

Mining conflict in the Dominican Republic: The case of Loma Miranda

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Highlights

- The WTP for a conservation program is higher in the metropolitan areas and lower in the vicinity of Loma Miranda.
- The analysis found significant statistical differences based on the level of interest in the debate about Loma Miranda.
- Respondents who said that they were in favor of protecting Loma Miranda are more likely to pay more.
- Respondents who considered ecosystems services as critical are significantly more willing to pay for conservation.
- The social determinants of the debate about Loma Miranda seem to be related to the exploitation method in the highlands.

Abstract

This paper assesses the willingness to pay (WTP) of the Dominican Republican society for a restoration and conservation program in Loma Miranda, an area rich in natural resources that is also proposed as a mining exploitation site. Loma Miranda is located in the Quisqueya mining concession, approximately 100 km from the country's capital, Santo Domingo, making the decision to exploit or conserve a national dilemma. A national face-to-face survey was conducted during the first quarter of 2019, reaching a representative sample of 1200 individuals. The estimation of the WTP was performed using a non-parametric and a parametric, logistic estimation by way of robustness check. The average WTP estimated by the parametric method was \$DOP 159.00 ($\approx$ US\$3.15) per month per household. The aggregate WTP reached a total amount of US\$87.2 million per year. The WTP in favor of the conservation of Loma Miranda is higher in the metropolitan area of Santo Domingo but lower in the vicinity of Loma Miranda.

Introduction

This study assesses the Willingness to Pay (WTP) of the Dominican society for a restoration and conservation program in Loma Miranda, as an alternative to the proposed mining exploitation of the site. According to the Academy of Sciences of the Dominican Republic (ACRD, 2012a), Loma Miranda is the refuge of high biodiversity and an ecosystem services space, especially for hosting important aquifers for water recharge and supply. These aquifers support essential rural and urban settlements in Bonao and La Vega provinces for human consumption and production activities in one of the most important agricultural regions of the country.

According to the same source in Loma Miranda (ACRD, 2012a), has been inventoried about 30 species of native and endemic birds of the Spanish Island, with a rate of 85% of endemic amphibian and reptile of the 13 reported species. In terms of flora, about 444 species of plants have been counted with 62% native plants and 10% of endemism. These biodiversity values have motivated the proposal of the Loma Miranda as National Park, with a total area of 42.7 square kilometers, of which 10.7 km² would be a buffer zone (ACRD, 2012b).

The Dominican government is caught in a dilemma of difficult resolution because of the sharp social debate that still divides the Dominican society, which has provoked a clash between the sides in favor and against the exploitation. What is the willingness to pay of the Dominican Society for a restoration and conservation program of Loma Miranda? How strong is it? This study aims to provide some insights to support the decision-making process by exploring these questions using a well established quantitative method, the contingent valuation method.

Although this study focuses on the debate around the case of Loma de Miranda, we believe it is an interesting case study for a more general audience, given that exploitation/conservation dilemmas are all too frequent throughout the world (Butsic et al., 2015; Helwege, 2015; Paredes, 2016). For a seminal reference of the trade-offs between conservation and exploitation see Krutilla (1967). The conservation/exploitation dilemma is especially prevalent in those developing countries with significant mining resources where such dilemmas and conflicts have deep political and social roots (Helwege, 2015;

Temper et al., 2018). A recent review of the frequency and the different scales of discussion and social implications of these conflicts can be found in Conde (2017).

Loma Miranda is located in the Quisqueya mining concession, between the provinces of Monseñor Nouel and La Vega, approximately 100 km from the city of Santo Domingo. The Loma Miranda concession was granted to the mining company FALCONDO for the exploitation and metallurgical processing of nickeliferous laterites (PNUD, 2013a). According to a report from the United Nations Development Program (PNUD, 2013b), the mining concession covers an area of 217.8 km² at an altitude range of 300–700 m above sea level. The surface mining occupies an area of 460 ha or 4.6 square kilometers, equivalent to 2.1% of the total concession surface. Fig. 1 shows the location of Loma Miranda.

Between 2012 and 2014, the Dominican society was the protagonist of an acrimonious debate regarding the conservation or exploitation of Loma Miranda's mining resources. Two groups clashed: the conservationist groups in favor of turning Loma Miranda into a protected area and the groups in favor of the mining exploitation. The former group included community associations, ecological organizations, NGOs, representatives of both catholic and evangelical groups, and academics. The National Academy of Science of the Dominican Republic also publicly declared its support in favor of turning Loma Miranda into a National Park because of its natural resources and ecosystem services, such as water and biodiversity (ACRD, 2014).

The arguments in favor of exploiting Loma Miranda were supported by the results of the environmental impact assessment commissioned by the mining company. The results favored the exploitation based on the mitigation measures included in the project environmental management plan. The public debate forced the Dominican government, in October 2012, to request the collaboration of the UNDP to assess the quality of the environmental impact assessment commissioned by the mining company (Medina and Betances, 2013). A high-level commission was created, and in May 2013 this commission delivered a report with its findings. The commission concluded that the environmental impact assessment had limitations, the most important one was the lack of an economic analysis of the ecosystem services provided by Loma Miranda; indicating that a more balanced determination of the magnitude of the environmental impact was missing (PNUD, 2013a). The social pressure led to the declaration of Loma Miranda as a National

Park through an Emergency Law passed by the Congress in August 2014. In September 2014, the President of the Dominican Republic vetoed the law that declared Loma Miranda a National Park; highlighting the compliance with the rule of law and respect for State agreements on the protection of foreign investment (Betances, 2017).

This type of debate is common in developing countries rich in mining resources, where there is lack of information about the potentially serious environmental impact and negative externalities of the mining industry (Arellano-Yanguas, 2011; Bebbington et al., 2008). An extensive body of literature has emerged around these debates; highlighting both the negative impact of the mining industry in developing countries and the need for greater transparency and accountability of both the industry and the public regulatory bodies (Helwege, 2015; Kemp, 2009; Mutti et al., 2012; Spiegel et al., 2015).

The Dominican Republic is located in the Caribbean and covers an area of approximately 48,448 square kilometers, and has a population of around 10.5 million inhabitants (ONE, 2015). The Dominican Republic shares the Hispaniola Island with the Republic of Haiti, occupying two-thirds of its territory. According to the World Bank, the country is considered the biggest economy of Central American and the Caribbean, experiencing a 6.6% economic growth rate between 2014 and 2018 and a gross domestic product (GDP) of US\$81.2 billion in 2018 (WB, 2019b). In 2018, the gross national income per capita was US\$7,370, the GINI index was 45.7, and the general level of monetary poverty was 30.5% (WB, 2019a). Despite its social distortion, the Dominican Republic is considered a high human development country (UNDP, 2018). Between 2010 and 2018, the mining activity became one of the most dynamic sectors of the economy and one of the pillars of economic growth, accounting for an average of 1.7% of the GDP (BCRD, 2018c). In 2018, there were around 125 mining concessions in the country, 123 were non-metallic and 2 were metallic (DGM, 2019); including the largest gold mine in the Americas and the second in the world, Pueblo Viejo, operated by Barrick Gold (BARRICK, 2019). In 2018, mining was the second largest export sector in volume after free zone companies, generating US\$ 1770.9 million and over 5000 direct jobs in 2016 (BCRD, 2018b). Therefore, mining is an important economic sector for the economic growth of the Dominican Republic. Despite the increasing importance of the mining industry in the country, environmental liabilities of both formal and informal mining are a legitimate concern in the Dominican Republic. In the case of Pueblo Viejo, environmental liabilities were estimated at ~ US\$ 375 million (AIRD, 2019), as a result of irresponsible exploitation. All these factors exacerbate the debate and

social concerns about the potential environmental impact that the exploitation of Loma Miranda may cause.

Section snippets

Contingent valuation

The Contingent Valuation Method (CVM) creates a hypothetical market or contingent scenario, where respondents declare their preferences for a good or service by using detailed questionnaires to estimate the WTP for such good or service (Hanley et al., 1998; Johnston et al., 2017). One of the most emblematic cases that highlight the role of contingent valuation is the Exxon Valdez oil spill in the Valdez Narrows in Alaska. The impact assessment of the release of 11 million gallons of crude oil

Methodology

The CVM estimates WTP by using questionnaires to explore a hypothetical market (Johnston et al., 2017). Therefore, the essential element of a CVM survey is the hypothetical market. -The described situation should be credible to respondents and should motivate a genuine commitment in terms of the expected results in conservation efforts (Chilton, 2007; Whittington and Pagiola, 2012).

Results

In this section we start with the simpler, non-parametric estimation. Table 2 shows the proportion of “yes” responses obtained for each element of the bid vector, expressed in Dominican pesos. This is the basic building blocks of the survival function for the non-parametric estimation of the WTP (Kriström, 1990).

Based on the results shown on Table 2, it is possible to generate a probabilistic corrected survivor function, assuming that a reasonable top amount of payment would be 400.00 Dominican

Discussion: implication for the Loma Miranda's debate

As shown in Table 4, respondents who said that they were very interested in the Loma Miranda' debate are willing to pay larger amounts. This preference is statically significant at a 1% p-value as indicated in Table 3 (

$\alpha=1$

). This difference is highly significant in terms of WTP, ranging from \$DOP 68.00 ($\approx$ US\$1.34) for people not interested in the debate to \$DOP190.00 ($\approx$ US\$3.76) for people highly interested in the debate. The next two variables in Table 3 capture the two sides of the coin.

Conclusions

From the monetary point of view, the benefits of the exploitation of Loma Miranda seem to be clear, as the Pareto criterion of economic efficiency is met. The average WTP to exploit Loma Miranda is statically significant even in the vicinity of Loma Miranda, where respondents are willing to pay lower to protect it. However, this could not be taken as a direct recommendation in favor of exploiting Loma Miranda because of the social concerns that motivated the public debate. The results of the

Declaration of competing interestCOI

The authors do not have any conflict of interest with the parties involved in the Loma Miranda's debate. This research was carried out independently and only for academic purposes.

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CRediT authorship contribution statement

Víctor Gómez-Valenzuela: Conceptualization, Methodology, Writing - original draft, Data curation, Validation, Supervision, Writing - review & editing. Francisco Alpízar: Conceptualization, Writing - review & editing, Data curation, Software, Validation, Formal analysis. Solhanlle Bonilla: Visualization, Writing - review & editing. Carol Franco-Billini: Writing - review & editing, Visualization.

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Research data for this article

Data not available / Data will be made available on request

Further information on research data

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significant local impacts (Cesar, 2019; Gómez-Valenzuela, Alpízar, Bonilla, & Franco-Billini, 2020; Holley & Mitcham, 2016). Such projects, especially those with considerable environmental impacts, are frequently met with controversy that challenges the legitimacy of the project (i.e., its social approval by key constituencies).

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