



# NOTA DI LAVORO

103.2015

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**Bargaining to Lose the  
Global Commons**

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# Climate Change and Sustainable Development

Series Editor: Carlo Carraro

## Bargaining to Lose the Global Commons

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### Summary

In "Bargaining to Lose: The Permeability Approach to Post Transition Resource Extraction" [1] Natasha Chichilnisky-Heal introduces an original and fertile explanation for the resource curse. Her "permeability" approach questions the treatment of the state as a decision maker having the public good as an objective, and replaces it by the results of a bargaining game between the state and International organizations. Her new theory is illustrated with unique hands-on experience in the case of copper and gold mines in Mongolia and Zambia, and focuses on a bargaining game between the state and key financial organizations: the Bretton Woods Institutions (IMF, World Bank) and MNCs. This piece extends and generalizes "Bargaining to lose" providing economic models that validate the original conclusions, and exploring its implications for the global commons: the atmosphere, the oceans and biodiversity. Chichilnisky-Heal's "permeable state" is a transition to a new globalized society where the sovereign state - a relatively recent creation - is receding giving rise to a new set of global economic agents and institutions that better explain the dynamics of the global commons. We show that the permeable state complements other explanations for the resource curse [2] as a global market failure magnified by globalization and based on the lack of well-defined property rights on natural resources during the pre-industrial period. We generalize Chichilnisky-Heal's "bargaining to lose" approach to the resource curse and explore its natural implications for the environmental crisis on the global commons. The solutions that Chichilnisky-Heal proposes, e.g. limiting the Bretton Woods' Institutions' 'seat at the negotiation table' of resource extraction contracts, could help resolve the environmental crisis that is based on over-extraction of global resources.

**Keywords:** Bargaining, Global Commons

**JEL Classification:** C70, C78

*This paper was presented at the Conference on "Extractive Resources and Global Governance: Distributive Justice and Institutions" hosted at Yale University on October 23rd 2015 in memory of Natasha Chichilnisky-Heal. Yale-based coordinators of the conference were Allan Dafoe and Susan Hyde. The Conference was cosponsored by the MacMillan Center for International and Area Studies at Yale University and the Harriman Institute at Columbia University.*

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# "Bargaining to Lose the Global Commons"

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Conference "Extractive Resources and Global Governance:  
Distributive Justice and Institutions " Yale University October  
23rd 2015.

## Abstract

In "Bargaining to Lose: The Permeability Approach to Post Transition Resource Extraction" [1] Natasha Chichilnisky-Heal introduces an original and fertile explanation for the resource curse. Her "permeability" approach questions the treatment of the state as a decision maker having the public good as an objective, and replaces it by the results of a bargaining game between the state and International organizations. Her new theory is illustrated with unique hands-on experience in the case of copper and gold mines in Mongolia and Zambia, and focuses on a bargaining game between the state and key financial organizations: the Bretton Woods Institutions (IMF, World Bank) and MNCs. This piece extends and generalizes "Bargaining to lose" providing economic models that validate the original conclusions, and exploring its implications for the global commons: the atmosphere, the oceans and biodiversity. Chichilnisky-Heal's "permeable state" is a transition to a new globalized society where the sovereign state - a relatively recent creation - is receding giving raise to a new set of global economic agents and institutions that better explain the dynamics of the global commons. We show that the permeable state complements other explanations for the resource curse [2] as a global market failure magnified by globalization and based on the lack of well defined property rights on natural resources during the pre-industrial period. We generalize Chichilnisky-Heal's "bargaining to lose" approach to the resource curse and explore its natural implications for the environmental crisis on the global commons. The solutions that Chichilnisky-Heal proposes, e.g. limiting the Bretton Woods' Institutions' 'seat at the negotiation table' of resource extraction contracts, could help resolve the environmental crisis that is based on over-extraction of global resources.

# 1 Introduction

In "Bargaining to Lose: The Permeability Approach to Post Transition Resource Extraction" Natasha Chichilnisky-Heal [1] tackles the *resource curse* in an original and fertile way. Her "permeability" approach questions the standard treatment of the state as a single decision maker having the public good as an objective. She offers instead a new analytical and policy oriented methodology, with hands-on experience in Mongolia and on Zambia, putting on the table the state's bargaining game with key global organizations. The state bargains with the Bretton Woods Institutions (IMF, World Bank) and with MNCs in the creation of contracts for exploiting the nations' resource extraction; these are the institutions that led the globalization of the world economy since the post WWII period when colonialism receded and was replaced by market oriented international financial institutions. Chichilnisky-Heal argues that the developing nation loses from the bargaining - and the loss is the resource curse.

This article extends Chichilnisky-Heal's work in two directions: one, providing a mathematical model that formalize her arguments about the impact of the state's permeability on the exploitation of extractive resources and showing that the model validate her results; and two, showing that the resource curse takes a particular form: accelerating and increasing the quantities of resources extracted and lowering their prices in international markets. Through Hotelling's formalization of extractive resources as financial assets, it leads to higher discount rates on the future, which in turn affects negatively savings and investment within resource rich GDP poor nations. The results link the resource curse analysis of Chichilnisky-Heal with other work (Chichilnisky [2]) that views the resource curse in developing nations as originating from the lack of private property rights on resources in developing nations, and from the Bretton Woods' institutions role in magnifying the corresponding tragedy of the commons into the global environmental crisis of our time.

The resource curse explains the failure of resource rich developing nations to use their resources as needed to achieve economic growth. It is highly applicable today to poor nations. About 70% of the exports of Latin America today are raw materials and that number is 90% in Africa. Ultimately the resource curse impacts the entire global economy and underlies the global environmental crisis. This crisis is based on the over-extraction of resources such as coal and petroleum, causing dangerous CO2 emission levels, the biodiversity loss due to over extraction of forest resources and overextraction of biomass from the oceans. Most of the natural resources consumer in the world today are extracted in poor nations (LA, Africa, post-transition economies) and they are extracted for exports, leading to today's over-consumption in the OECD world and to worldwide environmental losses.

This piece explores the assumptions in "Bargaining to lose" comparing it with the literature, and generalizes its results to explore its implications for what is usually known as the *global commons*: the atmosphere, the oceans and the planet's biodiversity. The results address the following issues: (1) whether Chichilnisky-Heal's "permeable state" represents a transition to a new

globalized society where the sovereign state - a relatively recent creation - is receding giving rise to a new set of global economic agents and institutions that better explains the dynamics of the global commons, (2) how the permeability approach substitutes and complements other explanations for the resource curse (Chichilnisky [2]) as a global market failure greatly magnified by globalization and based on the lack of well defined property rights on natural resources in poor nations during the pre-industrial period (3) provides an extension and generalization of Chichilnisky-Heal's "bargaining to lose" approach to enhance the understanding of the environmental crisis on the global commons, and the solutions that she proposes [1], e.g. limiting Bretton Woods Institutions' 'seat at the negotiation table' of resource extraction contracts, thus helping resolve the environmental crisis based on over-extraction of global resources.

## 2 The results

A simple mathematical model extend the original piece [?] under stereotyped conditions that capture its key aspects, and establish the validity of its conclusions. Both models interpret in mathematical terms the excellent policy examples and recommendations provided by Natasha Chichilnisky - Heal's original article [1], as well as her game theoretical approach to a bargaining game between the state and IFIs (International Financial Institutions). We establish how the permeability of the state causes inferior outcomes in terms of undermining the nation's economic growth and inducing poverty. Within this simplified framework the model expands on Natasha's piece by showing how the resource curse causes environmental degradation by generally leading to overextraction of extractive resources in developing nations. The oversupply of resources leads to prices that are lower than would be optimal without the permeable state, ultimately inducing overconsumption in the industrial nations as well as global loss of biodiversity, overexploitation of the oceans, and overemission of CO2 into the atmosphere..

## 3 The "permeable" state: a formal economic model

The model and their results are presented in a summarized form as appropriate for the October 23rd Yale conference. It formalizes the "permeability" approach by defining a continuous parameter  $\lambda$  with values between 0 and 1 that measures the extent of "weakened sovereignty" by the state - this is the methodology proposed in [1]. The model studies the optimal intertemporal allocation problem of a developing nation that extracts natural resource, such as for example the optimal exploitation of the largest copper-gold mine in the world that is located in the Gobi Desert Mongolia. The results show that there is overextraction in the short run and a lowering of the prices, due to the permeability of the state. In a permeable state, the intertemporal allocation in the developing

nation is compromised and becomes suboptimal, undermining economic growth and producing poverty while the nation increases its extraction and exports of resources. This is the *resource curse* that Chichilnisky-Heal focused on in her original piece. The parameter  $\lambda$  that measures permeability of the state can be interpreted as the degree of control by the state of its resources, including the state's ability to exercise property rights on the nation's territory and on its extractive resources, where  $\lambda = 1$  implies full control and  $\lambda = 0$  implies complete loss of control or lack of property rights - such as, for example, during the period of colonization. This formulation follows the approach suggested to a continuum of degrees of permeability as indicated in Chichilnisky-Heal's original piece [1]. Within this formulation we compare the intertemporal allocation of resources that occurs when the parameter  $\lambda = 1$  and when  $\lambda < 1$ . The state negotiates a contract with a MNC for extraction of resources as explained in the original piece [1] - and the model shows how a low amount of control, namely a lower value of the parameter  $\lambda$ , leads to inefficient intertemporal allocation of resources. In particular it leads to the overextraction of resources that are offered to the export markets at prices that are lower than would be optimal when  $\lambda = 1$  and there is no permeability. The result is that the developing nation overextracts its resources, and that extractive resources are excessively exported, traded in international markets, and thus undervalued. This in turn produces a negative effect on the nation's economy, leading to poverty and to suboptimal economic growth. It also leads to negative effects on the world as a whole, a massive overconsumption of extractive resources. The former is the "resource curse" and the latter is the origin of the environmental crisis in the world economy. Therefore we thus find an explanation based on the "permeability approach," for the resource curse and the global environmental crisis. The environmental crisis includes for example the overextraction of trees from developing nations' forests leading to biodiversity destruction and destruction of carbon sinks that recycle the world's carbon, as well as the overextraction of petroleum and coal leading to increased CO2 emissions and therefore to climate change.

The model we propose for the bargaining between the state and the ICIs is based on contract theory and emerges from the original Chichilnisky-Heal piece [?]. It explains the process by which a developing nation negotiates a contract with a MNC - such as Rio Tinto and the Mongolian government in the example of the copper and gold mine in Mongolia - with the participation of the World Bank as a third party that participates in the process. In the example of [1] after five years of World Bank recommendations in favor of an (unfavorable) contract with Rio Tinto the person who led the World Bank team joined Rio Tinto in a senior role once the contract was signed by the Mongolian government, see [1]. We show that "hidden contracts" - which are typical in contract theory - can emerge in this context, and use the policy example in Chichilnisky-Heal to illustrate with a real world case study. Hidden contracts are known to cause inferior outcomes in terms of the allocation of resources in the developing nation, once again explaining the resource curse as originating from the permeability of the state, as Natasha set out to do in her original piece. This contract model is not presented formally here and will be developed mathematically elsewhere.

## 4 Permeability, the Resource Curse and the Global Environment

This section examines the intertemporal allocation of resources in a nation with a permeable state. A sovereign nation  $N$  has a total amount  $M$  of an extractive resource such as gold, copper, coal, a forest, or a fishery. Developing nations typically lack private property rights for natural resources, which can be either treated as common or a free access asset or may be owned by the government, for a discussion see [2]. This is different for developed nations such as USA and Australia, where resources are typically privately owned. As examples of developing nations, consider Zambia and its copper mines, Mongolia and its Gobi Dessert's Gold-Copper mines that are the largest in the world, Brazil and its rainforests, and Nigeria and Mexico and their petroleum. In these cases the resource is either owned by the government, or in the case of Brazil the resource (the Amazon forest) is often used as a common or free access property. In all cases, there are no well defined private property rights. This dichotomy between industrial and developing nations along the lines of property rights on resources was observed in Chichilnisky [2]. In industrial nations where natural resources are often privately owned such as the US and its EXXON-Mobile petroleum, Australia and Rio Tinto, Canada and its tar sands.

Focus therefore on a developing nation  $N$ . Lacking *private* property rights, the role of  $N$ 's sovereign state is to optimize over time the extraction and sale of  $M$ , and to do so optimally for the welfare of its citizens. In general terms the value of the resource to the nation  $N$  can be represented as

$$V(M)$$

where  $V$  represents welfare that the nation  $N$  can obtain from exploiting - extracting, producing exporting and selling - the resource stock  $M$ .

This section will offer a very simple economic model that validates in standard economic terms the results in Chichilnisky-Heal on how the *permeability* of the state in  $N$  diminishes the optimal value the nation can achieve from its extractive resource. It shows how the nation ends up overextracting the resource in the short run with respect to the what would be an optimal pattern of resource extraction over time. This in turn causes lower resource prices when the nation has an impact on global markets - for example in the case on Mongolia, who has the largest copper and gold mines in the world in its Gobi Desert. In the context of nation  $N$ , the loss of welfare and the economic losses produced by the misallocation of its extractive resources undermines economic performance and can be called the *resource curse*. Obviously there may be other contributing factors, but this model suffices to indicate the extent to which the *permeability of the state* inevitably leads to the misallocation of economic resources.

The following is a simple intertemporal allocation model for nation  $N$ . From the above, the optimal intertemporal allocation problem of  $N$  can be simply summarized as the following optimal resource extraction problem over time:

$$V(M) = \text{Max}_x(x + \beta V(M - x))$$

where  $M$  is the total amount of the resource in  $N$ ,  $x$  is the amount extracted in the first period,  $\beta$  is a time discount factor indicating the value to the nation of increasing value today rather than tomorrow, and  $V(M-x)$  represents the value from extracting the remaining stock after  $x$  is extracted today. As famously indicated by Hotelling, an extractive resource can be considered a financial asset, so that its optimal allocation has to take into consideration the financial gains of extracting today and investing the money in financial markets, obtaining a financial rate of return  $r$ . The extraction plan must reflect  $N$ 's indifference between a dollar from extraction today and a dollar times  $(1+r)$  tomorrow. Therefore  $\beta$  satisfies the equation

$$\beta = \frac{1}{1+r}$$

where  $r$  is the financial return that can be obtained from extracting the resource and investing the money in a financial institution. The optimality condition is therefore

$$1 = \beta V'(M-x)$$

where  $V'$  is the derivative of  $V$  with respect to  $x$ . So far this represents in a highly simplified form the optimal extraction plan for nation  $N$  over time.

Now introduce the "permeability factor"  $\lambda$  that is defined in [1] as discussed above. In that case the optimization problem changes to

$$V_\lambda(M) = \text{Max}_x(x + \lambda\beta V(M-x))$$

where the parameter  $\lambda$  represents the degree of permeability as defined in [1] and described above. The degree of permeability is between 0 and 1, *i.e.*  $\lambda \in [0, 1]$ . When the state is permeable, for any firm that exploits the resource, the value of the second period of the contract is more uncertain, since the state cannot fully ensure a future contract for extracting the resource. The extent of this uncertainty varies with the permeability parameter, between 0 and 1, with 0 representing no property rights by the state and 1 representing full control. This decreases the firm's economic value of a contract for extraction in period 2 with respect to the value of extraction in period 1. The loss of certainty is represented here by multiplying the second term by the parameter  $\lambda$ . We therefore have the new modified optimality condition:

$$V_\lambda(M) = \text{Max}_x(x + \lambda\beta V_\lambda(M-x))$$

where  $V_\lambda(M)$  represents the optimal welfare that can be obtained under the permeability approach with permeability factor  $\lambda$ .

**Proposition 1:** When the state is permeable, any firm that exploits the resource faces an uncertain future about its contract. The extent of this uncertainty varies with the permeability parameter and more permeability decreases further the firm's economic value of a contract for extraction in period 2 with respect to the value of extraction in period 1. The result is acceleration and magnification of extraction today, and a corresponding lowering of resource



prices in international markets, leading to the resource curse. The larger is the permeability, the larger is the inefficiency.

Proof: The loss of certainty is represented here by multiplying the second term by the parameter  $\lambda$ . We therefore have the new modified optimality condition:

$$V_\lambda(M) = \text{Max}_x(x + \lambda\beta V_\lambda(M - x))$$

where  $V_\lambda(M)$  represents the optimal welfare that can be obtained under the permeability approach with permeability factor  $\lambda$ . Since  $\lambda \in [0, 1]$  we have the following inequality:

$$\begin{aligned} V_\lambda(M) &= \text{Max}_{x_\lambda}(x_\lambda + \lambda\beta V_\lambda(M - x)) \\ &< V(M) = \text{Max}_x(x + \lambda\beta V(M - x)) \end{aligned}$$

so when the state is permeable, namely  $\lambda < 1$ , the welfare of  $N$  decreases with the permeability of the state while extraction in the first period  $x_\lambda$  increases, in particular with a permeable state the extraction today increases over what is optimal leading to lower international prices for the resource. Recall the example of Mongolia, whose copper and gold mines in the Gobi desert are the largest in the world:

$$x_\lambda > x$$

This completes the proof..

**Proposition 2:** *Permeability* leads to higher discount factors in financial markets and to lower rates of savings and investment in a developing nation that would be optimal.

Proof: This follows directly from Hotelling's observation that extractive resources are equivalent to financial assets, and from the fact that more permeability is equivalent to a higher discount factor for the future..

**Proposition 3:** *Permeability* leads to global over extraction of resources and to lower resource prices. The overextraction in developing nations and overconsumption in OECD nations causes the global environmental crisis in the Global Commons: Overuse of the atmosphere (over consumption of fossil fuels as extractive resources), the Oceans (overextraction of biomass from the oceans) and Biodiversity extinction (overextraction of forests, destruction of ecosystem and landscapes).

Proof: This follows from Propositions 1 and 2, see also Chichilnisky [2]

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