

Measuring and explaining the willingness to pay for forest conservation: evidence from a survey experiment in Brazil

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Recent research suggests that there is substantial public support (including willingness to pay) for forest conservation. Based on a nationwide survey experiment in Brazil ($N = 2500$) the largest and richest of the world's tropical developing countries, we shed new light on this issue. To what extent does the public in fact support forest conservation and what factors are influencing support levels? Unlike previous studies, our results show that the willingness to pay for tropical forest conservation in Brazil is rather low. Moreover, framing forest conservation in terms of biodiversity protection, which tends to create more local benefits, does not induce more support than framing conservation in terms of mitigating global climate change. The results also show that low levels of trust in public institutions have a strong negative impact on the public's willingness to pay for forest conservation, individually and/or via government spending. What could other (richer) countries do, in this context, to encourage forest conservation in Brazil and other tropical developing countries? One key issue is whether prospects of foreign funding for forest conservation are likely to crowd out or, conversely, enhance the motivation for domestic level conservation efforts. We find that prospects of foreign funding have no significant effect on willingness to pay for forest conservation. These findings have at least three policy implications, namely, that the Brazilian public's willingness to pay for forest conservation is very limited, that large-scale international funding is probably needed, and that such funding is unlikely to encourage more domestic effort, but is also unlikely to crowd out domestic efforts. Restoring public trust in the Brazilian government is key to increasing public support for forest conservation in Brazil.

1. Introduction

Deforestation in tropical developing countries accounts for around 6%–17% of global anthropogenic CO₂ emissions. In 2000–2010, an estimated 1.0 PgC yr⁻¹, out of a total of 228.7 PgC stored in tropical woody vegetation, were emitted due to deforestation. Brazil and Indonesia, which account for around 35% of total carbon stored in tropical forests globally, are responsible for the largest emissions from tropical deforestation (Baccini *et al* 2012).

Existing research suggests that progress towards reducing deforestation is possible (Assunção

et al 2013, Hargrave and Kis-Katos 2013, Held *et al* 2013, Nolte *et al* 2013, Viola 2013). For instance, legislative and enforcement efforts appear to have led to a drop in Brazil's deforestation rates (Lapola *et al* 2014). Moreover, public opinion, which sets important constraints on what policy-makers can do in democratic societies (Geels 2013, Patt and Weber 2013, Wiseman *et al* 2013, Gebara *et al* 2014), such as Brazil and Indonesia, appears quite favorably disposed towards climate policy and forest conservation. For example, the PEW Global Attitudes Surveys (Pew Research Center 2015) indicate that 86% of Brazilian respondents agreed that climate change is a very

serious problem, and 88% supported limiting greenhouse gas (GHG) emissions as part of an international agreement, with only 9% opposed. 89% of the Brazilian respondents agreed that major changes in lifestyle are needed, whereas only 10% think that technology could solve the problem without requiring major changes.

With regards to forest conservation more specifically, a 2010 World Bank survey asked ‘Would you favor or oppose [Brazil] taking each of the following steps to help deal with climate change? [...] Preserving or expanding forested areas, even if this means less land for agriculture or construction.’ 68% of the respondents were in favor and 23% were opposed. Moreover, a recent study by Vincent *et al* (2014) of upper-middle-income countries, which account for around 80% of tropical primary forests, concludes, ‘that protective government policies have lagged behind the increase in public demand in these countries...’ In a case study from Malaysia, they also show that rising household income is associated with an increased willingness to pay for forest conservation. Their main conclusion is that domestic funding in (upper-middle-income) tropical countries can play a larger role in (i) closing the funding gap for tropical forest conservation, and (ii) paying for supplementary conservation actions linked to international payments for reduced GHG emissions from deforestation and forest degradation in tropical countries.

We agree with these studies that public support for climate policy and forest conservation more specifically is crucial, but we remain somewhat sceptical about observed high levels of public support for GHG mitigation measures and forest conservation, notably in view of major economic difficulties in most tropical developing countries. We employ a composite measure of willingness to pay that consists not only of stated preferences concerning climate-change mitigation, but also captures people’s intention to pay for it when there is a potential of foreign financial support. To shed more light on this issue we carried out a representative survey in Brazil ($N = 2500$), the largest and richest tropical developing country, where previous research suggests strong public support for forest conservation (World Bank 2010, Vincent *et al* 2014, Pew Research Center 2015).

2. Willingness to pay for forest conservation

Our research has two objectives:

(1) to find out whether public support, and willingness to pay for forest conservation more specifically, remains as high as suggested in previous research when respondents are made aware of cost implications, and given the economic and political problems Brazil is facing;

(2) to find out what the implications for public support and willingness to pay are of framing forest conservation as biodiversity conservation or climate change mitigation, and how varying prospects of foreign financial support for forest conservation could affect citizens’ support and willingness to pay.

The Brazilian authorities and residents of Brazil do favor forest conservation and the issue also receives large media attention (e.g., Verchot 2015, Batty 2016, Plumer 2016). Preserving forests does not only impact on clean air, safe drinking water, fewer droughts or floods but also the survival of the species depends upon a healthy forest ecosystem (Nunes *et al* 2012, Viola 2013). That said, there is limited knowledge on the extent to which such benefits are likely to materialize, and what the costs of forest conservation are likely to be. We anticipate though rather limited public support for forest conservation when respondents are made aware of relevant cost implications, notably under negative economic conditions in Brazil. Existing research suggests that public support for climate change mitigation—more broadly defined—tends to drop with increasing costs of such policies to individual citizens (ego-tropic effect) and to countries as a whole (socio-tropic effect) (Bernauer and Böhmelt 2013). Moreover, it suggests that public support for climate change mitigation, and environmental protection more generally, tends to become stronger when the economy is doing well, and tends to weaken during economic recession (Scruggs and Benegal 2012, Bechtel and Scheve 2013, Kachi *et al* 2015). In other words, compared to the existing evidence on public support for forest conservation in Brazil, which stems from economically better times, we expect to find a rather limited willingness to pay for forest conservation, particularly when citizens are made aware of the cost implications of such policies.

Regarding the second objective, we address two arguments that play an important role in the international debate on tropical forest conservation, but remain insufficiently substantiated empirically.

The first argument holds that framing forest conservation as a biodiversity conservation issue may elicit more public support, compared to framing forest conservation as a contribution to global climate change mitigation efforts. The logic is straightforward and backed by economic theories of public goods provision (Barrett 2003, Ostrom 2015). Even though biodiversity conservation is oftentimes presented as a global issue, its specific benefits are primarily local (Bernauer 2013, Schoenefeld and McCauley 2015, Hine *et al* 2016). This means that the benefits from greater forest conservation accrue primarily to people and collective entities within Brazil. Conversely, framing forest conservation as a global climate change policy issue, in terms of preventing the loss of carbon sinks, is likely to elicit less support. Assuming that

most people tend to put their country and its citizens first, and that they are relatively myopic in terms of when the benefits of a policy should preferably materialize, we anticipate biodiversity conservation to be more popular than contributing to the mitigation of global climate change.

The second argument builds on a large literature on development assistance, and on recent debates about the pros and cons of foreign funding for forest conservation (Alesina and Dollar 2002, Easterly 2006, Jacobsen and Hanley 2009, Wright and Winters 2010, Asner 2011, Lindhjem and Tuan 2012, Van de Sijpe 2013, Waldron *et al* 2013). It also takes account of the fact that international funding has paid an important role in debates over forest conservation in tropical developing countries, both in the climate change and biodiversity context (Viola 2013, Held *et al* 2013). Some scholars argue that increased foreign funding will motivate increased, i.e., additional, domestic spending on forest conservation. Yet others believe that good prospects of foreign funding may weaken support among stakeholders and the general public for more domestic investment into sustainable development, including forest conservation (Chao and Yu 1999, Burnside and Dollar 2000, Sachs 2005). The latter expectation is based on the fact that money is fungible, and that there will always be competing societal needs, above all in poor countries. In other words, increased inflows of foreign funding allow for diversion of existing domestic funding for forest conservation to other policy-areas where there is strong public pressure for increased public spending (e.g., social welfare). This potential negative effect seems particularly likely under conditions of economic duress, from which Brazil is suffering.

3. Study design

We fielded a survey-embedded experiment in Brazil to find out how strong public support for forest conservation is, and how biodiversity or climate change framing, as well as prospects of foreign funding affect willingness to pay. The survey was designed by the authors. YouGov fielded the survey with the support of a local partner in Brazil (Netquest). 3223 Brazilian residents were interviewed. That sample was matched down to a sample of 2500 to produce the final dataset. We employed a sampling frame on the indicators of gender, age, geographic region, education, and experimental group (treatments). For instance, only adults above 18 years old were interviewed. In addition, YouGov balanced the sample according to gender, age, and education to match the characteristics of the population. The frame was constructed by stratified sampling from the full 2014 Americas Barometer from the Latin American Opinion project at Vanderbilt University, with selection within strata by weighted sampling with replacement. The matched cases were

weighted to the sampling frame using propensity scores. The matched cases and the frame were combined and a logistic regression was estimated for inclusion in the frame. The propensity score function included age, gender, region, years of education, and frequency of Internet usage. The propensity scores were grouped into deciles of the estimated propensity score in the frame and post-stratified according to these deciles. The final weights were post-stratified to match the distribution of the sampling frame on age, gender, and a three-category education indicator. (see SI-1 for details on these indicators, figure SI-1, and table SI-1 for demographics).

After some introductory text, participants were randomly assigned to pieces of information that presented forest conservation either in terms of an effort to protect biodiversity in Brazil, or an effort to mitigate GHG emissions and thus contribute to global climate change mitigation efforts, and pieces of information that primed survey participants for either good or bad prospects of Brazil receiving foreign financial assistance for forest conservation. The control group received no information. Comprehension checks items were used to make sure participants read and understood the treatment texts (see SI-2 for details).

After exposure to this information, which resulted in eight treatment groups and one control group (figure SI-2), participants responded to a series of questions about preferences with respect to forest conservation, our principal outcome variable. In the experimental part of the study, we used six of these survey items to construct a composite willingness to pay measure. Finally, participants responded to various items concerning environmental and political attitudes as well as socio-demographics (see SI-3 for survey items and SI-4 for the willingness to pay measurement).

4. Results

To start with, we observe very strong public support for climate policy and forest conservation in Brazil when gauging such support with questions that do not, or only to a minor degree, refer to cost implications (table 1). This evidence lines up well with previous surveys using similar items (World Bank 2010, Vincent *et al* 2014, Pew Research Center 2015). Importantly, compared to previous surveys, it does not seem to have dropped despite the fact that Brazil finds itself in a major economic and political crisis.

Moreover, levels of support for unconditional climate policy and forest conservation are also very high (table 2). More than 80% of the respondents support unconditional (i.e., non-reciprocal) reductions of CO₂ as well as forest conservation in Brazil. This is quite surprising because the majority of respondents also believes that: (a) rich countries should do more than

Table 1. General support for climate policy and forest conservation.

Survey items	Support	No support
Government pledge to reduce CO ₂	93.36	6.64
Change lifestyle to protect climate	71.96	28.04
Climate change harm to people in Brazil	95.56	4.44
Expected personal climate change harm	94.48	5.52
Government not doing enough against deforestation	85.52	14.44

Notes: To facilitate visual interpretation of the data, we recoded the responses to fit a binary scale, with support for climate policy and forest conservation coded as 1 (0 otherwise). The support category (1) thus comprises 'support' and 'strong support' and the non-support category (0) includes 'oppose' and 'strong oppose' answers. $N = 2500$. See also figure SI-3 and table SI-2 for detailed item wordings.

poor countries to reduce their GHG emissions (73.8%); (b) forest conservation benefits primarily the world, rather than Brazil (68.96%); and (c) Brazil receives too little international funding for forest conservation (68.16%) (table SI-3 for detailed item wordings). From a purely economic viewpoint, such high levels of support for unconditional forest conservation would make sense if respondents expected the largest part of the benefits to materialize within Brazil. However, high local WTP for forest conservation might also result from a situation where individuals view the prospects of international support as gloomy. Given that respondents expect forest conservation in Brazil to benefit primarily the world, we expected less support for unconditional CO₂ reduction and forest conservation. Our findings do not support this expectation (table 1). However, such findings might be due, at least to some extent, to social desirability bias, i.e., a prevailing social norm that forest conservation and CO₂ reductions are desirable and respondents thus react in ways they believe are expected by the survey team, or society.

When we gauge support for forest conservation in Brazil by using measures that clearly associate such efforts with costs, support drops quite dramatically (table 3). Only when we use measures that refer to cost

implications in terms that are not easily quantifiable for individual respondents (e.g., raise taxes, accept a reduction of government spending in other policy areas) we still observe rather high (but reduced, compared to table 1) levels of support. This finding is plausible because the latter items leave respondents somewhat in the dark as to what the exact financial consequences of more forest conservation would be for them personally. As soon as we use items that quantify the personal financial consequences we observe a strong drop in support for forest conservation. Moreover, we included a lottery in the survey, asking participants, in case of winning, whether they prefer to receive the prize of 78BRL or donate this money to an ENGO. Most respondents decided to keep the lottery win (55.84%) rather than donate it to an environmental organization engaged in forest conservation (44.16%). Large majorities were also opposed to raising taxes (60.92%) or contributing to non-governmental organizations (70.48) in support of forest conservation (table SI-4). In summary, we find that the Brazilian's willingness to pay for forest conservation is quite limited, and perhaps more limited than previous studies have suggested (e.g., Vincent *et al* 2014).

We now move to the experimental parts embedded in the survey. Survey participants were randomly assigned to pieces of information framing forest conservation in climate change mitigation (preserving carbon sinks and reducing GHG emissions) or biodiversity protection terms, and information concerning good or poor prospects of Brazil obtaining foreign financial support for forest conservation (see SI-2 for details). Including control groups, this resulted in a 3×3 design, i.e., nine groups, with group sizes ranging from $N = 255$ to $N = 299$. Both environmental issues; biodiversity and climate change, were framed as forest conservation, and thus, climate protection.

We examined the effects of these treatments on a composite measure of willingness to pay for forest conservation, constructed from six of the items shown in table 3 (see SI-4) and using confirmatory factor analysis (table SI-6). As noted above, we think that these

Table 2. Unconditional versus reciprocal climate policy and forest conservation.

Survey items		Support in %
Support for unconditional CO ₂ reduction		81.12
Support for conditional CO ₂ reduction		18.88
Developing countries should reduce as much CO ₂		25.56
Richer countries should reduce more CO ₂		73.8
Forest conservation in Brazil benefits primarily	Brazil	29.56
	The world	68.96
	None of the above	1.48
Support for forest conservation in Brazil...	Regardless of whether other countries provide funding	84.44
	Only if other countries provide funding	11.2
	No forest conservation	4.36

Notes: $N = 2500$. See table SI-3 for detailed item wordings.

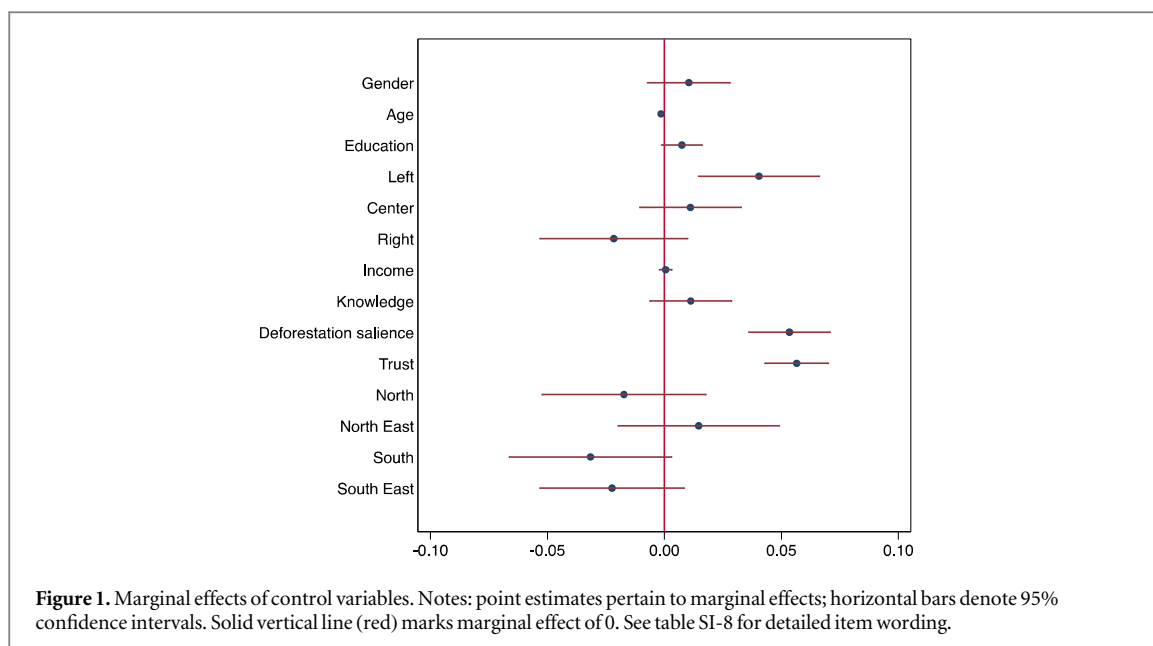


Table 3. Willingness to pay for forest conservation in Brazil.

Survey items	High willingness to pay	Low willingness to pay
Raise taxes	39.08	60.92
Accept less land use	79.16	20.84
Reduce other spending	74.24	25.76
Pay additional R\$30 tax	37.68	62.32
Pay R\$100 to ENGO	29.52	70.48
Pay more for forest prod.	68.44	31.56
Keep/donate lottery win	44.16	55.84

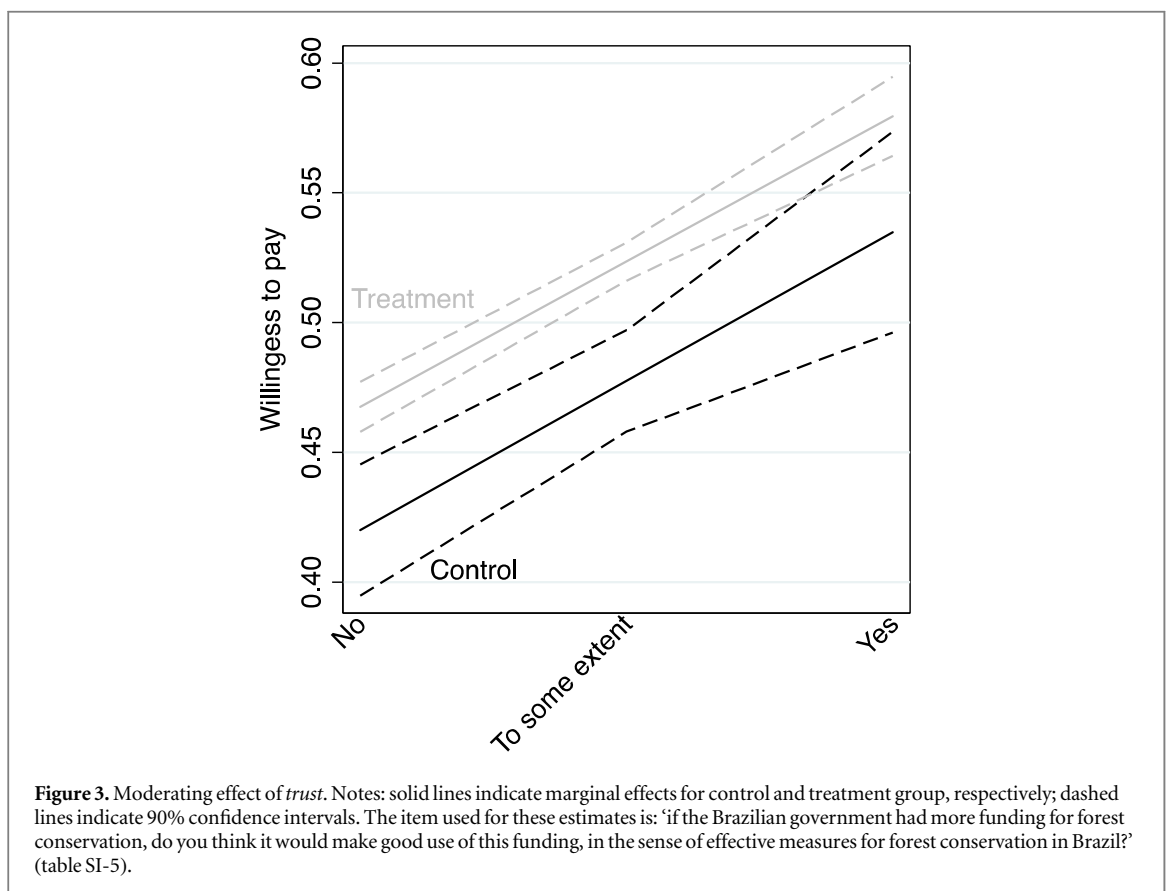
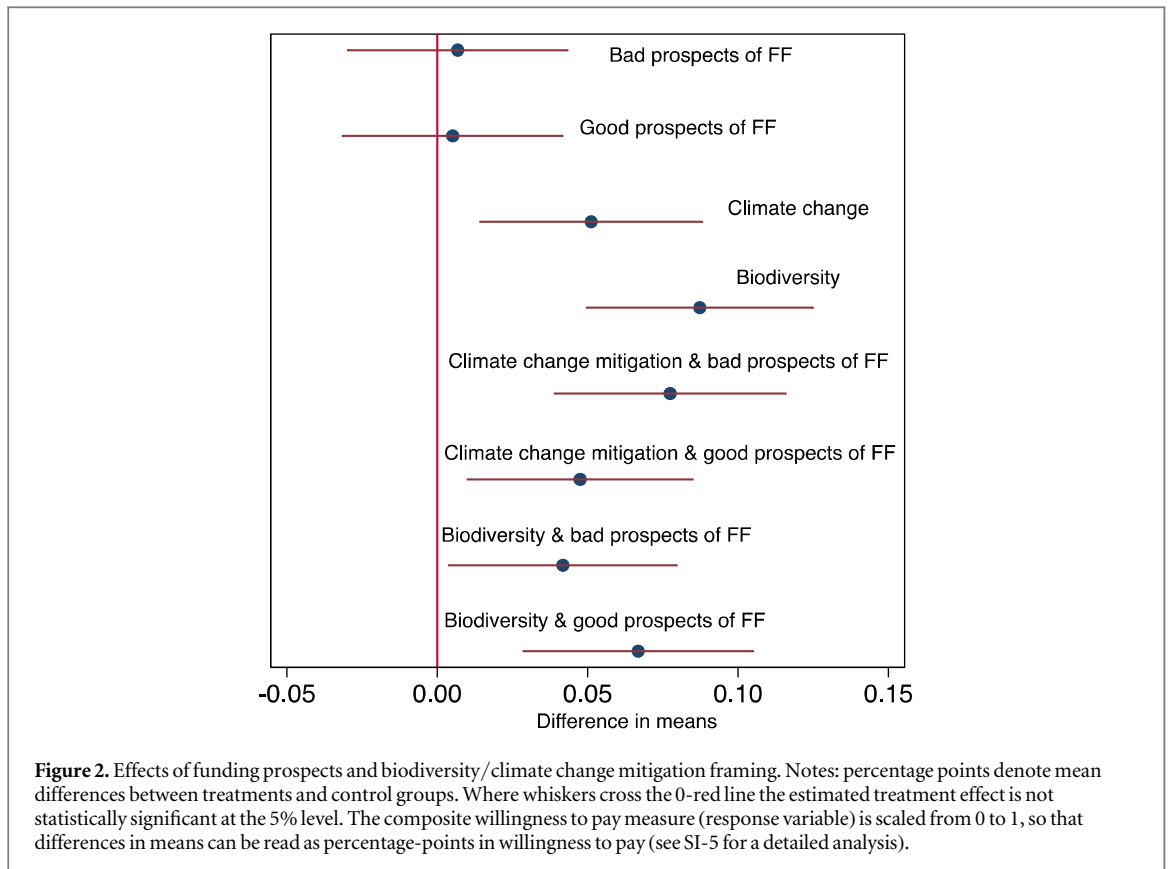
Notes: To facilitate visual interpretation of the data, we recoded the responses to fit a binary scale with willingness to pay for climate policy and forest conservation coded as 1 (0 otherwise). The high willingness to pay category (1) thus comprises 'agree' and 'strongly agree' and the low willingness to pay category (0) includes 'strongly disagree' and 'disagree' answers. $N = 2500$. See also figure SI-3 and table SI-4 for detailed item wordings.

measures are closer approximations of individual's 'true' willingness to pay for forest conservation in Brazil, relative to measures that do not include cost implications.

The results are based on multiple regression analysis, in which assignments to treatment groups are included as explanatory variables, alongside a range of control variables (e.g., socio-demographic variables, political ideology, trust in government, region of residence) (see also SI-5). Figure 1 illustrates that younger participants are more willing to pay for forest conservation. Generally, individuals with conservative political ideology tend to be less willing to pay for environmental policies (Nisbet *et al* 2015). Along these lines, we find that left-leaning individuals in Brazil are more willing to pay for climate change mitigation and forest conservation policies. Also, we find that willingness to pay increases with trust in government (Corbett and Durfee 2004, Hmielowski *et al* 2014). Individuals who consider deforestation a serious problem in Brazil are more willing to pay for forest conservation policies (Jamieson and Waldman 2003, Kellstedt *et al* 2008). Gender, education, income, and

knowledge as well as most of the geographic (region) variables have no significant effects. Different types of ecosystems characterize Brazil and people from different regions may thus hold different perceptions and preferences concerning deforestation and climate change mitigation. For example, residents of the Northeast region, which experiences more droughts, are more willing to pay for forest conservation, although they exhibit lower GDP per capita levels (UOL Economia 2013). We find that respondents from the south, which includes large cities, are less willing to pay, perhaps because they are less directly affected by deforestation.

It turns out that the experimental evidence does not support the expectations stated above. Figure 2 illustrates that both the climate change and biodiversity framing have a positive and significant, but very small effect on willingness to pay. The effect of the biodiversity frame is somewhat stronger, but not significantly different from the effect of the climate change frame. Thus, any framing increases willingness to pay for forest conservation, though the effects are very small. The prospects of foreign funding do not



seem to matter at all. This result lines up with the aforementioned finding that there is very strong support for unconditional forest conservation (see table 1). Combinations of the two types of treatment conditions have positive effects on willingness to pay, but these effects are small and appear to be driven more by the climate change/biodiversity, rather than the financial support prospects treatment.

In view of high levels of corruption and other inadequacies of government in Brazil, a key element appears to be the trust in public institutions. When asked to assess the statement 'I trust the federal government to do what is right', only 27.6% agreed, while 70.52% disagreed. When asked 'If the Brazilian government had more funding for forest conservation, do you think it would make good use of this funding, in the sense of effective measures for forest conservation in Brazil?' 9.6% answered Yes, 48.4% 'to some extent', and 41.9% answered No. Trust in domestic and international non-governmental environmental groups making better use of funding turned out to be much higher. Only 7.3% and 8.2% respectively said No. Also, 82% of the respondents agreed with the statement 'I am suspicious of the federal government.'

The existing literature shows that citizens who trust public institutions tend to be more willing to pay for new policies because they anticipate effective implementation (Breffle *et al* 2015, Jones *et al* 2015). The results displayed in figure 3 (Model 1 in table SI-7) support this argument. Individuals who do not trust the government exhibit lower willingness to pay for forest conservation. Untreated respondents exhibit slightly lower willingness to pay than treated respondents (aggregate effect of treatment groups) at low to mid-sized levels of trust. We infer from this result that public trust in the Brazilian government matters much more for willingness to pay for forest conservation, compared to whether forest protection is framed as a climate change mitigation or biodiversity protection issue, or whether the prospects of foreign financial support for forest protection are good or bad (see SI-6 for additional moderating effects).

5. Conclusion

Overall, we find that public support for forest conservation drops substantially when we move from measuring stated preferences in a more general form to survey measures including specific willingness to pay elements. This means that the public in tropical developing countries, such as Brazil, may not be willing to support (and pay for) forest conservation measures at the same levels that other surveys on the issue have suggested. There is a lot of discussion in Brazil and elsewhere on the links of deforestation with different economic sectors, i.e., agriculture (e.g., Assunção *et al* 2013, Strassburg *et al* 2014). Further research could look more systematically into the costs

and benefits of deforestation with respect to agriculture, and their effects on public opinion. By treating respondents with a more detailed depiction of costs and benefits, support for forest conservation might in fact change among the general population. Regarding the framing of our experiments, further research could also refer to more specific consequences of deforestation e.g., droughts. Additional studies could investigate other large tropical developing countries, most notably Indonesia and the Democratic Republic of Congo, along similar lines to find out whether our results uphold in countries that are poorer than Brazil but have not experienced a recent and very rapid onset of economic and political crisis. Whether chronically higher levels of poverty have a more negative effect on public support for forest conservation than rapid economic downturns starting out from lower levels of poverty remains open, however.

Finding that the willingness to pay for forest conservation in Brazil is rather low, it is important to learn more about what could be done to foster domestic support for forest conservation, both in Brazil and other tropical developing countries. Framing forest conservation in biodiversity rather than climate change mitigation terms does not seem to make a significant difference. Moreover, despite the fact that most Brazilians think that other countries are not providing enough funding to Brazil for forest conservation, foreign funding prospects do not make a difference either. The negative news here is that more foreign funding may not help leverage more domestic level funding. The positive news is, however, that prospects of increased foreign funding seem unlikely to crowd out public support for domestic funding for forest conservation.

Finally, as Brazil is undergoing an acute political and economic crisis at the same time, it appears that re-establishing trust in public institutions will be crucial to increasing public support for forest conservation and also to mobilizing more foreign funding for that purpose.

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