HAS THE WORLD FAILED ECUADOR?

THE CASE OF THE YASUNI ITT INITIATIVE

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Abstract

In 2007 the Ecuadorian government announced the Yasuni ITT Initiative as an alternative to the mechanisms of the Kyoto Protocol for climate change mitigation. This Initiative proposed a moratorium on oil activities in a portion of the Yasuni National Park known as Ishpingo-Tambococha-Tiputini (ITT) in exchange of a compensation of 3.6 US billion dollars. The Initiative spurred significant support worldwide and led to the production of a significant amount of literature on the economics of climate change and other areas such as environmental justice. But in 2013 the Initiative was terminated on the grounds that the world had failed Ecuador by not providing sufficient funds to compensate for its resignation to revenues derived from oil exploitation in the ITT area. In this paper we provide a conceptual and empirical reasoning through which we prove that the Initiative was doomed to failure since its inception due to its numerous flaws such as the underestimation of the opportunity costs of oil activities and the omission of the discounts on the carbon credits price because of the Initiative's uncertainty, non-additionality, leakage and non-permanency characteristics. On this basis, we find a probability of zero that the Government of Ecuador could have collected the compensation stated as a target in the ITT Initiative (i.e. US$3.6 billion). We also find that the funds pledged by world donors were motivated purely by altruism and beyond economic rationality, which leads us to conclude that the world did not fail Ecuador since they did more than expected given the Initiative defective features.

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1. Introduction

In 2007 the Government of Ecuador, chaired by President Rafael Correa, launched the Yasuni-ITT Initiative through which the country proposed a permanent moratorium on oil extraction in a portion of the Yasuni National Park (YNP) known as Ishpingo-Tambococha-Tiputini (ITT) in exchange of a financial compensation from the international community equivalent to 50% of the value of the oil reserves in that area (i.e. 846 million barrels of oil); that is, US$3.6 billion over 13 years. The aim of the Initiative was to conserve biodiversity, protect indigenous people living in voluntary isolation, and avoid the release of CO2 emissions because of oil exploitation. Since its announcement the ITT-Initiative received worldwide support and was acknowledged as an innovative instrument for climate change mitigation. However, on August 15, 2013, the Ecuadorian government decided to end the Initiative, opening the doors to public and private companies to extract oil in the ITT area in the near future. According to President Correa the reason for this change of plans was because the world had failed to provide to Ecuador the requested compensation for the moratorium on oil extraction in that area in the YNP.

The collapse of the ITT-Initiative was considered as a defeat for conservation activists and organizations who were trying to save from oil exploitation, and potential pollution, an area that is considered as one of the world's most biodiverse regions (Bass et. al. 2010; Hearn 2010; UNESCO 1989). It also put an end to a plan that was considered by many as a model for other countries to resist the temptation of oil revenues through economic incentives that motivate to keep fossil fuels in the ground and thus protect nature. This unfortunate outcome left two open questions. First, did the world really fail Ecuador for not supporting this Initiative? Second, did this Initiative have any chance of success, or was it doomed to fail from its inception?

We argue that the Yasuni ITT Initiative was not at any moment a revolutionary or innovative instrument for climate change mitigation (Haddad 2011; Harstad 2012) unlike what some scholars (Finer et. al. 2010; Larrea et al. 2009; Rival 2010; Acosta et al. 2009; Vogel 2009) and the Ecuadorian government asserted. On the contrary we show that the ITT Initiative was severely flawed with ambiguities, contradictions and omissions on relevant issues, and even took the form of a hostage-and-ransom situation (Harstad 2012). For this purpose, we provide a conceptual and empirical analysis which will mainly focus on the design of the

Yasuni ITT Trust. We use as reference the criteria used for the Clean Development Mechanism (CDM) programs developed within the United Nations Framework Convention for Climate Change (UNFCCC), and for the Reducing Emissions from Deforestation and Forest Degradation (REDD+) projects (IPCC 2007). That is, we analyze the leakage, uncertainty, additionality and permanence of the ITT Initiative as a carbon sequestration project.

The arguments and results of this paper show that the ITT Initiative was designed on weak conceptual foundations which made it unfeasible to be considered as an emissions avoidance and/or sequestration project. Also, through the results of this study we determine that the Initiative had no economic value to be considered as a credible and viable donation alternative; however, we prove that the world responded in the best way possible by pledging to the Initiative an amount of funds equivalent to what it would have put in other sequestration projects available in the carbon market (i.e. European Union - Emission Trading System).

2. Description of the Yasuni ITT Initiative

2.1. The Yasuní National Park

The YNP is a protected area located in the Amazon Region of Ecuador. It extends over an area of 982,000 hectares and is located in the eastern provinces of Orellana and Pastaza about 250 kilometers southeast of Quito. The YNP was designated as a National Park in 1979 by the Ecuadorian Government and in 1989 the Park and much of its adjacent area (i.e. the Huaorani Ethnic Reserve) were designated by UNESCO as a Biosphere Reserve (UNESCO 1989). The YNP is recognized as one of the most biodiverse regions in the world (Bass et. al. 2010; Hearn 2010), and ancestral home of the Huaorani tribe as well as of at least two clans living in voluntary isolation (i.e. Tageri and Tamaorenami) (Finer et. al. 2009).

Despite the YNP's designation as a National Park and Biosphere Reserve as well as the official recognition of rights over a portion of this area to the Huaorani people, several large-scale development projects exist or

have been proposed in the area (Figure 1). Oil concessions cover the northern half of the YNP[3] and access roads have been constructed inside the park and its buffer zone.

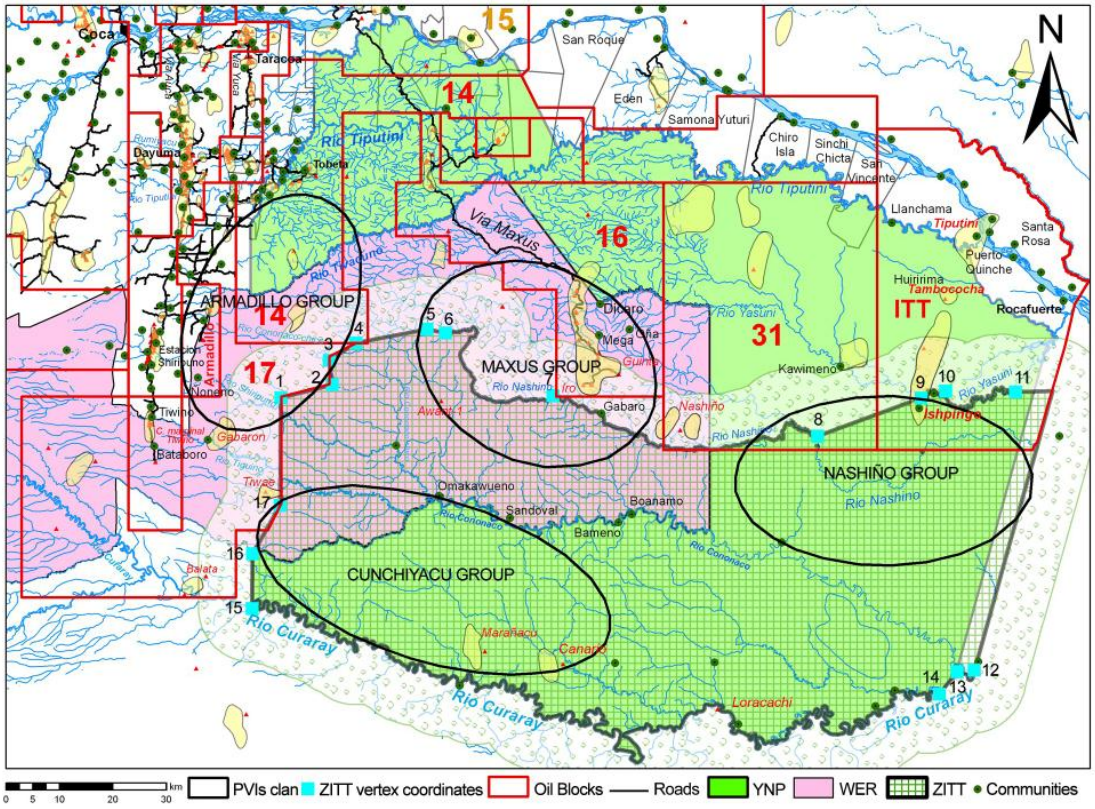

Figure 1. Yasuní National Park (YNP), Waorani Ethnic Reserve (WER), Intangible Zone Tagaeri Taromenane (ZITT), active and discovered oil blocks and hypothetical delimitation of territories of uncontacted clans. Source: S. Pappalardo, De Marchi M., Ferrarese F. (2013) Uncontacted Waorani in the Yasuní Biosphere Reserve: Geographical Validation of the Zona Intangible Tagaeri Taromenane (ZITT). PLoS ONE 8(6): e66293. doi:10.1371/journal.pone.0066293

The biggest threat to the YNP´s ecological integrity has been the discovery of oil in the northeast section of the park in what is called the ITT block or block 43 (containing the Ishpingo, Tambococha and Tiputini fields). This field is considered as the second largest untapped oil fields in Ecuador (846 million barrels corresponding to 20% of the country's proven oil reserves) (Larrea 2010). The latter fact increases the

[3] There are 8 oil blocks in the Yasuni National Park; they are, 14, 15, 16, 17, 31, ITT (43), and the marginal field Tiguino. The operation of oil drilling has taken place inside the YNP since 1985 in blocks 14 (1986), 15 (1985), 16 (1985) and 17 (1986). Block 31 which is adjacent to block 43 (ITT) was leased in 2008 and it will start to be exploited by Petroamazonas by the end of 2013.

attractiveness for exploitation activities over conservation ones and sparked a sense of urgency and alarm on scientists and conservationists who raised their voices in favor of further protection of the area. Examples of those voices are Oilwatch (2005), Acosta (2007), Accion Ecologica (2004), and Accion Ecologica (1999) who along with media personalities built a strong opposition against oil drilling.

2.2. The Yasuní ITT Initiative

In 2007 the Government of Ecuador, through President Correa himself, presented the ITT Initiative during the High Level Dialogue on Climate Change of the XLII Period of Sessions of the General Assembly of the United Nations. There he expressed that Ecuador had decided to make an immense sacrifice by keeping oil underground in the ITT area, but in return this country demanded co-responsibility from the international community reflected in a minimum compensation for the environmental goods that Ecuador generated and from which all the planet benefited.

The Initiative immediately gained notoriety for what was called a proposal with innovative objectives that represented a solution to the global environmental problem caused by the dependence on oil. In 2008 the German Parliament and by 2009, the European Union expressed support to the Initiative (Aguilera et al. 2009). In order to ensure transparency, in August 2010 the Ecuadorian Government put the Yasuní Trust Fund (YTF) under management of the United Nations Development Program (UNDP). The contributions to the Trust could come from governments and multilateral organizations in the form of debt-for-conservation swaps, emission permit auctions or specific conservation projects; and, from civil society organizations, private companies and individuals (UNDP 2010). Funds would be used for development projects aiming to increase energy efficiency and to promote social development in the zones of influence around the YNP.

In exchange for contributions, the Ecuadorian government issued Yasuní Guarantee Certificates (YGCs) which were documents equivalent to the face value of each contribution in US dollars. The YGCs included the metric tons of CO2 avoided according to the price of the European Union Allowances (EUAs) in the Leipzig Carbon Market. The maximum total amount of YGCs issued by the Government would be equal to 407 million tons of CO2 which is the estimated level of emissions for extracting and consuming oil from the

ITT field. The YGC was an instrument that did not earn interest and did not have an expiration or maturity date as long as the Government maintained its commitment to not exploit the ITT oil reserves. It is important to mention that any contribution below US$50,000 was considered as a donation to the Trust Fund and no Certificates would be given out.

By 2013 only US$386 million had been pledged (~10% of the initial target of the Initiative) and $13.3 million had actually been delivered (~0.37 of the initial target). Then, on August 15 President Correa terminated the ITT Initiative indicating that the international community had failed to embrace it and therefore did not provide the necessary support to it. "The world has failed us," he declared to international press and called "hypocrites" to the richest countries because "they emit the most Greenhouse Gases (GHG) in the world while waiting for poor nations like Ecuador to sacrifice economic progress in order to protect the environment"[4].

3. The ITT Initiative as a Carbon Sequestration Project

The Ecuadorian government did not present the ITT Initiative either as a CDM or a REDD+ project. However, the operating guidelines of the YTF were very similar to the formers because they entailed that any contribution would be divided by the prevalent carbon price and this calculation would result in an "equivalent amount of carbon offsets" (Finer et al. 2010). This derived offset would be denoted in the YGCs which were expected to be tradable and equivalent to the EUAs for international trade. Then because of this intended equivalence we use the CDM and REDD+ as references for our analysis.

3.1. Definition and Characteristics of CDM and REDD+ projects

The Clean Development Mechanism (CDM) enables industrialized countries to reduce costs of compliance with the Kyoto Protocol by implementing climate change mitigation projects in developing countries (IPCC 2007). These projects generate Certified Emission Reduction (CER) units that can be traded in emissions trading schemes. The CDM has been partially successful in mobilizing investment from public and private sectors to reduce GHG emissions (Zhang et al. 2011), and on enabling the transfer of environmentally safe technologies to developing countries (Costa-Júnior et al. 2012).

[4] See http://www.bbc.co.uk/news/world-latin-america-23722204

The REDD+ projects consist on a set of steps designed to use market and financial incentives in order to reduce GHG emissions from deforestation and forest degradation (Parker et al. 2008). The purpose of the REDD+ program is that payments for ecosystem services are made on a massive scale in tropical forest countries and be available on a long-term basis with stringent monitoring and verification. The services delivered (primarily saved carbon) might be sold through a market as offsets for countries with emission reduction targets (Lederer 2011).

The CDM and REDD+ projects must be evaluated with respect to four characteristics: permanence, additionality, leakage and uncertainty of the sequestered or avoided emissions (McCarl et al. 2008; Parker et al. 2008; Murray et al. 2004). The non-compliance of any or the entire set of criterions implies not only discounts in the price received for carbon offset credits (McCarl et al. 2004) but also limitations in the viability of any avoidance/sequestration project. A brief description of these characteristics is as follows:

Permanence

One barrier for including forest offsets in climate policy is the risk of the intentional or unintentional release of carbon back to the atmosphere. This influences the attractiveness of offset projects as an investment strategy, for landowners and credit buyers, and as a mitigation strategy for policymakers (Galik et al. 2009). Permanence encompasses the time dynamics of carbon sequestration in terms of the following: (i) the differential rates of accumulation over time and the long-run decline to a near zero rate of net sequestration until saturation, (ii) the possibility that carbon will not remain sequestered over the long term because of the reversion of contracted terms, storms, fire, pests and many other factors; and, (iii) the contract terms that require GHG offsets for a limited time period or costs that are not a function of carbon uptake (Kim et al. 2008).

Additionality

Additionality is linked to the existence of an emissions baseline which denotes the amount of GHGs emitted in a business-as-usual (BAU) scenario and the changes because of the implementation of REDD+ or CDM activities. The baseline allows for the formation of a contract setting the terms of compensation to be offered for tons of carbon sequestered beyond BAU (Ogonowski 2009). Furthermore, the baseline helps to resolve

the asymmetric information problem since sellers of offsets have private information about their opportunity costs which lead to concerns about whether offsets are truly additional (Mason et al. 2013).

Leakage

For carbon sequestration through forestry it is likely that market forces, coupled with less than global coverage of a GHG regulatory program, can cause net GHG emission reductions within one region to be offset by increased emissions in others (McCarl 2005). This phenomenon is called leakage in the context of GHG rule making.

Uncertainty

Uncertainty arises at all the stages of the implementation of a CDM/REDD+ project. It is a formidable task for the project designer to provide information regarding the variability of offsets, the tradability of the credits, the likelihood about other activities affecting the project, the institutional and political stability of the country or region where the project is established among many other issues. The feasibility of the project should be addressed with uncertainty taken into account; otherwise its omission may lead to unrealistically optimistic estimates of carbon sequestration (Kurkalova 2005; McCarl et. al. 2004; Marland et al. 2001).

3.2. Compliance of the ITT Initiative to CDM and REDD+ Characteristics

Given the previous criteria to be met by CDM and REDD+ projects we examine the consistency of the ITT-Initiative with respect to these characteristics. Though there may be some overlaps we approach each criteria separately and holding the others constant.

Permanence

Oil exports have been Ecuador's main source of revenue for more than 40 years, and oil exploration activities have already occurred in the YNP and its buffer zone (Arsel 2012; Martin 2011). Despite the promotion of the ITT, these latter actions do not explicitly appear as investments in the YNP's long-term productivity in order to signal a commitment to co-operation and to the terms of the ITT Trust (Singleton 2000). The implicit idea behind the Initiative would be then that a hostage is held as a condition for supplying environmental services on favorable terms. This appears as an arbitrary exercise of power where the stronger party "demands" a ransom from the world that is assumed to accede it because it has no other choice

(Williamson 1983). These issues combined contradict the ITT Initiative and cast doubts about Ecuador's willingness and ability to guarantee the preservation of the ITT area in the YNP beyond the current administration. Plus, there is the credible threat that in the case of negative macroeconomic shocks when additional funds may be needed, the (current or future) government's goals may switch from international compensation for avoided emissions to oil exports revenues, particularly when the latter is more profitable. Thus on economic terms the Initiative was not credible in the long-run and its permanence was perceived as fragile.

In addition, though the Initiative made provisions on the donations reimbursement in the case of oil extraction, the financial and legal mechanisms that would operationalize this reimbursement process were not clear and concerns arose due to the ambiguity of the Trust guidelines and the institutional instability of the Initiative design, promotion and management[5] (Arsel et al. 2012, Arsel 2012).

Additionality

From a carbon sequestration perspective, the Initiative did not provide any baseline and offset estimations. This implies in market terms that YGCs cannot be considered equivalent to either CERs or EUAs because credit buyers would pay only for offsets they can claim as credit under regulatory schemes and would not wish to pay for offsets that someone would disallow for not being additional (McCarl 2005). Plus, the YNP is a mature and saturated ecosystem where carbon sequestration is low, if it at all exists, where no additional offsets could be identified in case a baseline would exist.

Also, it is important to emphasize that the YNP has already been a protected area for more than 34 years. Then no additional environmental services occur because of the Initiative and, therefore, no further international funding should be needed as the conservation results, in terms of biodiversity conservation and protection of indigenous peoples in voluntary isolation, should have already been achieved. This, however, depends on whether the legislation is adequately enforced (Ogonowski 2009) which is not a direct issue in the environmental and conservation realm. Still, as long as the Yasuni is conserved and given the previous

[5] The institutional design of the ITT Initiative bounced between being a direct responsibility of the Ministry of Foreign Affairs, to an Independent Technical Secretariat, and then back to a shared responsibility of three commissions chaired by the Ministry of Foreign Affairs

commitments compelling Ecuador to do so, any credit buyer or potential contributor may be in no hurry to pay for emission avoidance. In turn, what has actually occurred is that public high-ranked officers have denounced that oil extraction will occur[6] unless a certain amount of contributions is received. Apart from the implications of the current Constitution and legislation, the YNP would take the form of a hostage that is under the constant threat of being liquidated unless the world complies with certain conditions. This makes the whole ITT Initiative ambiguous and contradictory on its proper terms, and it could be considered as a ransom operation (Harstad 2011).

Furthermore, despite the claims that the ITT Initiative was an innovative alternative given the Kyoto Protocol's limitations because of the "low-hanging fruit" problem (Han et al. 2011) and rent-seeking incentives, we argue that these limitations of the CDM and REDD+ programs are not resolved since they obey a broader scope of issues related to the Ecuadorian institutions which are beyond ITT the Initiative.

Leakage

The ITT Initiative claims that its main outcome would be the avoidance of emissions from the combustion of the oil that is left underground. However, Ecuador does not have any power over oil markets, so Ecuadorian oil is easily substituted by purchases in some other country or through further extraction in the rest of Ecuador's oil fields. Thus, with the ITT Initiative no emissions are truly avoided in the short run (i.e. Green Paradox, Sinn 2008). The Proposal itself recognizes leakage may exist in the short term but in the long term this would not be an issue because of the finite and non-renewable nature of oil. However, this latter argument is not a justification for non-accounting the emissions still produced and the implications over the prices of the YGCs. Moreover, the Proposal claims that the Initiative would instantly motivate "massive programs of reforestation, forestation and natural forest recovery (that) will lead to more CO2 being absorbed from the atmosphere" (Larrea et al. 2009). This is worrisome under the light that deforestation rates in Ecuador are estimated to be 198,000 hectares per year (Larrea et al. 2009) and have increased steadily even around the YNP. Then there is no reason a priori to expect that profitable forestry activities will stop just

[6] See: http://www.laprensagrafica.com/el-salvador/lodeldia/137554-ecuador-explotara-petroleo-si-fracasa-su-propuesta-ambiental

because of the existence of the Initiative. Moreover, limiting activities in the YNP may motivate relocation of forestry and agricultural expansion to other areas and provoke even further leakage (Eichner et al. 2011).

Uncertainty

Following Haddad (2012), the ITT Initiative takes the form of a compensated moratorium where the requested compensation is estimated with respect to the value of foregone oil activities rather than the environmental benefit. Plus, given the unavailability of a baseline and incrementals, potential credit buyers cannot make decisions regarding compliance with regulatory limits for emissions and compliance penalties. Thus, it is not clear the rationale about how the compensation requested by the Ecuadorian government is related to the offset levels, or whether it is just an arbitrary amount.

In its current form the Initiative takes a two-stage form where in the first one it is a compensated moratorium and voluntary donations were cash transfers obeying donors motivations to contribute to international sustainable development (Arsel 2012); and a second stage based on transactions in the carbon market where YGCs were expected to be equivalent to CERs or EUAs. However, this latter issue never seemed likely to occur for the following reasons: (i) the YGCs were not recognized in the Kyoto Protocol mechanisms and no formal procedure was specified in order to achieve it, and (ii) though the Initiative expected the YGCs to be recognized by the US government as a pilot study for carbon offsets (UNDP 2010; Larrea 2009), the transaction costs for this were too large to make this a reasonable goal.

In summary, the ITT Initiative did not fully comply any of the four criteria for the CDM and REDD+, then it could not be considered as a true sequestration project capable of receiving payments in carbon offset markets. Hence by definition it did not have any chance of succeeding on collecting the requested compensation of US$ 3.6 billion.

4. Feasibility Analysis of the ITT Initiative

This section examines the feasibility of the ITT Initiative. The results obtained in this section give us a comprehensive view of the flaws of the Initiative both as a climate change mitigation instrument as well as a financial tool to raise the compensation that "supposedly" would have made the government indifferent between conservation and oil extraction.

The Initiative assumed that the YGCs would be equivalent to the EUAs but by definition this is not correct. EUAs are electronic certificates distributed to the industries by the European governments. Each EUA represents the right to release one ton of CO2 into the atmosphere, whereas the CERs are awarded by the United Nations for CDM and REDD+ projects in developing countries. Then YGCs are more similar to CERs and, hence, we assume they are financially and operatively equivalent. We also assume that donors are rational and utility maximizers, and that financial resources are scarce and therefore they will use the market as reference for the amount of their donations. Finally we assume that the Ecuadorian Government will keep its promise of keeping the ITT oil underground as long as the compensation is incentive compatible; that is if the compensation is equal or greater than the 50% of the actual oil revenues derived from the exploitation of the ITT block in the YNP.

Alongside, it is important to note that we overlook the fact that YGCs are certificates that do not represent either a portion of the oil reserves or avoided carbon emissions. That is, we ignore that in practice the YGCs are the representation of nothing more than a bona fide promise from Ecuador of not exploiting the ITT block. We do this in order to simplify the analysis and to approach the problem from a financial perspective using information from the European Union Emission Trading System (EU-ETS).

Given these conditions we proceed, first, to estimate the discount range that would have been applied to the YGCs' price for their non-compliance to the criteria required for CDM and REDD+; and, second, we estimate both the value of oil activities in the ITT block and the value of YGCs under market conditions.

4.1. Price Discounting

Any non-compliance to the CDM/REDD+ criteria is partially resolved by discounts to the price of carbon credits (McCarl 2005). Then it is important to calculate the price discount that the Initiative should have received if the YGCs had been subject of free trade in the EU-ETS market.

Following Murray et al. (2010), Kim et al. (2008) and McCarl (2005) we set up in Equation 1 a price discounting scheme.

$$Price\ Discount\ = \frac{\sum_{t=0}^{T}\left(B_t(1+g)^t + \left(\frac{M_t}{P_0}\right)\right)(1+r)^{-t}}{\sum_{t=0}^{T} Q_t(1+g)^t(1+r)^{-t}} + (1-PA) + (1-PL) + z_\alpha * CV, \quad (1)$$

where Q_t stands for carbon offsets per hectare and per year (because of the implementation of the ITT Initiative) and it is assumed to be constant. This assumption is innocuous because of the maturity and saturation of the YNP. We simulate price discounts for three different levels, namely: 2 tCO2e, which is the carbon offset assumed for the Initiative (Larrea et al. 2009), and for 17 and 32 tCO2e per hectare and per year. B_t is the buyback per reverted offset which we assume is equal to the initial price, (P_0), and is paid one period after the reversion of contract terms. In order to take into account the situation when the ITT Initiative was supposed to be fully functional, we use a 2009-average CER price of $16 per tCO2e. The carbon price changes at the rate g which is assumed equal to 0%; the discount rate is r and equal to 12% (similar to Larrea 2010). Also, since no agricultural or forestry practices are funded to be changed in order for the Initiative to exist (McCarl 2005) we assume that maintenance costs (M_t) are equal to zero.

The first term of the right hand side of Equation 1 corresponds to the permanence discount which is also dependent on the project's time horizon (*T*). For the rest of terms, PA and PL denote the proportion of additionality and non-leakage simulated respectively and $z_\alpha * CV$ is the uncertainty discount where z_α is the value from a normal distribution that reflects a confidence interval established with probability α, and CV is the coefficient of variation of offsets generated by the Initiative in year t.

Because of data unavailability and for simplicity we assume that PL ranges between 0 and 50% and that the uncertainty discount ranges between 0 and 10%. This latter figure agrees with Murray et al. (2004), Marland et al. (2001a), Marland et al. (2001b) and Kurkalova (2005) for cases where no readily data are available for valuation purposes. Additionality is analyzed separately. As argued above, for estimating additionality we need an emissions baseline and the incrementals given the Initiative implementation. Apart from data unavailability, the YNP is a saturated ecosystem which may have already reached maturity so that its ecosystem services remain constant regardless the implementation of the ITT Initiative and assuming adequate enforcement of the rules for the protection of the YNP (UNESCO 1989). Then we could argue that because of non-additionality only, the total price discount would be close to 100%. However, we will not include it in the analysis in order to observe the behavior of the other types of price discounts.

In Figure 2 we show the results of the simulations on the price discounting. In that figure the y axis represents the price discount and the x axis represents the different time horizons for the Initiative. We first consider the permanence, and successively we introduce the uncertainty and leakage discounts.

Based on our assumptions the uncertainty discount ranges between 0% and 10% regardless the time horizon of the Initiative and holding fixed the rest of the price discounts. The same applies to the leakage discount. In turn, for the permanence discount only, when carbon sequestration is 2 tCO2 per hectare and per year, the price discount for the Initiative is equal to 100% if the time horizon is shorter than 7 years. This discount decreases monotonically until 0% for horizons longer than 20 years. We also simulate an intermediate case of 17 tCO2e per hectare and per year, the permanence discount is equal to 100% if the horizon is shorter than 4 years. The discount monotonically decreases to zero and is less than 10% for horizons longer than 8 years. For offsets of 32 tCO2e per hectare and per year, the permanence discount is less than 10% for projects longer than 7 years and becomes insignificant for horizons longer than 15 years.

When combining all discounts, for the case of 2 Tco2E and under permanence and uncertainty, the price discount remains at 100% for 8 years, and then it monotonically decreases until reaching 10% from year 16 and beyond. Now with the introduction of leakage the combined discount is equal to 100% until year 9 and then decreases until 60% from year 16. This latter case would be the more realistic for the ITT Initiative given the arguments in the previous section. For the case of 17 tCO2E and when uncertainty is introduced, the discount curve shifts rightwards and after year 14 the discount is never lower than 10%, where the permanence discount vanishes and only the uncertainty prevails. However, with leakage and even for a long–horizon project, after year 14 the combined discount is never below 60%. In turn, for 32 tCO2e and with uncertainty, discounts account between 3% and 100% for projects shorter than 10 years but are never lower than 10% after year 16. With leakage, discount is total for projects shorter than 6 years and it is never below 60%.

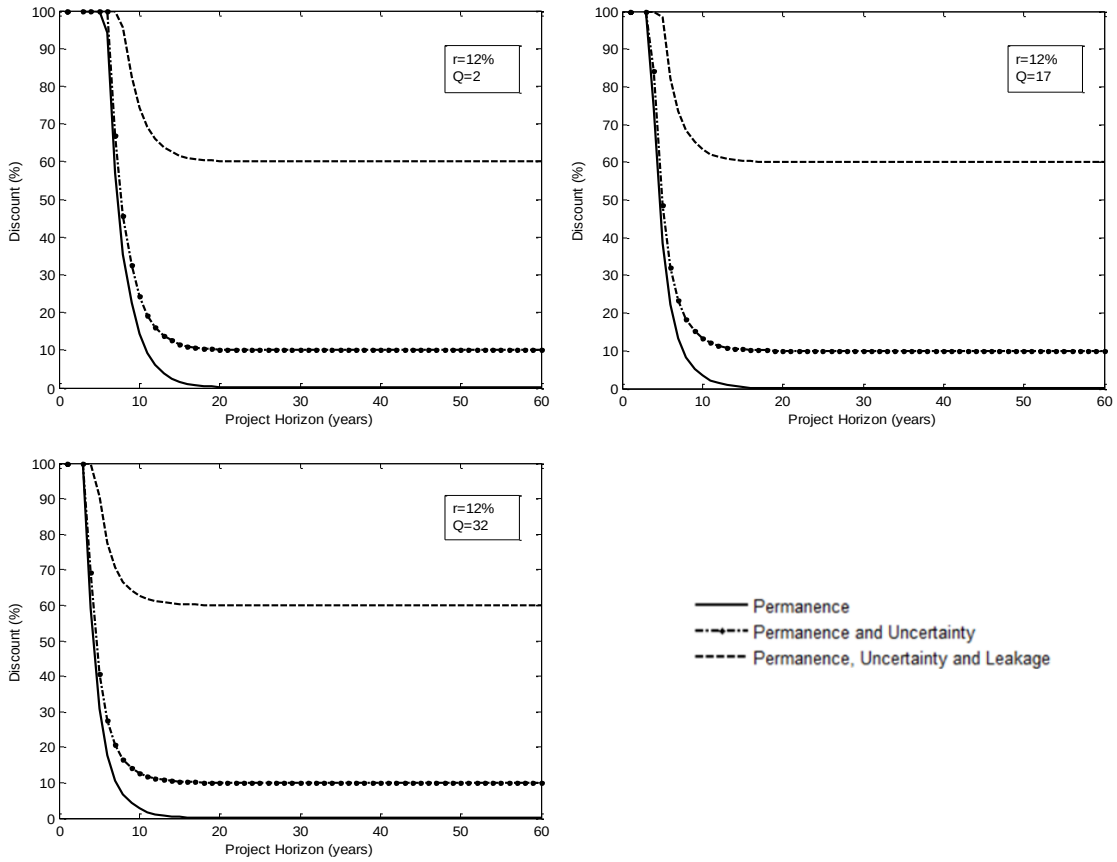

Figure 2. Estimated price discounts (in percentage terms) on CGYs because of permanence, uncertainty and leakage issues. Additionality is analyzed separately. Units of the quantity of emission offsets, Q, are in tons of CO2-equivalent per hectare and per year. Scenarios are prepared for Q equal to 2, 17 and 32 tons per hectare and per year, and for a discount rate equal to 12% as similarly used in the ITT Proposal.

From the simulations we conclude that the longer the time horizons the lower the price discounts derived from permanence and uncertainty; however, there is a minimal effect on the heavy discounts for leakage. Hence, price discounting is relevant for the ITT Initiative because of the following: (i) the unclear and likely short time horizon of the Initiative, which makes its permanence questionable; (ii) the degree of uncertainty on the entire IIT Trust design and implementation, and (iii) the significant leakage in the short run.

4.2. Financial Valuation of Oil Drilling Activity and ITT Initiative

In this section we will evaluate whether the ITT Initiative, as it was designed, was an incentive compatible contract for the Ecuadorian Government. According to the condition imposed by the ITT Initiative, the compensation that was expected by the Ecuadorian Government was US$ 3.6 billion which according to the

designers of the Initiative is a number that is equal or greater than 50% of the revenues that could potentially be generated by the oil exploitation of the ITT block located in the YNP. Therefore, the latter has an embedded assumption through which one might expect that if the actual oil revenues derived from the exploitation of the ITT were higher than $ 7.2 billion, the Ecuadorian government would have no incentive to keep the oil of this block underground, this would result in the government breaching the promises within the ITT Initiative.

In addition we also examine the market value of the YGCs if they would have been traded freely in the European carbon market. For this purpose, we use the price discounts calculated in the previous section as inputs for a Monte Carlo simulation in order to evaluate the expected revenue that could have been obtained from a hypothetical sale of YCGs in the EU-ETS market.

4.2.1. Valuation of Oil Drilling Activities in the ITT Block

The ITT Initiative was drafted under the assumption that the Net Present Value (NPV) of the oil revenues derived from the exploitation of the ITT block would be equal or less than US$ 7.2 billion. Then, the ITT Proposal claimed that a compensation equivalent to 50% of the previous value (i.e. US$3.6 billion) would suffice for the Ecuadorian government to keep the oil permanently underground. Consequently, it is assumed that if the oil revenues derived from the ITT exploitation exceeded US$ 7.2 billion the Ecuadorian government would have no incentive to comply with the agreements pledged in the ITT Initiative.

The Initiative's designers thought that this was an incentive compatible agreement, and that there would be no problem for the Ecuadorian government to fully comply with it, since they expected that the maximum revenues derived from the exploitation of the ITT oil would be US$ 7 billion approximately. The latter conclusion was obtained under the following assumptions (Acosta 2007): (i) expected production of 900 million barrels in total (in average 36 million of barrels per year); (ii) average oil price equal to US$32; (ii) production period of 25 years; (iv) production cost of US$12 per barrel; (v) discount rate of 9% which is the official rate of discount of the Ecuadorian Government (Ministerio Coordinador de Politica Economica

2013); and (vi) no initial investment[7]. Many of the previous assumptions are wrong and/or unrealistic. For instance, oil prices were in fact around US$80 per barrel in 2007, even more, in the first half of 2008 the oil price reached a maximum of US$141.66. However, from July 2008 there was indeed a downward trend, which brought the oil prices to a minimum of US$62.75. Yet, despite this negative trend it was never expected that the oil price would fall below $40, therefore the assumption of an average oil price of US$32 per barrel is very pessimistic and divorced from the actual price behavior of this commodity.

Then, it is necessary to determine the real revenue potential of the ITT block using a more realistic set of assumptions. For this purpose we use those provided by Petroecuador (2009), Larrea (2010), and Ministerio Coordinador de Politica Economica (2013) which are as follows: (i) the expected oil production of the ITT block reaches 846 million of barrels in average; (iii) the operation and transportation costs of the oil drilling operation are US$15 per barrel; (iv) a production period of 23 years; (v) an investment of US$ 5.5 billion; and (vi) a participation in the profits of 47% for the Ecuadorian Government. For the average oil price during the life of the project we use three scenarios, that is, US$70 per barrel (pessimistic scenario), US$80 per barrel (most likely scenario) and US$91.70 per barrel (optimistic scenario). We also use three different discount rates, 9% which is the one used by the Ecuadorian Government (Ministerio Coordinador de Politica Economica 2013) and 6% and 12% which are the ones used by Larrea (2010). Given these conditions we show in Table 1 the NPV of oil revenues.

We find that only in a very pessimistic scenario when the oil price is low ($70 per barrel) and the revenue flows are heavily discounted (12%) the expected compensation from the ITT-Initiative is incentive compatible. This is because; the NPV of the total oil revenues from the exploitation of the ITT block is US$6.6 billion which is lower than the target of US$7.2 billion. This provides an indication that the Initiative did not comply with the condition of being compatible with the Ecuadorian government incentives in most of the cases, since the expected compensation would have never reached a level that guarantees that the government would have met its pledge to keep the oil underground indefinitely.

[7] For a summary of these assumptions and a transcript of a conference of the then Ministry of Energy Affairs Alberto Acosta, promoting the ITT Initiative, see: http://sef.umd.edu/sef2007.html

Table 1. Net present value of oil revenues from exploitation of ITT block (US Billion Dollars)

		Average Price of Oil (US Dollars per Barrel)		
		70	80	91.7
Discount Rate (%)	6	10.6	12.9	15.6
	9	8.3	10.1	12.2
	12	6.6	8.1	9.7

For the Monte Carlo simulation of the valuation of oil extraction operations, we introduce some additional assumptions: (i) the oil reserves are not deterministic but stochastic; for instance, Petroecuador (2009) indicates the ITT block contains 412 million barrels of proven reserves, 846 million barrels of probable reserves and 1,531 million barrels of possible reserves. Then, we carry the valuation of oil revenues using this range. (ii) The bargaining power and contract conditions for the oil exploitation are not certain then we assume that the participation in the profits for the Ecuadorian Government ranges between 40% and 50%; (iii) the production and transportation cost ranges between $11 and $19 per barrel; (iv) the discount rate ranges between 6% and 12%; and, (v) for the annual average oil prices during the period 2007-2012 we use the WTI oil price series observed in the NYMEX market, whereas for the period 2013-2017 we used the NYMEX WTI oil forecast; and, for 2018 and beyond we use the range of oil prices assumed by Larrea (2010) and Ministerio Coordinador de Politica Economica (2013); that is, a range between $ 70 and $ 91.7 per barrel. Using these assumptions, we obtain the probability distribution in Figure 3.

We find that the probability that the ITT Initiative be incentive compatible (i.e. oil revenue less than US$ 7.2 billion) is 6.81%. This result confirms our initial assertion that the designers of the ITT-Initiative greatly underestimated the potential oil revenues of the ITT block and, therefore, they claimed a low compensation relative to the true opportunity cost of keeping the oil underground. This situation led to contradictions and conflicts in the management of the Initiative and offered no long-term security about its permanence both from a financial perspective and in political terms for future administrations.

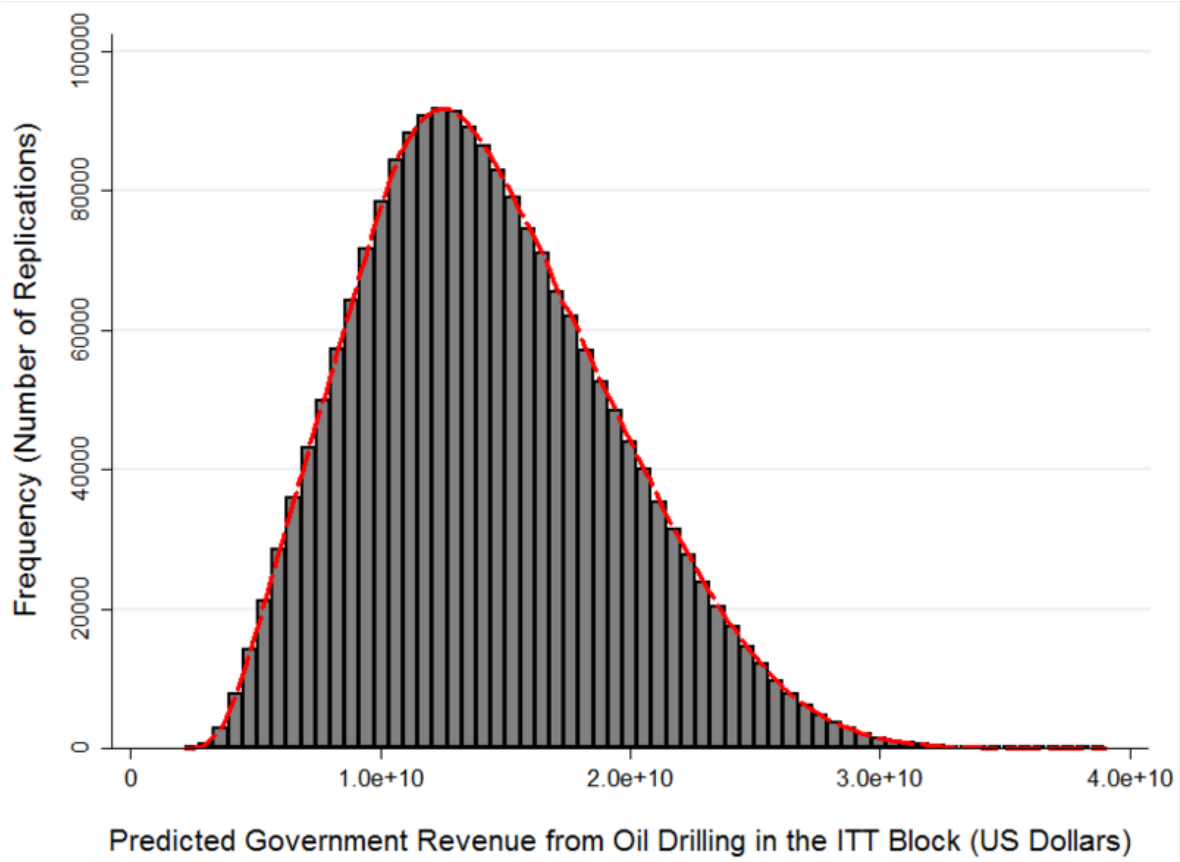

Fig 3. Density distribution obtained from a Monte Carlo simulation of the Net Present Values of the Expected Revenue from Oil Drilling in the ITT Block. In this case the density distribution is the result of 1,000,000 replications under different scenarios.

4.2.2. Valuation of Total YGCs

The other component that is required to analyze the financial feasibility of the ITT Initiative is the financial valuation of the YGCs issuance. For this we use as a proxy the market conditions (observed and predicted) for CERs in the EU-ETS market. We conduct two scenarios, the first one where no price discount occurs, and the second one where we apply the discounts from section 4.1.

The assumptions used in this section are as follows: (i) the period of YCGs' emission or fund collection is 13 years; (ii) the maximum amount of YGCs issued by the Government is 407 million units; (iii) the sale-success rate is 100% (i.e. all the YGCs are sold and traded); and, (iv) the price of the YGCs is assumed to be equal to the price of CERs in the EU-ETS market. For the latter assumption we use the historical prices of

this instrument from 2007 to 2013 whereas for the period 2014 to 2020 we use the forecast price provided by Thomson-Reuters.

Under the no-discount scenario and for a discount rate of 9%, we find that the NPV of the total funds that could have been raised from the YGCs is US$544 million. For discount rates of 6% and 12%, the NPV of the total funds is equal to US$617 and US$484 million, respectively. That is, we find that even without any price discount the funds that could have been raised through using carbon market mechanisms are actually lower than the target compensation US3.6 billion (i.e. 50% of US$ 7.2. billion which was target for oil revenues derived from the ITT oil exploitation).

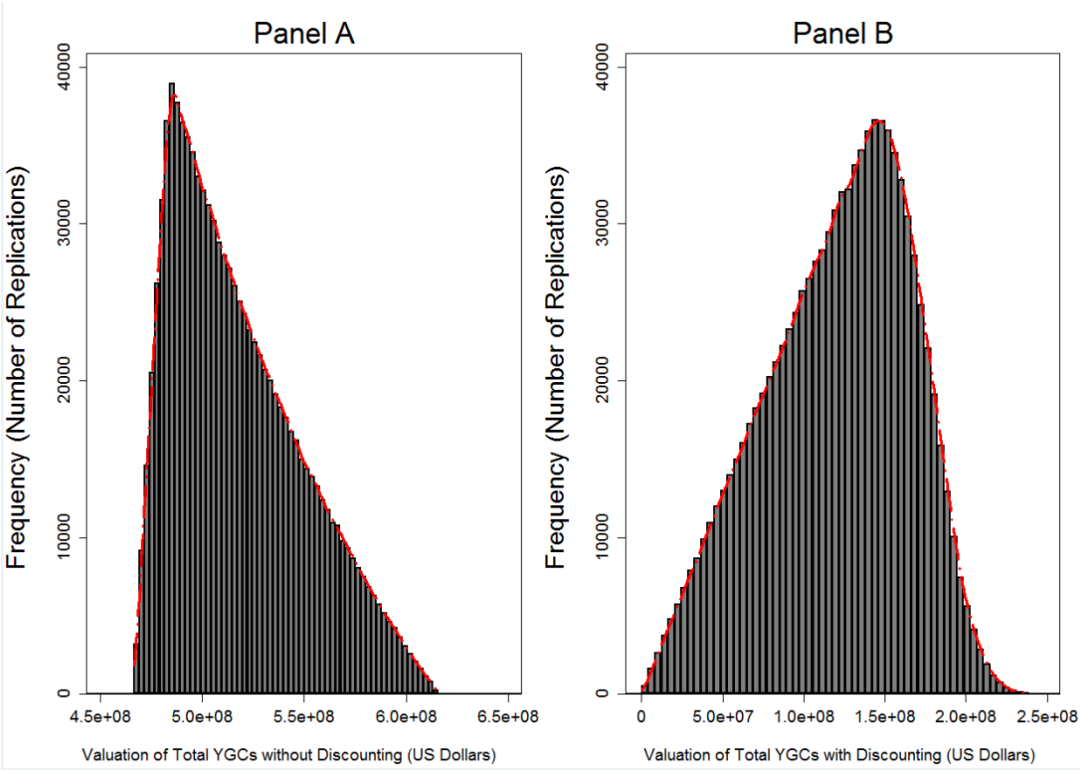

Figure 4. Density distribution obtained from a Monte Carlo simulation of the Net Present Values of the Expected Value of the Yasuni Guarantee Certificates issuance. Panel A shows the simulation under the assumption of no price discount and Panel B shows the simulation under the assumption of a range of price discounts between 60% to 100%. Both density distributions are the result of 1 million replications.

We also conduct a Monte Carlo simulation procedure for the valuation of this operation in order to analyze the impact of the price discounts in the YCGs valuation. We further assume that the sales-success

rate of the YGCs ranges between 70% and 100%, and that the discount rate ranges between 6% and 12%. We have a scenario where no price discount occurs and another one where the price discount ranges between 60% and 100%. Thus we obtain the two probability distributions in Figure 4.

We find that the probability that the Ecuadorian government would have been able to raise US$3.6 billion through the ITT Initiative is zero regardless the YGCs price discounting[8]. The more likely amount of funds that could have been raised was US$518 million in the no discount case and U$121 million with price discounts. An important implication that arises is that the value that was actually pledged to the YTF (i.e. US$ 386 million) was within the range of the YGCs valuation (US$121-US$518 billion).

It is important to emphasize, that if additionality were introduced surely the valuation would be even lower and would render the Initiative completely valueless. The latter would reinforce even more the results provided previously and the main conclusion derived from those results; indicate that world's donors indeed valued the Initiative from an altruistic point of view since they provided funds to it even though there were different donation opportunities available in the market most of them with both higher returns and lower risk (i.e. permanence). Hence we conclude that the world did not fail Ecuador, but rather the world did what they were supposed to do and even more with respect to financial contributions under an economic and rational perspective.

5. Remaining Questions

When initially presented, the ITT-Initiative was characterized for being an innovative option for: a) combating global warming by avoiding the production of fossil fuels in an area (i.e. ITT) which is both biologically rich and culturally sensitive; b) protecting the biodiversity of Ecuador and supporting the voluntary isolation of indigenous cultures; and c) promoting social development, nature conservation and implementing the use of renewable energy sources, as part of a strategy aimed at consolidating a new model of sustainable human development in the country (Larrea et al. 2009).

[8] If we used EUAs prices instead of CERs ones the probability that the Ecuadorian government would have been able to raise US$3.6 billion is still zero.

However, in this paper we argued that the Initiative was severely flawed and lacked clarity on major issues which weakened its outcome in the context of already existing procedures. Thus, based on what we have learned until now in this paper we proceed to answer three important questions as follows:

Was the ITT Initiative Feasible?

The Initiative suffered of a great deal of uncertainty (within the context of CDM and REDD+ projects) mainly because of the lack of information regarding emissions baseline, opportunity costs and non-compliance indicators for limits on emissions. In addition to the conceptual flaws on the proposal of the Initiative, which pretended to compare the CGYs with the EUA or CERs, uncertainty motivated their non-equivalence and restricted the potential use of the CGYs as financial instruments in carbon markets.

With respect to additionality, since the YNP is a saturated ecosystem and it is already subject to the Ecuadorian legislation for protected areas, the results sought in terms of conservation were supposedly to be achieved decades ago and no additional international funding should be needed and, therefore, the Initiative lacks of additionality traits.

On the other hand, both Ecuador's need for funds to boost its economic growth, and the high profitability of oil drilling activities in the YNP since the mid 80's cast doubts over the likely permanence of the ITT Initiative. Similarly, Ecuador's oil can be easily substituted from purchases in other countries or even through further extraction in other Ecuadorian fields, then leakage occurs and in global terms no emissions could be avoided.

All these issues altogether would imply heavy discounts on the price of the YCGs, should they become equivalent to CER and be subject of trade in carbon markets. Moreover, in the form of a compensated moratorium the YCGs take the form of government bonds, but the Initiative stated that they did not earn interest and were non-negotiable. These restrictions on tradability hampered even more the incentives and the chances of collecting the target compensation. Hence, from our point of view the Initiative was not feasible for its implementation through market mechanisms, and could not have worked on collecting the US$3.6 billion of compensation that the government imposed as target.

Was the ITT Initiative Sustainable?

The Initiative presented as its main innovation the willingness of Ecuador to refrain from exploiting fossil fuel reserves in a highly environmentally sensitive area. But this so-called innovation is its main weakness because avoided emissions projects have non-additionality problems which precisely motivated the development of the REDD+ program. Though some customizations may be needed (i.e. the component of the isolated tribes) there is a clear fit for the Yasuni to become a REDD+ project. Thus the ITT Initiative is redundant to existing climate change mitigation mechanisms and there is no any innovative or revolutionary feature in its current form.

Regarding to the sustainability of the ITT Initiative, only on a conceptually basis there are issues that were not completely addressed for its design. For instance, if the Ecuadorian government intended to follow a scheme of compensated moratorium for the future management of the Reserve, an entirely institutional structure was needed where several issues have to be dealt, namely: (i) how to calculate the compensated moratorium that would cover the opportunity costs of foregone oil and eliminates the incentives for extraction and processing; (ii) what would be the optimal time horizon of the moratorium; (iii) what guarantees and actions are needed in order to make the proposal credible. Besides, the Initiative may have fit as well as a debt-for-conservation swap, but this scheme has not proved to be successful in terms of generating significant revenue streams as the one expected through the ITT Trust.

On the other hand, if the Ecuadorian government had taken the path of implementing a REDD+/CDM project some omitted issues should have been considered. First, since liability rests with the seller of the carbon offsets, there was an incentive at the project level to minimize exposure to reversal risk. Then a clear understanding of the magnitude of reversal risk would be needed. Second, an insurance scheme should have been contemplated in order to allow for the replacement of lost carbon in the event of reversal. (Galik, Jackson 2009). Third, given the low participation of developing countries in CDM projects (because of high transaction costs, lack of knowledge of the carbon market, complicated procedures and largely unquantified sequestration levels) then, a large and comprehensive institutional framework should have been established at country-level in order to prevent the non-sustainability of the ITT Initiative (Han et al. 2011). Fourth,

research and clarifications are needed in other areas such as intergenerational justice; that is, why current generations should bear the burden of not getting the oil revenues and foster development at the expense of future generations which may in turn incur in the oil extraction themselves. Fifth, regardless the risk minimization strategies, the institutional responses should be anticipated for oil spills that are systemic to extraction activities and are characterized as low probability events but with high impact. This implies theoretical challenges in the necessary valuation of the Reserve's ecosystem services in order to construct the basis for future Cost-Benefit Analysis if new oil sources are found in the area. Hence, because of these problems the Initiative could be considered as unsustainable in the medium and long run.

Was the ITT Initiative Attractive?

Oil activities are much more profitable than the valuation indicated in the ITT Proposal. This leads us to consider that the target compensation should have been higher so that this could be incentive compatible for the Ecuadorian Government. Besides, by setting this compensation to 50% of foregone oil revenues as compensation because avoided emissions that are non-existent does not obey economic reasoning and, hence, its operation in carbon markets was not viable.

In addition, the Initiative is contradictory and ambiguous in the sense that it claims compensation with respect to the revenues of a foregone activity (i.e. oil extraction) rather than the valuation of the environmental service that promised (i.e. avoidance of 407 million tons of CO2). For this reason, voluntary donations were the only way to raise funds for the Yasuni, but this mechanism is constrained by the willingness and priorities of potential donors. Still, the US$386 million actually pledged is within the range of the YGCs valuation as equivalent CERs issued because of the existence of CDM projects, which gives us a strong indication that the ITT-Initiative was indeed an attractive donation alternative. However, the target compensation was unrealistically high because for donors there were other available donation alternatives that are less risky, cheaper, better structured and, more importantly, more credible since the ITT Initiative took the form of a hostage-and-ransom situation (Harstad 2012).

6. Conclusions

In this paper we argue that the reason behind the failure of the ITT-Initiative is its lack of conceptual foundations. Specifically we prove that the Initiative could not have been successful as a sequestration or avoidance project. Though donors reacted generously due to altruistic motives pledging donations similar to the valuation of CGYs, they did more than expected given the different donation alternatives available where many of them had higher returns and lower risk than the ITT Initiative. Therefore, we conclude that the world did not fail Ecuador rather the designers of the Initiative failed to ground it on sound economic theory and omitted relevant issues of carbon markets functioning and CDM/REDD+ framework.

Even though the parties involved in the design, management and promotion of the ITT Initiative agreed upon the normative basis of the proposal (i.e. a post-petroleum Ecuador and a post-Kyoto plan for the developing world), they failed to make this normative perspective explicit and effective in positive terms; that is, the proposal from its inception lacked of an adequate translation from norms and ideals into economic and political structures (Martin 2011). Yet, the ITT Initiative has spurred an important body of literature and has led to the more active involvement of developing countries in the mitigation actions of climate change. The road ahead will be the development of broader and better proposals for which the ITT Initiative could be considered as a predecessor though its replication in its current form is not advisable.

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