with data from 350 forest user groups in 14 developing countries. Our results suggest that securing harvesting rights for local user groups can contribute to more equal benefit sharing, especially in ethnically homogenous groups.

Keywords

Forestry, governance, inequality, institutions, REDD+, IFRI

1. INTRODUCTION

Forest land in developing countries often lacks legally recognized, readily identifiable owners. In addition, rights to forest *products* are often ambiguous, even where land ownership is clear. These property rights issues hamper the efforts of the rural poor to secure their livelihoods, as does the exclusion of women and other marginalized groups (Alston and Andersson, 2011). Previous studies have also noted that insecure or absent property rights increase the risks of elite capture within user groups—a situation in which more powerful group members are able to obtain a disproportional share of group benefits, such as income from resource harvesting (Larson, 2011, Iversen et al 2006). In this paper, we look at the extent to which the presence of secure forest harvesting rights by user groups affects the distribution of forest-related benefits within the groups. Our analysis seeks to bring new evidence to bear on the debate about the risks of elite capture in decentralized governance regimes, with a particular focus on the role played by local institutional arrangements around property rights, as well as the social characteristics of the local user groups.

Our analysis here is particularly relevant for the ongoing debate within the framework of REDD+; the international initiative for improved conservation and sustainable management of forests and carbon stocks though Reduced Emissions from Deforestation and Degradation that is primarily targeted to developing countries,; because equitable benefit-sharing constitutes a key objective of this initiative (PROFOR, 2011). Nevertheless, the specific details of how such sharing might actually happen under REDD+ remain unclear. To date, these discussions have focused on benefit sharing among different stakeholder groups such as national governments,

indigenous communities, and other local forest user groups, and less so on benefit sharing within these groups. One of the difficulties for the architects of REDD+ programs and projects is that there is little information regarding which approaches to benefit sharing work better than others in specific contexts. Further, there is a lack of knowledge about how to ensure equitable benefit sharing among all program participants *as well as within such groups*. And while there are many REDD+ programs under design or in a pilot stage, few have reached a stage of maturity in which it would be possible to observe benefit-sharing impacts. This limits the number of relevant empirical cases of REDD+ activities that one can learn from and raises challenging question for the research community: How can the analysis of existing data on benefit sharing in current community forestry activities help to shed light on likely benefit-sharing outcomes in future REDD+ projects that target community forestry activities?

The conceptual framework underpinning REDD+ is similar to current and previous well-known intervention approaches such as Payments for Ecosystem Services (PES) and Integrated Conservation and Development Programs (ICDPs). ICDPs were implemented in the 1990s in an effort to integrate biodiversity conservation with community development goals but were criticized because they resulted in limited conservation outcomes and increased poverty among marginalized groups. This result was attributed to the indirect linkages between actual rewards given to targeted communities and actions needed to conserve the biodiversity itself, as well as inattention to power and institutional dynamics within communities that tend to maintain existing social and wealth disparities (Muradian,2013; Muradian et al, 2013). As a successor to ICDPs, the more recent move PES approach is oriented around direct payments between suppliers and buyers of environmental services. PES schemes have also been roundly criticized for reinforcing existing inequalities in power relations and especially in access to benefits and decision making

by participants (Van Noordwijk et al, 2012). Adhikari and Boag (2013) indicate that elements of the political, social and economic context (such as land tenure arrangements, incentive structures, gender and equity issues) affect the success of PES implementation. Though REDD+ schemes retain the incentive-based structure of PES, whereby payments and rewards are offered for specified performance targets, they also increasingly integrate social safeguards aimed at countering or mitigating negative effects (the 'do no harm' dimension) as well as enhancing the likelihood of positive effects (i.e. the 'do-good' dimension) associated with PES schemes (Daviet and Larsen, undated; Krause and Nielsen, 2014; Arhin, 2014). Safeguards include: protection of the rights of local people; transparency; participation in decisions; fair, transparent and equitable benefits sharing and so on (UNFCCC, 2011). However, the effectiveness of safeguards is thought to be limited by the socio-economic settings in which they are applied, which often face considerable push-back from local customs, norms and practices (Arhin, 2014; Corbera, 2012).

In this paper, we use existing data on how forest-related benefits are shared among local forest users in forest-dependent communities across 14 developing countries, in order to generate useful lessons regarding how benefits from *future* REDD+ activities are likely to be distributed, by analyzing the factors that affect *current* patterns of benefit sharing. That is, we suggest that the institutional arrangements that *currently* influence the distribution of benefits in forest-dependent communities in pre-REDD+ contexts, such as in community forestry settings which REDD+ initiatives often build from, are likely to prevail and also affect *future* benefit-sharing patterns under REDD+.

To carry out this analysis, we draw on data from the International Forestry Resources and Institutions (IFRI) Research Program and observations from 350 forest user groups in fourteen developing countries in Latin America, South Asia and East Africa. These data contain detailed

information around the attributes of local forest users, the forest products they harvest, and information on how those products are distributed amongst group members. We analyze how the rights of user groups to harvest forest products affect the degree of intra-group inequality in the distribution of benefits from forest products. In other words, do groups with usufruct rights to forest products that they harvest, share benefits from products harvesting more equally than groups who do not enjoy such rights?

The rest of the paper is structured as follows: the next section reviews existing research on benefit-sharing in REDD+-related activities, including Payment for Environmental Services (PES) projects, community forestry activities, bio-prospecting, and timber concession partnerships. The third section presents our theoretical proposition that internal group characteristics, such as existing socio-economic and status differentials and the extent of forest user rights, will affect benefit-sharing patterns, and are thus key issues that should be considered for REDD+ policy. We briefly illustrate this argument using two case studies drawn from existing literature, develop a set of hypotheses, and test them empirically with IFRI data. The latter sections of the paper focus on the empirical data, methods, results, and interpretation of analytical findings.

2. PREVIOUS RESEARCH

REDD+ seeks to incentivize conservation by giving standing forests an economic value, which accounts for the opportunity cost of alternate uses, such as forest exploitation and conversion, in addition to the value of avoiding negative externalities related to deforestation and degradation. Scholars have expressed a number of concerns about the REDD+ approach. First, REDD+ might undermine community property rights, benefitting central governments and large

property owners at the expense of forest-dependent communities (Larson 2011). In Kenya, for example, reports of forced evictions of local, forest-adjacent and forest-dwelling communities on account of forest conservation for REDD+ initiatives are receiving increased attention by international NGO community.[1] Second, insecure property rights to forest land and forest products might make REDD+ more difficult to implement by making payments to forest users difficult to carry out, or unfairly exclude individuals with less established claims (Awono 2014, Duchelle 2012). Third, raising the monetary value of standing forests could spur increased competition for this new form of forest benefit, potentially driving enclosure of important common pool resources, and negatively affecting politically weaker forest-dependent people (Larson 2011). This last issue is a particularly important concern, because REDD+ has not specified the mechanisms for benefit-sharing, and much existing research suggests that such voids in implementation guidance can make elite capture—and resulting inequalities—more likely. For instance, in a weak institutional setting, characterized by the absence of property rights enforcement, high values of forest products have been found to incentivize local elites to capture a disproportionate share of benefits (Iversen, 2006). This paper, therefore, aims to highlight issues that will be important for policymakers and practitioners to consider when constructing a benefit-sharing mechanism. While a substantial literature has emerged over the last two decades examining the effects of inequality on outcomes such as forest governance (Chhatre, 2008), collective action (Baland, 1999; Dayton Johnson, 2002), and forest condition (Baland & Platteau, 2003; Andersson and Agrawal, 2011), the factors that affect economic inequality in general, and unequal forest benefit sharing in particular, are not well understood.

Thus, while REDD+ may provide a window of opportunity for increased safeguards over long-standing concerns around community rights in forest contexts (Larson et al 2013), the

processes by which REDD+ projects might effectively address tenure concerns and safeguard local communities rights to access and benefit from forest resources are not currently well-articulated (Naughton-Treves and Wendland 2013). Most REDD+ projects are too few and too recent to be systematically evaluated on these issues, but it is possible draw useful lessons from the much longer history of scholarship around benefit-sharing related to Payment for Environmental Services (PES) projects, community forestry activities, and timber concession partnerships. The existing literature from such examples points to several factors that affect the distribution of forest benefits, and two that we highlight as particularly relevant in the REDD+ context: first, the nature of property rights, and second, the heterogeneity of the forest user community.

Property right and tenure issues are paramount because in many countries the existence of overlapping formal and informal tenure arrangements with respect to forest land and forest resources presents a complex property rights picture (Alston and Andersson, 2011). REDD+ could exacerbate such situations. For example, as standing forests gain value under REDD+, there is concern that outsiders or elites could manipulate those with less secure property rights into transferring use rights or selling forest land (Chhatre et al. 2012), or otherwise capture a disproportionate share of benefits for themselves (Duchelle 2010, Larson 2011, Murdiyarso 2012). Previous research also suggests that more secure access rights to forests may prevent elite capture of forest benefits (Larson, 2011).

The relationship between land and forest resource rights and natural resource benefits is well studied, although many uncertainties remain. Much of this work focuses on the distributive impacts of changing land rights, and the struggles that result when there is disagreement between de jure and de facto rights. For example, the introduction of formal property rights may either

expand or contract access and control of land that was previously held under customary rights, with potentially different repercussions for different social groups (Kumar and Kerr 2013; Benjaminsen et al 2009; Lebert and Rohnde 2007, Mwangi, 2007). Simply strengthening de jure land tenure rights may not always be sufficient to protect disenfranchised groups, as implementation and access to benefits do not always follow the written laws, and may instead be brokered by informal but entrenched dynamics across groups (Meinzen-Dick and Mwangi, 2008; Mwangi and Dohrn, 2007). Moreover, different kinds of formalized rights vary in strength and durability. For example, constitutional rights tend to be more durable than executive decrees (Larson, 2011), but can also fail to provide a sufficient safeguard if not enforced (Gebara et al, 2014).

Here we follow the conceptualization of property rights as a bundle of individual permissions around accessing, exploiting, making decisions over, and outright selling or transferring land or resources (Ostrom and Schlager, 1992). Thus, it is important to consider both land ownership and forest usage rights, particularly because in many developing country forest contexts, usufruct rights are commonly separated from land ownership or alienation rights and this separation is also likely to apply to carbon rights (Yeang, 2010; Unruh, 2008; Larson et al 2013). In cases where forest usage rights are limited to landowners, poor and landless households may be excluded (Coad et al. 2008). A number of authors (Larson 2011, Coad et al. 2008, Bray et al. 2008, Kaimowitz and Sheil 2007, Schwartzman, Moreira, and Nepstad 2000) emphasize that usage rights must focus on the many different values of forests- and not just carbon sequestration—in order to protect and benefit local communities. For example, these authors suggest an approach to REDD+ that would allow benefit-sharing with local communities across a broader range of forest resources, such as access to gather non-timber forest products,

limited hunting of wild animals, and sustainable timber harvesting. Some studies suggest that allowing such compromises to protect local livelihoods can be just as effective for forest conservation objectives as the creation of strict protected areas, and more effective at delivering local benefits (Bray et al. 2008, Schwartman, Moreira, and Nepstad 2000). Overall, usage rights are more likely to benefit a broader range of local community members when such rights follow local norms and are shaped via local input rather than arbitrarily imposed from outside. Furthermore, rights are only part of the context that shapes access to forest benefits. As Ribot and Peluso (2003) point out, access is shaped by the whole web of power relations in a society. Property rights are one manifestation of group power, but there are other ways in which groups could enhance their access to resources, including illicit means, or when harvesting rights are enhanced by economic or social dominance.

Along these lines, a second theme in the existing literature is the complex relationship between community heterogeneity —especially ethnic and caste diversity—and unequal benefit distribution. For example, scholarship suggests that ethnic diversity lowers trust and public goods provision (Habyarimana et al., 2007; Habyarimana et al., 2009; Easterly & Levine 1997; Banerjee, Iyer, & Somanathan, 2005; Lanjouw and Rao, 2010) impedes collective action (Bandiera et al, 2005, Bardhan & Dayton-Jonson 2006), encourages rent-seeking behavior (Easterly & Levine 1997), and increases the likelihood of civil conflict when coupled with inter-group inequality (Cederman 2011). Specifically regarding forest benefits, case studies from Nepal and Burkina Faso found that caste or ethnic differences were related to families' ability to appropriate benefits from the forest (Adhikari 2005, Adhikari, DiFalco, and Lovett, 2004, Coulibaly-Lingani, et al., 2009). At the same time, others have found the relationship between ethnic diversity and forest governance to be more complex or dependent on local institutions

(Poteete and Ostrom, 2004, Naidu 2009). Given existing findings around the role that group heterogeneity can play in fueling social exclusion, discrimination, conflict and ensuing inequities in benefit-sharing, it is relevant to consider how heterogeneity might drive the distribution of benefits from forests, and whether this relationship is mitigated by clearer recognition of particular specifications of property rights to forests.

As indicated above, a large body of research suggests that the distribution of benefits from any particular forest product to a group of forest users - whether that be a financial flow from forest protection, such as tourism revenues or a carbon payment; or a quantity of forest goods that result from direct exploitation, such as a timber allotment—is likely to be affected by the nature of property rights enjoyed by the group, and key characteristics of the group itself, such as ethnic diversity or caste. Here, we seek to test how property rights and a proxy measure for within-group status differences, ethnic fractionalization, together affect forest benefit-sharing.

3. CASE STUDIES

Before proceeding to our empirical model, we briefly draw on two case studies of community forestry experiences to help illustrate our hypotheses. These cases illustrate a range of ways in which the structure of property rights and community heterogeneity can affect the distribution of benefits from forestry activities, and serve to contextualize our hypotheses.

In Nepal, Iverson, et al. (2006) studied the experience of forest user groups in the Terai region. They found that the high value of the forest created rent-seeking behavior in which local elites captured the majority of benefits. Under a 1993 decentralization reform—the Forest Act—local communities have been able to organize their own Forest User Groups (FUGs) and create their own local rules for accessing and using forest resources. Typically, FUGs give members

access to timber at a heavily subsidized price, ostensibly for personal use. However, if sold on the market, the subsidy is worth up to $200 per year. This is a substantial amount of money in Nepal, but is only available to those with access to enough financial capital or credit to buy the timber at the subsidized price. In addition, elites are often able to earn additional income by bribing local authorities to permit more harvesting than the legally permissible limit. Rents from these activities can only be realized through illegal activities. Iverson's research illustrates how political and economic inequality, and the form of the benefits themselves, can have a strong influence on distributive outcomes for forest communities.

In India, Saito-Jensen et al (2010) examined how existing social inequalities, in this case associated with castes, led to gains by local elites from forest management, despite project structure aimed to safeguard against elite capture. In this study, forest projects explicitly mandated the creation of forest management committees within villages, with proportional representation by marginalized groups—typically lower caste and landless households or households with only marginal landholdings. The newly formed forest management committees set harvesting rules and fees. Despite committee representation by marginalized social groups, net effects of the forest management programs included reduced benefits received by the poorest households, and increased unsanctioned forest use (and associated penalties) by disaffected groups. In addition, revenues were generally spent in ways that were favored by the upper castes (Saito-Jensen et al 2010). This case illustrates how existing disparities in the social constituency of a community can foster elite capture at the local level, and highlights a need for projects to better attend to how local institutional designs might better mitigate this effect (Persha and Andersson 2014). Saito-Jensen et al. thus suggest that weak institutions and existing social disparities can work together to promote unequal outcomes, but also note that in the presence of

substantial social disparities unequal outcomes are still likely even where institutions (such as property rights) are strong.

We build on these illustrations and related literature to construct two hypotheses about how the characteristics of forest property rights regimes, together with social differences within communities, affect the equity of community benefit sharing. We first hypothesize that user groups that hold recognized property rights to harvest forest products will experience more equal benefit sharing compared to groups without such rights. Second, we examine the interactive role of social heterogeneity within the community, hypothesizing that ethnic diversity will tend to generate greater inequality in benefit sharing, even in the presence of relatively strong property rights.

4. DATA AND METHODS

We test our hypotheses using data from the IFRI research program, a network of researchers that since 1992 has used a common broad research framework and comprehensive set of social-ecological data collection tools in more than 350 forests and villages across 17 countries to answer a wide range of questions related to forest use and governance (www.umich.edu/~ifri). IFRI research instruments facilitate linked data collection and analyses across social, institutional, economic, and ecological variables, and focus on characteristics of and interactions among forest users, institutions for forest management, and forest conditions. Data collection is structured to enable finely parsed institutional analyses, by using several hundred discrete variables to characterize the broader policy settings and local level forest governance arrangements (including information on forest use rules and rule formation, monitoring and enforcement processes), as well as socio-economic and livelihoods

characteristics of forest users, patterns of subsistence and commercial forest use, forest product harvesting at household and forest user group levels, forest ecological outcomes, and historical information on major changes in such characteristics, patterns and processes over time.

The dataset used for this analysis was drawn from the October 2008 compiled version of the full IFRI database. Our data are comprised of 582 forest product records across 350 forest user groups, who harvest from 223 forests in 14 countries. Of the 223 forests, 60 have been visited two or more times, and the ensuing analysis pools these observations so as to take advantage of both cross-sectional and longitudinal variation in the data. A forest user group is defined as a group with shared rights to use the forest in the same way. In practice, these groups may be comprised of all members of a village, a sub-set of villagers, or even individuals from multiple settlements. They may be formal, informal or even illegal, but all group members share the same set of rights (or lack thereof) to particular forest products (although the extent to which the right is exercised in practice of course many vary within the group). For the purpose of this analysis we consider extractive forest products only and the degree to which local users enjoy usufruct rights to the products that they actually harvest from nearby forests. These include wood products, either for construction or fuel, and a smaller number of non-timber forest products, such as fruits, nuts, and medicinal plants. We do not focus on forest or land ownership because we do not have much variation on rights to land in our data, and in the vast majority of 350 observations across the countries in our dataset, the national government claims de jure ownership of forest land. In all cases, however, the forests are used by local forest users to varying degrees and with varying levels of usufruct rights to different forest products.

4.1 *Dependent Variable*

Our dependent variable is inspired by the commonly used Gini index for income inequality; we constructed a 'forest harvesting Gini index' measuring the equality of benefits that forest users obtain from harvesting forest products.

[Insert Figure 1 about here]

To create this measure, We draw on data about the total number of households in each user group, the total quantity of product harvested, as well as the *greatest* quantity of a given forest product and the number of households that harvested the *smallest* quantity of the total harvest. We use these data to plot points on a Lorenz curve. We calculate the area between the Lorenz curve and the line that represents a perfectly equal distribution to determine the Gini coefficient for each user group-product combination.[2] (See Figure 1).

4.2 *Independent Variables*

To test our first hypothesis—that forest benefits will be more equally shared where user groups have a recognized right to harvest forest products —we create a measure of forest-user property rights. Here, we draw on an IFRI variable that specifies whether a group's current claim to harvest or use a forest product is 1) "de jure," 2) "de facto," 3) "de jure and de facto," or 4) "contrary to formal law.", to create three dichotomous variables which define the type of claim to forest harvest rights held by forest users. The first measure is simply whether a user group has any recognized right to harvest a product versus groups that are harvesting contrary to formal law ("rights" is given a 1 if the claim is in category 1, 2, *or* 3 from above, 0 if not). The second measure is whether groups have formal, de jure rights to harvest ("de jure" is given a 1 if the legal claim is category 1 or 3, 0 if not). The last measure is whether groups have only de

facto, but not de jure rights ("de facto" is given a 1 if the legal claim falls under category 2 from above, 0 if not).

Second, we test whether the influence of these property rights on forest benefit sharing was conditional on the ethnic diversity within the group. Our measure of ethnic diversity is the fractionalization index of Bossert et al. (2005). It ranges between 0 and 1 and measures the probability of two members of a user group coming from different ethnic groups. A score of 0 would mean there is only one group, while a score approaching 1 means each member of the user group is a different ethnicity. This index is computed from all the values of the IFRI variable U_GRPNUM for a given user group. We test our hypothesis via an interaction term which multiplies our measure of property rights by our measure of ethnic fractionalization.

Finally, our model incorporates several control variables that may also affect inequality in sharing of harvesting benefits. Our analysis controls for the size of the forest, how long the settlements associated with a user group have existed, the average wealth of the user group[3], and how valuable the forest is considered to be for subsistence purposes on a five-point scale, as evaluated by a forester familiar with regional forests. Previous studies have shown that forest size matters for livelihoods and forest outcomes (Chhatre and Agrawal, 2009, Persha et al 2011), which leads us to expect that the bigger the forest the more equal sharing of benefits because there will be less scarcity of products to compete over. Younger settlements are less established, and therefore less likely to have strong governance arrangements including property rights regime that are well enforced. We predict that the younger the settlement the more inequality of harvesting benefits because the users will be less constrained in this socioeconomic context (Angelsen, et al., 2014). Typically in developing countries empirical studies find that the richer the communities the lower the socioeconomic inequalities (i.e. Persha and Andersson, 2014).

We also include this variable because it is plausible that average wealth will affect the types of forest use that most people in a particular user group engage in. Finally, we expect that the more important a forest is for subsistence purposes, the more users rely directly on the forest for their livelihoods, and in similar ways. When this is the case we expect that are likely to observe less inequality of harvesting benefits within the group.

[Insert Table 1 here]

4.3 *Analytical Methods*

We use generalized estimating equation (GEE) regression models in our statistical analyses, to address possible problems of autocorrelation. The IFRI data are collected at different levels which we then structure hierarchically: 1) a set of biophysical, ecological and governance variables about each *forest* and associated settlement(s); 2) for each forest, a set of variables about the characteristics of the *user group(s)* within the village who use forest resources; and 3) within each user group, a set of variables about the use and governance of forest *products* that are harvested from each forest that is used by the group. Each observation in our analysis therefore contains variables that may vary by the specific forest product and user group combination, by the user group for a given forest, or by the forest itself. Therefore, observations across different forest products within a user group, or across different user groups for a forest may not be independent. Our modeling approach enables scrutiny of these group effects, and also avoids potential confounding between group-level dummy variables and predictor variables. It also lends greater confidence in our regression inferences, since failing to account for hierarchical data structure can underestimate the coefficient standard errors and lead to overstated statistical significance (Rabe-Hesketh and Skrondal, 2008). In the models

presented here, residuals are approximately normally distributed, therefore we assume normality in our regression models.

We ensured that our results are robust through a series of post-estimation and sensitivity tests. First, we re-ran models after excluding outliers, visually detecting outliers using added variable plots and by plotting errors against each independent variable. We note this isthe best available approach because measures used to detect outliers in OLS regression (DFITTS, Anscombe residuals etc.) are not available for GEE regression. We found that our reported results were not sensitive to the exclusion of outlier cases. Second, we re-tested our models using alternate working correlation matrices, finding that assumed autocorrelation has no meaningful effect on our reported results. Finally, we carried out a series of sensitivity tests, in which we included a number of additional control variables in different combinations, including the number of households in each user group, the proportion of female heads of household, and the proportion of poor households in each user group[4]. We found that our reported results were quite robust to the inclusion of these additional controls.

5. RESULTS

[Insert Table 3 about here]

Our statistical results are consistent with our hypotheses; they indicate that secure collective harvest rights are systematically associated with more egalitarian outcomes, conditional on ethnic diversity. Figure 2 and Table 3 presents these relationships quantitatively. Where ethnic diversity is low, the presence of recognized property rights tend to be associated with significantly less inequality in benefit sharing. Where diversity is higher, however, the relationship between property rights and inequality in benefit sharing becomes insignificant.

Distinguishing between de jure and de facto rights did not yield any significant effects. We also find that higher average wealth for the user group as a whole is associated with less inequality in benefit sharing.

[Insert figures 2 and 3 about here]

6. DISCUSSION

For our data, we find that having some form of property rights over forest products at the level of forest users is associated with more equitable benefit sharing within community groups. However, we also find that existing social differences among group members (here, a high level of ethnic diversity) can overwhelm the likelihood for equitable outcomes. We first discuss some plausible mechanisms underlying these results, and then turn to implications of our findings in the context of REDD+ program design.

One possible mechanism underlying our finding around property rights is that the presence of a well-defined right to forest products across all group members serves to more effectively constrain some individuals from discriminating against others in ways that would otherwise be pursued in the absence of defined harvest rights. Harvesting rights may take the form of a government permit or some kind of legal recognition of the members of a user group, or an informal, *de facto* right to harvest. If all group members hold an equal right to harvest products, it may be more difficult, costly or risky for some individuals to pursue disproportionate benefits at the expense of other group members. At the same time, it is possible that rights do not necessarily prevent discrimination, but rather are more likely to be present in communities that already have more equal power relations: they may be a symptom of a certain type of community dynamic rather than a cause.

Our finding around an interaction effect with ethnic diversity further complicates this picture. Referring to Figures 2 and 3, we find that a higher level of ethnic diversity is associated with greater inequality in benefit sharing, even in the presence of defined property rights. This suggests that clarifying property rights on its own is not sufficient to ensure more equitable forest benefit-sharing. Drawing on the copious existing literature linking social distinctions within communities to socio-economic discrimination and elite capture, we infer that observed higher levels of inequality in benefit sharing is likely driven by higher levels of conflict or discrimination within user groups that correlate with more heterogeneous group membership. Higher levels of ethnic fractionalization could make cooperative outcomes more difficult (Easterly and Levine, 1997, Alesina, Baqir, and Easterly, 1997, Collier, 2001), thus resulting in more unequal distribution of benefits. Or more powerful ethnic groups may take advantage of their dominant status over other group members to siphon off a disproportionate share of products harvested.

We also considered an alternative explanation for this result, wherein it could be possible that some individuals within the groups simply have a higher subsistence need for forest products than others, and these differences in forest reliance also stratify along ethnic lines. Group decision processes may take such differences in needs into account, and permit differential harvesting based on need. Such unequal distribution of benefits would not imply any active discrimination or elite capture. If this were the case, we would expect the effect of ethnic diversity and property rights to be weaker when restricting the inequality measure only to products that are not used for subsistence (that is, they contribute primarily to cash income rather than meeting a household's subsistence needs). We test this in a separate model as an additional check on our interpretation, and find that the relationships between property rights,

diversity, and benefit sharing for non-subsistence products is actually *stronger, not weaker* (Table 4). Consistent with Bardhan (2002) this result suggests that unequal benefit sharing is likely a result of discrimination, and underlying social disparities associated with ethnic cleavages within communities play a role in producing such discrimination.

[Insert Table 4 and Figure 4 about here]

An additional possibility is that some poor individuals or groups lack the capital to take advantage of legal harvest opportunities. In order to address this possibility, we re-tested our models, adding an additional variable—the proportion of local households considered poor by local standards. We found that the inclusion of this variable had no effect on the direction or significance of the relationships above, suggesting that the relationships in table 3 are not a spurious result of existing poverty.

Finally, we re-tested our models including a measure of intra-group inequality to ensure that benefit-sharing inequalities are not being driven by inequality rather than ethnic diversity. Following Andersson and Agrawal (2011) we generated a measure of the size of the local population considered neither "poor" nor "wealthy." In effect, this measures the size of the local middle class. The inclusion of this inter-group inequality measure also had no effect on the direction or significance of our relationships of interest.

With regards to specific guidance for REDD+ programs , one direct implication stemming from our results is that where new property rights over forest resources are created in a setting with pre-existing social heterogeneities based on ethnicity or other cleavages, the introduction of these property rights alone is unlikely to be sufficient to reduce existing inequalities. Instead, the effect of property rights is likely to depend on the social context of the particular forest user groups. For further insight into where the effect of ethnic heterogeneity

might be most relevant, Tables 5-7, in the appendix, give the descriptive statistics for inequality, rights, and ethnic fractionalization by country. One example of a country context where the new introduction of property rights may be insufficient on its own for reducing intra group inequalities is Nepal, which according to our data has one of the most unequal distribution of benefits despite near universal harvesting rights by forest users. Nepal also has one of the highest levels of ethnic fractionalization in our dataset, providing support for the idea that group heterogeneity along diversity lines can weaken the effect of property rights on equality of benefit sharing.

This is not to suggest that ethnic fractionalization is a necessary precondition for unequal benefit sharing, but rather to highlight that existing social differences within communities can be a powerful force for REDD+ or other forestry interventions to overcome in order to achieve equitable forest benefit-sharing objectives. We note there is abundant literature from decades of forest sector research which suggests that pre-existing social distinctions amongst forest-dependent communities is likely to be the norm, rather than the exception. We additionally note that ethnic dominance or polarization may be more harmful than the presence of ethnic diversity on its own (Collier 2001, Garcia-Montalvo and Reynal-Querol, 2004, Waring and Bell, 2013), and that even in relatively homogenous settings, one very small elite group can dominate others (Waring & Bell 2013), a situation that would yield a low score on our ethnolinguistic fractionalization index. Furthermore, we emphasize that our measure of ethnic fractionalization is one of several potential indicators of inequality-generating heterogeneity between groups, which can be based on a number of social factors beyond ethnicity, including religion, caste or clan, economic class, and other such cleavages that can promote marginalization of individuals within communities.

In terms of the type of rights that matter, our results are more puzzling, because although there is a fairly strong body of work that suggests de jure rights to forest resources are more important than de facto rights, we find that neither solely de jure nor solely de facto rights are significant on their own for explaining equitable benefit-sharing in our data. However, many studies have found that the distinction between de jure and de facto rights is an important one, and that tenure security often requires users to have acquired both de facto and de jure rights to their land (Adger and Lutrell, 2000; Gibson et al 2002; Andersson and Pacheco, 2006; Larson et al 2010). Others argue that the legal status of rights (i.e. whether de jure or de facto) matters less than the level of protection or guarantees provided by relevant authorities (Bromley, 2008; Clerc and Mwangi, in review), but this is something we are unable to test with our existing data. We can merely conclude that we find evidence to support the idea that groups that have *some* level of recognized rights to harvest and use forest products tend to share the benefits from those products more equally among its members.

We think our failure to observe statistically significant effects of either right on its own may be explained by two factors. The first is related to the challenge of measuring these variables accurately in the field. While it is relatively straightforward to ascertain whether or not a forest user groups enjoys *some* rights to a forest product--either de jure, de facto or both--it can be much more difficult to establish whether the right is just one of these categories and if so which one. It may be that our operational measures of de facto and de jure have blurred the theoretical distinction between the two, which would help to explain the result that the variable Rights (which includes having de jure, de facto, or both rights) is significant while neither de facto nor de jure rights are significant for our data by themselves. The second reason relates to the type of benefit sharing that we are looking at, benefit sharing *within* communities, which may

be less sensitive to these different types of property rights, which are defined at the group level. For example, it may be that having formal de jure rights that are also recognized by local users is particularly important for helping members of a forest user group to secure their claims to forest benefits vis a vis outsiders, while either the de facto or the de jure claim may serve to effectively influence benefit sharing among users *within* the same community.

A word of caution seems warranted when it comes to the interpretation of these results. Our results do *not* suggest that community homogeneity will necessarily usher in improved forest protection; the relationship between social context and the conservation of common property forest is certainly more complex than that (Alix-Garcia, 2008; Andersson and Agrawal, 2011). Thus, we do not assume that more egalitarian user groups are necessarily more interested in protecting forests. While an interesting hypothesis, we do not test this idea here but leave this for future work.

7. CONCLUSION

As the architecture and implementation of REDD+ continue to develop, important questions remain with regards to how REDD+ programs can be structured at local levels so that all members of communities will be able to benefit from REDD+ activities. The literature on REDD+ benefit sharing has been mostly concerned with how benefits will be distributed between states, private investors and communities of forest users. Scholars have suggested that REDD+ will likely generate inequalities where forest users do not have formal property rights to forest resources (Chhatre et al. 2012, Larson 2011). Thus, REDD+ advocates have rightly encouraged policy actors to recognize and formalize rural peoples' *de facto* rights to forest use

into more formal *de jure* protection. However, our results here also suggest that there may be limitations to what formalizing *de facto* property rights can do when it comes to achieving more equal sharing of benefits *within* forest-user communities, especially when there are pre-existing social differences within groups that also influence these processes.

Here, we use data on benefit distribution from forest product harvest. However, our results also carry implications for non-extractive benefits, such as REDD+ payments. We would caution policy actors that blueprint rights formalization programs may not always be sufficient for promoting benefit sharing. For instance in our cases, the equality-enhancing effect of property rights is lost when user groups are ethnically diverse, suggesting that different implementation strategies may be more effective in contexts with relatively high ethnic diversity, or other starkly apparent disparities with respect to the social make-up of a community. In such situations rights formalizations may not, on its own, ensure equitable distribution of REDD+ benefits from forests.

Instead, it may be more useful for policy actors to begin by engaging in the (significantly more complex) task of addressing existing social inequalities within forest dependent communities. That is, if stronger property rights alone are unlikely to reduce benefits inequalities that emerge from existing cleavages in society, policy makers may find that REDD+ will be most successful where other tools—such as redistributive policies, the rule of law, and impartial judicial institutions—are also in place. On the other hand, there are approaches that REDD+ implementers can consider during implementation alongside reforms of judicial institutions and enforcement of redistributive policies. One such example is the Adaptive Collaborative Management, a portfolio of approaches that allow for cycles of joint problem identification, reflection, visioning, problem solving, conflict resolution and learning. This

approach has been deployed by CIFOR colleagues to achieve gender and overall equity in forest use and management in diverse settings.[5] Further research to examine the impacts of redistributive reforms on forest benefit-sharing and resulting inequality would enable better understanding of the relative contributions of each on achieving more equitable benefits-sharing from forests.

END NOTES

[1] See reports from the NGO-supported online forums "REDD monitor" (http://www.redd-monitor.org) and the "Indigenous Environment Network"(http://www.ienearth.org)

[2] Technically, this method will slightly underestimate Gini, since it assumes a straight line between the points when the actual curve must, by mathematical necessity, be concave up so that the true area between the curve and the line of perfect equality is actually greater than that calculated. However, for purposes of comparing inequality, this should not bias our results.

[3] Total wealth was calculated as 0*proportion of the user group considered poor + 1*proportion considered neither rich nor poor + 2*proportion considered wealthy.

[4] User group members were asked to estimate the number of user group members considered "poor", according to the community's own definition of poverty.

[5] For example, see

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Tables

Table 1: Descriptive Statistics

Variable	Description	Mean	Std. Dev.	Min	Max	N
gini_index	Measure of product benefit inequality: higher=more unequal	0.135	0.188	0.000	0.971	378
fsize_ln	Natural log of forest size in hectares	5.678	1.734	0.000	10.090	338
syear	Settlement year	1860	117	1200	1987	311
utotwealth	Measure of total wealth of the user group	0.892	0.240	0.012	2.000	310
fvaluesub	Subsistence value of the forest	-0.009	0.490	-1.000	1.000	348
uethnicelf	Amount of ethnic fractionalization	0.417	0.253	0.000	0.839	313
rights	Whether a user group has harvest rights (de jure or de facto)	0.788	0.410	0.000	1.000	353
dejure	Presence of de jure rights	0.578	0.495	0.000	1.000	353
defacto	Presence of de facto rights	0.210	0.408	0.000	1.000	353
ethnic_rights	uethnicelf*rights	0.329	0.287	0.000	0.839	313
dejure_ethnic	uethnicelf*dejure	0.249	0.290	0.000	0.812	313
defacto_ethnic	uethnicelf*defacto	0.080	0.195	0.000	0.839	313

Table 2: Models without interaction terms, DV= Gini index

	Model 1 Rights= Any type	Model 2 Rights= De Jure	Model 3 Rights= De facto
ethnic fractionalization	0.123 (0.041)***	0.140 (0.042)***	0.147 (0.041)***
rights	-0.087 (0.026)***	-0.000 (0.022)	-0.052 (0.022)**
forest size	-0.011 (0.006)*	-0.008 (0.006)	-0.012 (0.006)*
settlement year	0.000 (0.000)*	0.000 (0.000)*	0.000 (0.000)
user group total wealth	-0.110 (0.042)***	-0.099 (0.043)**	-0.104 (0.043)**
forest value for subsistence	0.003 (0.022)	-0.006 (0.022)	-0.002 (0.022)
constant	0.048 (0.155)	-0.057 (0.156)	0.068 (0.162)
Chi-squared	39.28	26.39	32.54
N	235	235	235

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Table 3: Models with interaction terms, DV= Gini index

	Model 4 Rights= Any type	Model 5 Rights= De Jure	Model 6 Rights= De facto
ethnic fractionalization	-0.076 (0.098)	0.157 (0.061)***	0.173 (0.067)***
rights	-0.191 (0.052)***	0.009 (0.039)	-0.033 (0.040)
forest size	-0.007 (0.006)	-0.008 (0.006)	-0.011 (0.006)*
settlement year	0.000 (0.000)	0.000 (0.000)*	0.000 (0.000)
user group total wealth	-0.123 (0.042)***	-0.104 (0.044)**	-0.107 (0.044)**
forest value for subsistence	0.001 (0.022)	-0.004 (0.022)	-0.0003 (0.022)
rights*ethnic fractionalization	0.246 (0.052)***	-0.028 (0.086)	-.040 (.088)
constant	0.166 (0.168)	-0.070 (0.170)	0.030 (0.182)
Chi-squared	45.33	26.30	31.65
N	235	235	235

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Table 4: Inequality of Benefit Sharing for Non-subsistence Products

Rights (any type)	-0.228 (0.068) ***
Ethnic Fractionalization	-0.161 (0.150)
Rights*Ethnic fractionalization	0.343 (0.169) **
Forest Size	-0.012 (0.008)
Settlement Year	0.000 (0.000)
User Group Total Wealth	-0.112 (0.053) **
Forest Value for Subsistence	-0.002 (0.026)
Constant	0.278 (0.164) *
N	157
R SQ	0.18

Standard errors in Parentheses
*p<.1, **p<.05, ***p<.01

Table 5: Gini index by country

Country	Mean	Std. Dev.	Freq.
BHU	0.029	0.083	8
BOL	0.074	0.165	11
BRA	0.000	0.000	1
COL	0.263	0.000	1
ECU	0.000	0.000	1
GUA	0.052	0.102	32
HON	0.001	0.001	2
IND	0.153	0.265	48
KEN	0.166	0.184	15
MAD	0.040	0.089	33
MEX	0.032	0.092	17
NEP	0.187	0.212	88
TAN	0.000	0.000	5
UGA	0.175	0.165	115
Total	0.136	0.188	377

Table 6: Property rights by Country

Country	Mean	Std Dev.	Freq.
BHU	1.000	0.000	10
BOL	0.913	0.288	23
BRA	1.000	0.000	2
COL	0.000	0.000	1
ECU	0.000	0.000	1
GUA	0.930	0.258	43
HON	1.000	0.000	6
IND	0.797	0.405	69
KEN	0.698	0.465	43
MAD	0.976	0.154	42
MEX	0.926	0.267	27
NEP	0.915	0.279	130
TAN	0.833	0.389	12
UGA	0.705	0.457	173
Total	0.826	0.379	582

Table 7: Ethnic fractionalization by country

Country	Mean	Std. Dev.	Freq.
BHU	0.071	0.174	6
BOL	0.229	0.193	20
BRA	0.392	0.000	2
COL	0.000	0.000	1
ECU	0.000	0.000	1
GUA	0.045	0.102	28
IND	0.252	0.232	35
KEN	0.386	0.228	34
MAD	0.117	0.124	42
MEX	0.057	0.160	17
NEP	0.515	0.247	120
TAN	0.540	0.223	9
UGA	0.431	0.201	169
Total	0.361	0.260	484

Figures

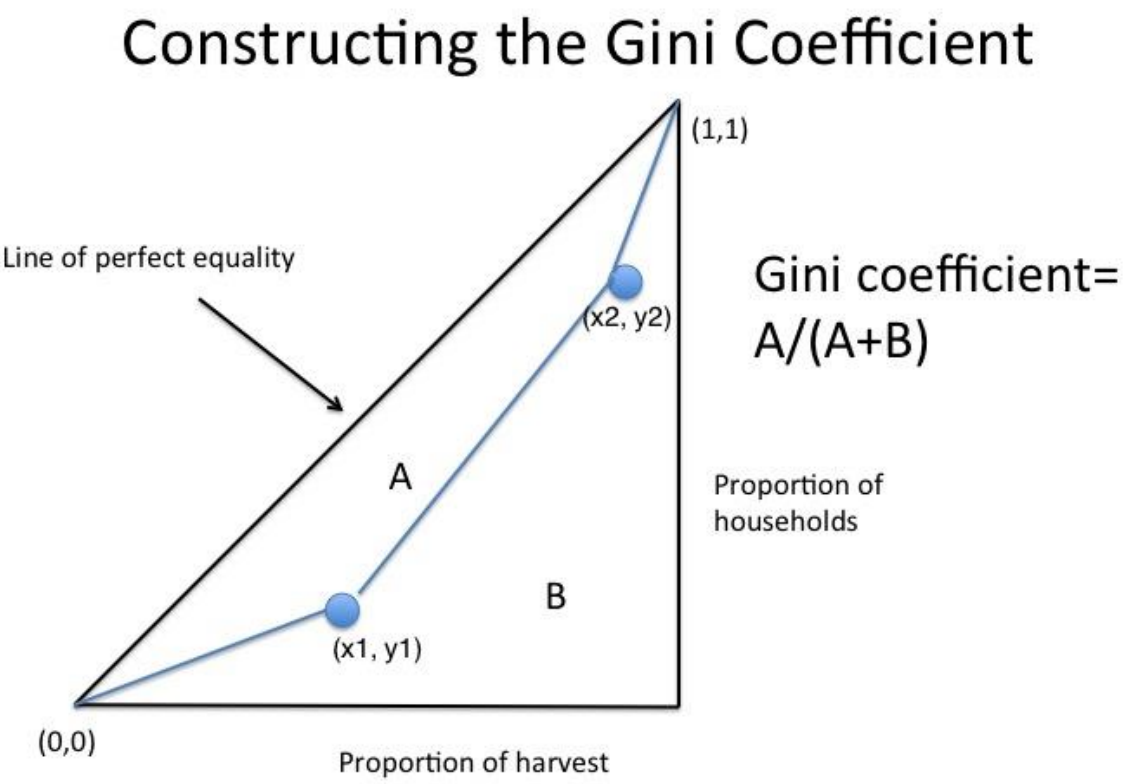

Figure 1: Gini Coefficient

The Gini index is defined as a ratio of the areas on the Lorenz curve diagram. If the area between the line of perfect equality and the Lorenz curve is A, and the area under the Lorenz curve is B, then the Gini index is A / (A + B).
Since A + B = 0.5, the Gini index is G = 2 * A or G = 1 – 2 B.

See below for calculation:

x1=proportion of product harvested by poor households
y1=proportion of households that are poor
x2=1-proportion of product harvested by rich households
y2=1-proportion of households that are rich
area1=1/2*(x1-x0)*(y1+y0)
area2=1/2*(x2-x1)*(y2-y1)+((x2-x1)*(y1))
area3=1/2*(1-x2)*(1-y2)+((1-x2)*(y2))
B=area1+area2+area3
gini_index=1-2*B

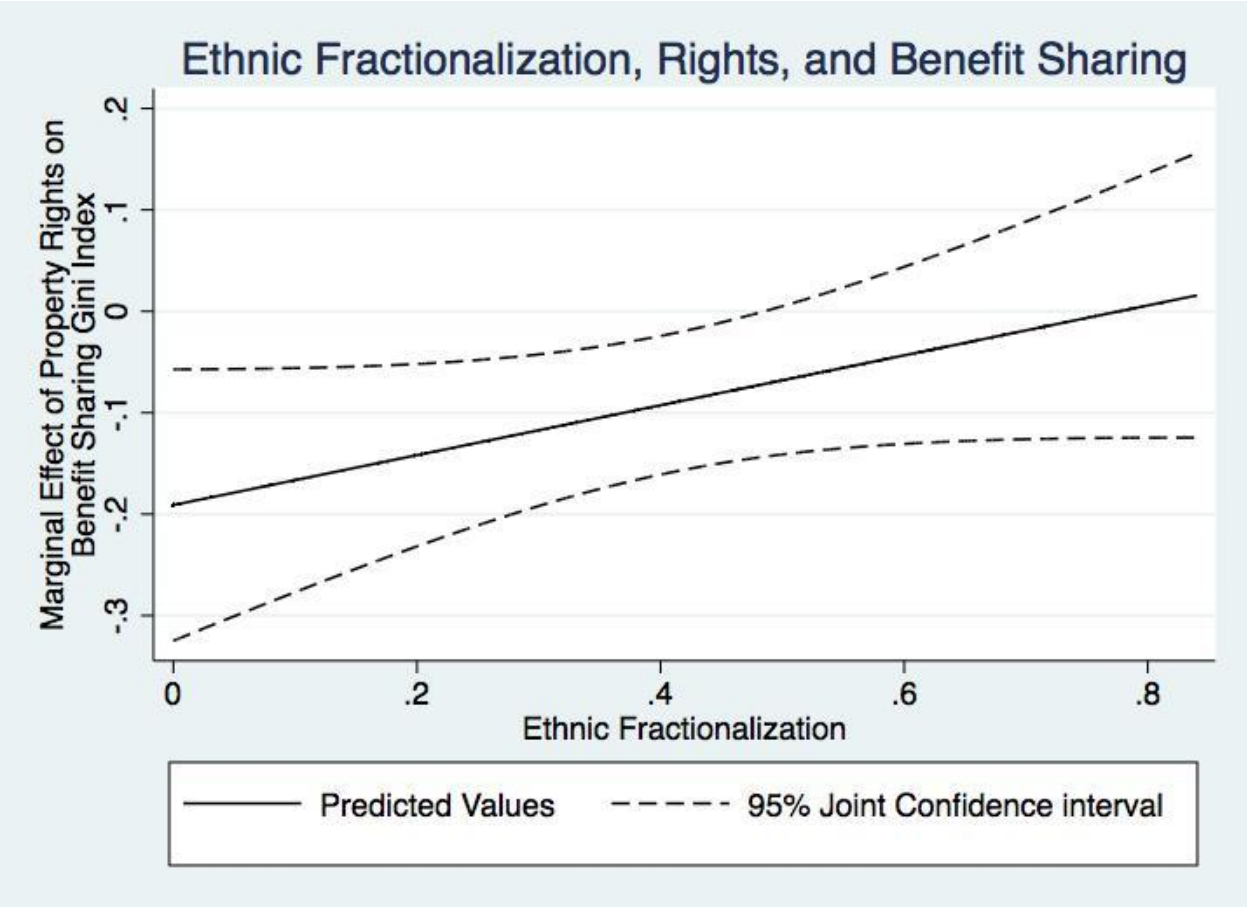

Figure 2: Marginal Effect of Harvest Rights at Various Levels of Ethnic Fractionalization

Note: A negative effect means that having rights is associated with lower harvest benefit inequality (therefore, more equal benefit sharing). This effect is statistically significant only for user groups with low levels of ethnic fractionalization.

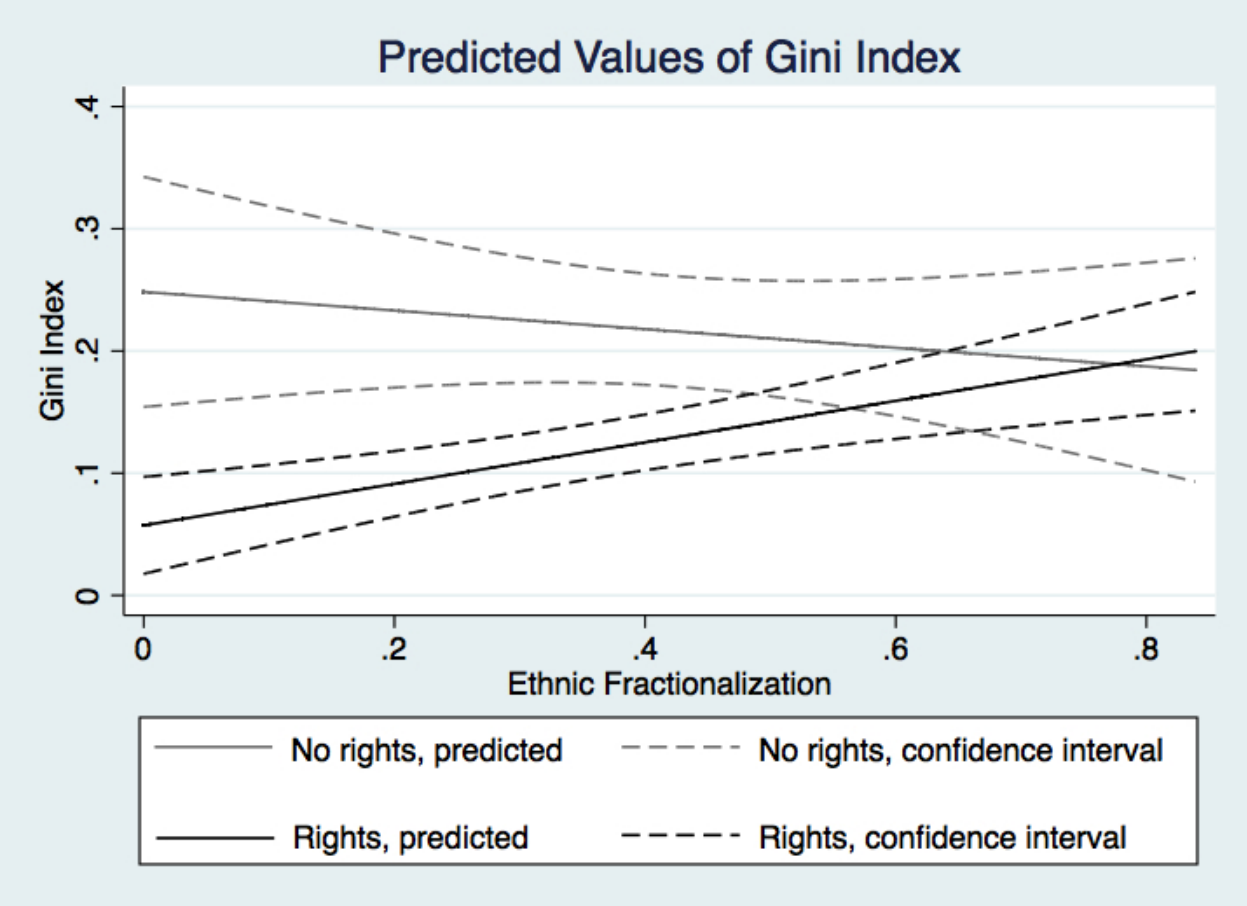

Figure 3: Predicted Inequality at Different Levels of Ethnic Fractionalization

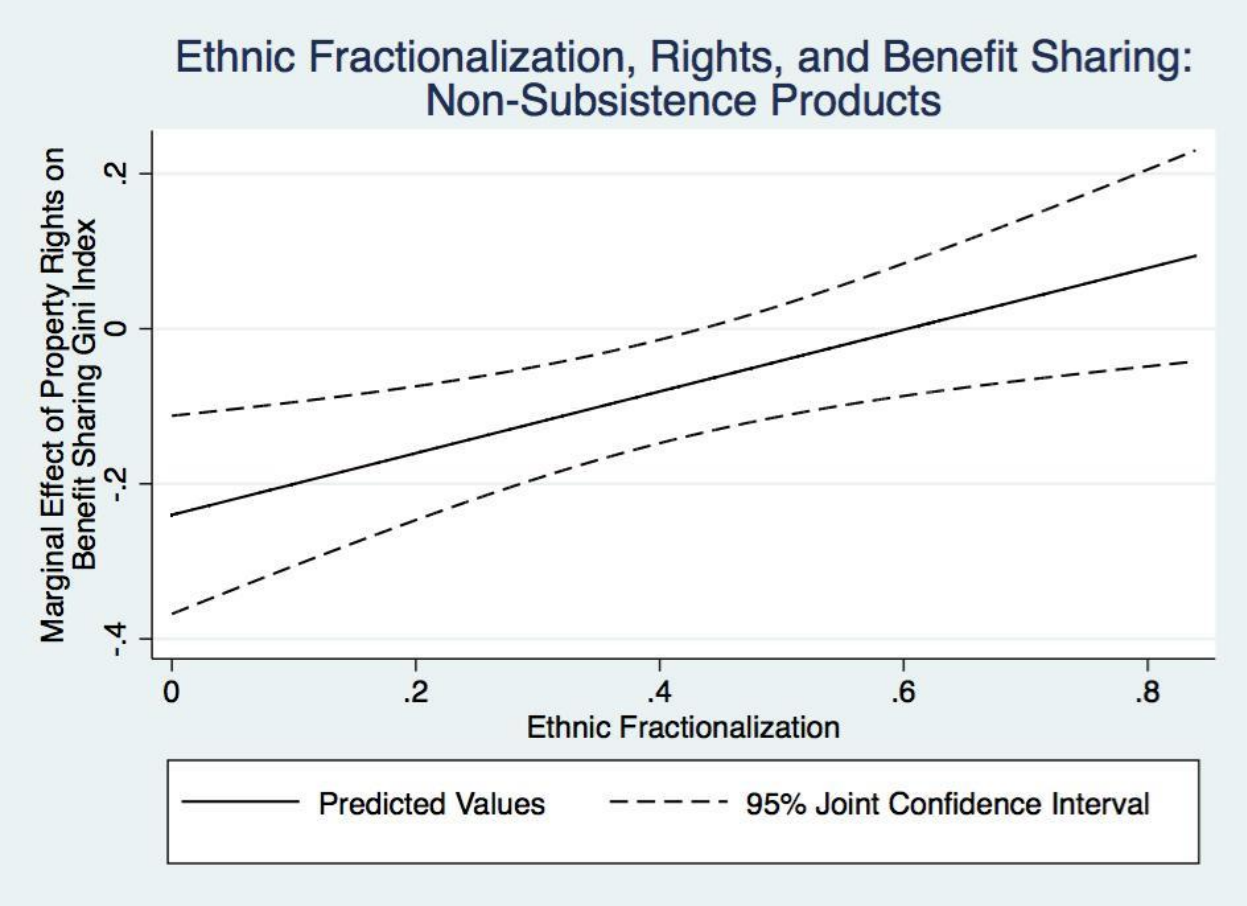

Figure 4: Marginal Effect of Harvest Rights at Various Levels of Ethnic Fractionalization for Non-Subsistence products only

Note: A negative effect means that having rights is associated with lower harvest benefit inequality. This effect is statistically significant only for user groups with even lower levels of ethnic fractionalization than when all products (subsistence and non-subsistence) are considered. Thus, for non-subsistence products, ethnic fractionalization can even more easily counteract the positive effects of property rights on equality of forest products benefit-sharing.