Eco-regional Biodiversity Cartels on the Genetic Resource Market: the Andean Community's response to the Convention on Biological Diversity

Sarah Winands[a] *, Karin Holm-Müller[a]

[a] Institute for Food and Resource Economics, University of Bonn, Nussallee 21, 53115 Bonn, Germany

* Corresponding Author. E-Mail address: sarah.winands@ilr.uni-bonn.de; Phone: +49 228 732324

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Abstract

The United Nations' Convention on Biological Diversity raised expectations of high benefits in genetic resource trade. As a reaction the megadiverse countries of the Andean Community (CAN) passed strict community access legislation. Against this background the main objective is to investigate whether public eco-regional biodiversity cartels of megadiverse countries on the genetic resource market can increase the appropriable benefits from biodiversity. We analyse how cartel design affects cartel benefits and discuss the benefit distribution among cartel members. The CAN biodiversity collusion serves as a case study. Our main finding is that cartels–contrary to their negative connotation–are potentially able to stimulate genetic resource trade and increase the appropriable benefits from biodiversity. This depends largely on the cartel design and the ability to attract bioprospecting agents. A member's benefit share rises in the member's relative biodiversity richness and even more in the quality of the institutional environment. The CAN collusion nullifies its market power by a deterringly overly strict access regulation and a lack of internal cooperation.

JEL classification: F53, K23, Q27, Q28, Q57

Key words: cartel formation; genetic resource market; Andean Community; CBD; institutional analysis

1 Introduction

The Andean Community (CAN) made history in 1996 by passing Decisión 391 on a 'Common Regime on Access to Genetic Resources'[1]. The CAN members are unique in forming (at least on paper) what we term an *eco-regional biodiversity cartel*–a collusion[2] of megadiverse countries which increases profits through regulating genetic resource access. In this paper we discuss the role of eco-regional biodiversity cartels on the genetic resource market, i.e. cartels trading the product 'genetic resources'. We refer to the CAN biodiversity governance collusion as its presently sole, though as we expound theoretical, example. The Andes stretch over the countries Colombia, Ecuador, Peru, and Bolivia, which are currently CAN[3] members, as well as Venezuela, Chile, and to a small extent Argentina.

The CAN members decided to regulate access to their genetic resources by community law as a reaction to the Convention on Biological Diversity[4] (CBD). The CBD codified the sovereignty of nation states over their genetic resources and established an Access-and-Benefit-Sharing (ABS) mechanism to govern biodiversity use and conservation compensation around the globe in form of a bilateral instrument. The Nagoya Protocol[5] specifies this mechanism, which member countries have to implement by national legislation. Costa Rica, the Philippines, and the CAN were among the first to draft legislation, because the CBD raised high expectations with megadiverse countries to reap large benefits from their biodiversity.

Time has proven the benefit expectations of megadiverse countries to be far too exaggerated. The magnitude of *potential* bioprospecting benefits is still controversial (Barrett and Lybbert (2000); Costello and Ward (2003)) and the much fostered ABS has not lived up to expectations in terms of contract numbers and magnitude of realised benefits (Boisvert and Vivien 2005, p. 466 f.). Conceptual shortcomings together with a poor implementation of national ABS legislation (Kamau et al. 2010, p. 248), strict access regulation on the part of megadiverse countries, and thereby

[1] Comision del Acuerdo Cartagena (1996): Decisión 391: Régimen Común sobre Acceso a los Recursos Genéticos, Gaceta Oficial del Acuerdo de Cartagena, Año XII, Numero 213, Lima, 17.06.1996.

[2] We refer to a collusion when countries make secretive or open agreements to increase their benefits irrespective of whether these attempts are successful. A cartel is a collusion that is successful.

[3] The Andean states established the Andean Community with the Cartagena Accord in 1969. Chile was a member until 1976, Venezuela from 1973 until 2006.

[4] United Nations (1992): Convention on Biological Diversity, 31 Int'l Leg. Mat. 818, Rio de Janeiro, 05.06.1992.

[5] United Nations (2010): Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, Nagoya, 29.10.2010.

a presently oligopsonistic genetic resource market structure (Richerzhagen 2011, p. 2248) with few agents on the demand side, prevent countries even to obtain the benefits which could realistically be appropriated via genetic resource trade. Additionally, monitoring of ABS contract compliance proofs to be a challenge for most resource-rich countries (Ten Kate and Laird 2000, p. 244). They face asymmetric information as regards the commercial research process in the purchasing country and the sources of a final product's components. Detection of genetic resources taken without prior consent of the host country or of resources acquired through illegal trade is similarly difficult.

The appropriability of biodiversity benefits is a sufficient, albeit not necessary, condition for conservation. Political will is crucial; countries may even conserve in compliance with the CBD though they do not reap benefits. Biodiversity conservation financing has been high on the agenda of the COP 11 in Hyderabad, India, in 2012. The CBD consensus goal of increasing global conservation action codified in the Aichi targets[6] implies the need to improve the effectiveness of the ABS mechanism or to find new ways to unite use *and* conservation. A recent proposition from the field of law are regional common pools (Winter 2009). Biodiversity cartels on the genetic resource market are regional common pools of megadiverse countries which achieve market power. From this point of departure our analysis takes an unusually positive perspective on cartel formation. Biodiversity cartels, as we will expound, can for example increase transparency on the supply and demand side.

Our main objective is to investigate whether eco-regional biodiversity cartels of megadiverse countries can increase the appropriable benefits from biodiversity. We introduce the conception of eco-regional biodiversity cartels. We analyse on a generic level how cartel design impacts on cartel benefits and stability as well as how a cartel member's characteristics influence its benefit share. In our analysis we consider state-run cartels based on a multinational agreement similar to the OPEC oil cartel. We assume that cartel members are states governed by an executive which maximises the benefit of society (contract theory of the state)–in reality, the executive might have considerable degrees of freedom (North 1979). The sole state-run eco-regional biodiversity cartel formed (at least on paper) by the CAN serves as case study. It adds empirical findings to our theoretical analysis.

To the best of our knowledge, economic research has so far merely touched upon eco-regional biodiversity cartels on the genetic resource market[7], but neither

[6] UNEP (2010): CBD, COP 10 Decision X/2 Strategic Plan for Biodiversity 2011-2020.

[7] Reid et al. (1996) for example briefly mention genetic resource cartels in their general study

provided an in depth analysis of biodiversity cartels nor an economic study of the CAN biodiversity governance collusion. Closest, Vogel et al. (2000) study cartels for traditional knowledge associated with biological resources formed by indigenous communities on the ethnobioprospecting market. In addition, there are parallels to the Industrial Economics Literature, which we transfer and adapt to eco-regional state-run biodiversity cartels[8]. From a legal perspective, Asebey and Kempenaar (1995) and Tilford (1998) study cartelization on the biodiversity market, and Tafur-Dominguez (2000), Bucher (2008), Ruiz (2003), Rosell (1997), Ten Kate (1997), and Mariaca (1999) review the content of CAN Decisión 391.

The paper proceeds as follows: In Section 2 we provide an introduction to the genetic resource market and relevant CBD regulations as a background for the subsequent analysis. In Section 3 we define our concept of eco-regional biodiversity cartels more thoroughly. Next, in Section 4 we analyse the benefits which megadiverse countries can obtain from such cartels and in Section 5 their distribution among the cartel members. We discuss factors limiting cartel benefits in Section 6. Section 7 is dedicated to the CAN biodiversity collusion. With Section 8 we conclude.

2 Background: The market for genetic resources

The products traded on the genetic resource market are genetic resources, which are genetic blueprints of plants and essentially information. Countries hosting biological resources, the carrier of genetic resources, can act as suppliers on the international genetic resource market. Customers are industrial firms and their research institutes; among others pharmaceutical firms, personal care and cosmetic industries, biotechnology, seed, crop protection and horticulture companies, as well as food and beverage industries (Ten Kate and Laird 1999, p. 9).

The genetic resource market is heavily influenced by the CBD. Prior to the CBD, interested firms and research institutes could obtain genetic resources without consent of and remuneration for the supplying host country. The CBD has changed this situation in 1992. Since then, countries have sovereignty over their genetic resources. The Nagoya Protocol to the CBD obliges countries to draft access legislation and to create a Competent National Authority to administer ABS. It also details the

of the commercial value of biodiversity prospecting. Richerzhagen (2011, p. 2254) states likewise briefly that biodiversity cartels "cannot contribute to biodiversity conservation".

[8]State-run cartels are not identical to industrial cartels. Levenstein and Suslow (2006, p. 49) stress that "their goals are more complex than private cartels, including not only the maximization of joint profits, but national economic stability and international political influence as well".

bilateral ABS process[9]. A user entity, e.g. a pharmaceutical firm, has to ask a provider country for access to its biological resources (Prior Informed Consent). If granted, both parties negotiate the terms of access and benefit sharing (Mutually Agreed Terms). The benefit sharing can take various forms and may include monetary (e.g. up-front payments, royalties) and non-monetary benefits (e.g. joint R&D, knowledge transfer, technology transfer). The benefits finally agreed upon mirror the relative negotiation power of provider and customer.

In cases where a genetic resource exists in more than one country, the identification of the country of origin ('Country-of-Origin-Principle', Nagoya Protocol, *Art. 5.1*) might be problematic. Moreover, in such cases the genetic resource market is a 'Winner-takes-it-all-market', a market where the most attractive, or simply the fastest country, with which the contract is signed, obtains all benefits. This may prompt countries to engage in undercutting the others' prices in order to secure a deal. Benefits from costly conservation or rents (e.g. scarcity rents) are not distributed fairly among all countries hosting the respective species.

Expectations to realise high benefits through ABS have induced strict access regulations on the part of many megadiverse countries. Difficult through to prohibitive access presently reduces the demand for genetic resources (Kamau and Winter 2009). The current genetic resource market is characterised by few buyers; Richerzhagen (2011, p. 2248) describes it as oligopsonistic. Relaxing the access conditions increases the potential number of buyers and improves the supplier's negotiation position. The underlying demand-side structure, albeit less concentrated, is still likely to be oligopsonistic. Ten Kate and Laird (2000, p. 245) describe that "'life science titans' such as Monsanto, Novartis and Aventis evolve alongside a host of small research biotechnology companies". The supply-side concentration depends on the type of screening. Only for random screening of genetic resources do all countries with reasonable biodiversity richness compete against each other. Today, however, most screening is knowledge-based, be it 'biorational', 'chemotaxonomic' or 'ethnobotanical' (Ten Kate and Laird 2000, p. 249 f.). In this case users search for specific genetic resources. This reduces the number of suppliers beforehand. Customers interested in an endemic species[10] are likely to face a monopoly power as trading

[9]The only deviation from the bilateral system is the multilateral system established by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA; FAO Resolution 3/2001, Rome, 3.11.2001) in conformance with the CBD. It applies to specific genetic resources for food and agriculture which are listed in Annex I, ITPGRFA. We focus on the general bilateral genetic resource trade excluding Annex I genetic material.

[10]Endemic species are species with are unique to a confined geographic location.

partner. In combination, we therefore describe the genetic resource market structure as a bilateral oligopoly, or for certain specific genetic resources even as a bilateral monopoly. The host country and the genetic resource demander bargain directly over economic rents. A cartel-induced increase of concentration on the supply side will strengthen the biodiversity suppliers' negotiation position and potentially lead to a cartel monopoly as suppliers that are not megadiverse are hardly attractive.

3 The conception of eco-regional biodiversity cartels

In this section we introduce the concept and characteristics of eco-regional biodiversity cartels. To this end we transfer and adapt findings from the Industrial Economics Literature. Biodiversity cartels are eco-regioanl collusions of megadiverse countries on the genetic resource market which achieve market power. They can be seen as a subset of the regional common genetic resource pools introduced by Winter (2009). Though Winter (2009) neither refers to the CAN nor the cartel notion, the basic conception is similar: Eco-regional biodiversity cartels stretch over eco-regions and operate within the existing genetic resource market structure.

Megadiverse countries can design different types of eco-regional biodiversity cartels. They may cooperate rather loosely by, for example, coordinating information they reveal to third parties. Or, in the other extreme, they can reallocate benefits and thereby be close to maximising their joint benefit. In the following we present general dimensions of coordination, different characteristics a cartel may exhibit depending on its degree of collusion:

(i) Public notification of all bioprospecting processes.

(ii) Public register of genetic resources within the eco-region.

(iii) A regional competent authority.

(iv) Coordination of access to genetic resources.

(v) Reallocation of the cartel benefit according to a pre-defined rule.

Public notification of bioprospecting processes (i) and a public register of genetic resources within the eco-region (ii) can vary in their set-up and comprehensiveness. Notably, they are not exclusive to cartels, but cartels may act as a facilitator for them. If a cartels enjoys a high cartel power and trust among its members exists, it might have an incentive to increase bioprospecting rates via pro-active genetic

resource advertising. Joint advertising is a public good that the cartel will only provide if it can appropriate benefits from its supply, e.g. in form of a reduction in transaction costs or a higher trade volume. A regional authority (iii) may coordinate the cartel and represent it. The cartel members decide upon the range and depth of its competencies; the central authority might be responsible for or merely streamline information, communication, negotiation and trade.

Cartel members can regulate access to their genetic resources (iv). Most industrial cartels coordinate both in prices (= benefits) and market shares (Harrington 2006, p. 5)[11]. Coordinating market shares typically implies agreeing on trade volumes (volume of revenues per country) or allocating bioprospecting agents (e.g. per industry sector) according to a pre-defined rule. Considering genetic resource cartels, such rule could for example prohibit undercutting prices of another member country that is already negotiating with the customer. However, genetic resource cartels are more likely to coordinate in prices. Prices can be monetary or non-monetary benefits (ref. Section 2). Fixing explicit prices is easier if a cartel can focus on one or several endemic species. When a cartel's product is heterogeneous internal compliance control is more difficult (Carlton and Perloff 2005, p. 135). Thus, cartels might be inclined to define a standard set of non-monetary benefits. However, their downside is that information asymmetries often exist regarding their true value, e.g. a technology transferred might not be up-to-date (Vogel et al. 2000, p. 109). Contrary to standard cartel analyses (e.g. Carlton and Perloff 2005, p. 122), access coordination does not necessarily increase the total access price and reduces output: The total access price comprises the access price a provider country charges and a customer's transaction costs. If cartel access is much more streamlined, explicit and transparent after cartel formation, this reduction in transaction costs might overcompensate the rise in access price. This implies that provider countries need to consider both the direct access costs and transaction costs, which arise from their specific access regulation, in calculating their profit maximising access price.

Benefit reallocation (v) may include all or only collusion-specific additional benefits. In contrast to the latter, the former implies that countries obtain benefit shares which would otherwise accrue exclusively to a neighbouring country. Such total benefit redistribution is the strongest collusion type described.

[11]For example, the lysine cartel coordinated on one price, the citric acid cartel on two, and the electrical and mechanical carbon and graphite products cartel had many prices. The citric acid cartel additionally introduced a global sales quota for each firm, the lysine cartel a minimum sales target differentiated between global and European market, and the chlorine-chloride cartel followed the home-market-principle (Harrington 2006, p. 6, 24-26, 33).

Cartels are likely to suffer from a Prisoner's Dilemma. A country free-rides on the cartel if it cuts prices or under-reports conditions of a contract. Thus, cartels have to enforce their collusive agreement (Stigler 1964, p. 48). Punishment possibilities are generally limited. Exclusion is not an option because the high cartel price remains and makes the exclusion a treat rather than a punishment. More promising is the threat to temporarily dissolve the cartel. A review of empirical studies on industrial cartels suggests that cartels prefer to increase the probability of free-riding detection instead of adopting punishment rules which might afterwards not be enforceable (Levenstein and Suslow 2006, p. 78). Transparency increases free-riding detection. Mostly, though, incentives for truthful notification are difficult to set (Harrington 2006, p. 51). A commitment device to increase cartel stability ex-ante can take the form of strategies such as 'hands-tying' and 'union' (Kronman 1985). They purposely increase the cost of cartel break-up at the point of cartel formation; they create sunk costs. In the case of 'hands-tying' an agent gives his "reputation in the community as security for [his] promise to perform" (Kronman 1985, p. 18). By forming a 'union' agents develop common practices aimed at inducing joint welfare maximisation. Cartel members tend to be reluctant to transfer sovereignty. A combination of 'union' and 'hands-tying' could bestow the 'union' with credibility it would otherwise gain from a transferral of (more) sovereignty, e.g. eco-regional biodiversity cartels sign an international treaty ('hands-tying') that specifies the restricted competencies of a common ABS-authority ('union'). Evidence from industrial cartel shows that a competent central authority is expedient for cartel success as it is likely to avert free-riding (Levenstein and Suslow 2006, p. 69). In case of a biodiversity cartel the regional authority would have to be responsible for allocating bioprospectors and validating contracts.

4 The benefit potential for eco-regional biodiversity cartels

Megadiverse countries form a biodiversity cartel to increase their benefits. Benefits arise from cartel power which allows to realise a higher cartel price and from economies of scale which lead to a reduction in transaction costs. Thirdly, cartel members can also benefit from institutional factors such as transparency and reputation. The cartel design influences the set of benefits potentially available to the cartel. In the following, we discuss the benefits achievable by a far-reaching eco-

regional biodiversity cartel[12] that uses all design options (i) to (v) to include the entire amplitude of benefits in our analysis.

4.1 Cartel power

Cartel power allows to restrict the genetic resource access in order to realise higher profits–cartel profits. Cartel power consists of two related components: (a) *'market power'* (also referred to as 'strategic power' or 'bargaining power' (Komorita 1977, p. 68)) and which describes "the ability to price profitably above the competitive level" (Carlton and Perloff 2005, p. 8), and (b) *'bargaining strength'* which describes the cartels ability to speak with one voice, act as one, and commit credibly (also termed 'tactical advantage' (Komorita 1977, p. 68)) .

Bargaining strength prevents cartel members from being played off against each other and thus from access price cutting on an oligopolistic market. In a situation of a bilateral monopoly, cartel members are able to appropriate a higher percentage of a potential price differential between the buyers willingness-to-pay and the own willingness-to-sell. Moreover, bargaining strength reduces negotiation costs. Bargaining strength is easier to achieve if one has market power, but if one has market power one does not necessarily have bargaining strength and one can have bargaining strength without market power. A central access authority (iii) may facilitate obtaining bargaining strength; its success depends not on its existence but on its competencies and credibility. The cartel members will have to find a way of assuring its credibility, e.g. by agreeing on guidelines that balance freedom of authority and own sovereignty. In the context of contracts on genetic resource use this balancing act is tricky. The competent authority will negotiate every deal anew as there are no standardised products and prices, and will thereby accumulate considerable knowledge. This knowledge lead may erode the power of the cartel members and make them dependent on the central authority.

Market power is the stronger the higher the share of global biodiversity, the higher the estimated share of unknown species, and the larger the number of endemic species the eco-regional biodiversity cartel represents. The higher the market power, the greater the ability to dictate the trade conditions. The lower the market share the more important is bargaining strength: Cartels on an oligopolistic market with a high bargaining strength–acting credibly as one–are similarly likely to dictate the terms of trade. Both, market power and bargaining strength are important. Only if

[12] We use the term eco-regional biodiversity cartel in the following to refer to such far-reaching collusion if not indicated otherwise.

one has bargaining strength, one can profit from market power; and without having at least some market power, bargaining strength is irrelevant.

The effectiveness of the cartel's power in rising prices depends on the demand elasticity. Theoretically, demand elasticity hinges upon the ease of substituting genetic resources, random or specific screening. Reid et al. (1996, p. 168) assume good substitutability and thus elastic demand. Yet, Holm-Müller et al. (2005, p. 55) present evidence from Germany that the industry assumes a continued importance of genetic resources (and that some industry sectors[13] even expect the importance of genetic resources to grow in the future).

4.2 Economies of scale

Economies of scale in administration, monitoring, and enforcement may arise from collusion due to joint access regulation (iv) and mutual exchange of information, especially if facilitated by a central administrative authority (iii). The information complexity is distributed over all cartel members. Besides, knowledge spillovers and learning by others occur, which lessen each country's information burden share even further. This includes information production regarding the CBD, its ABS regulation and international negotiations, the reliability of customers, as well as information on genetic resources and related pharmaceutical and biotechnological knowledge. Public notification of ABS processes (i) further contributes to economies of scale in monitoring a customer's usage of genetic material and products developed thereof. Closely related, it also reduces the enforcement costs as non-compliance by prospecting agents is discouraged by a higher threat of detection.

A central organisation (iii) may increase the visibility and effectiveness of marketing campaigns and realise economies of scale in advertising; a public resource register (ii) will support these activities. Exchange of information through a regional authority may additionally create economies of scale in biotechnological development. Collusion increases the chance that the worldwide unevenly distributed information on genetic resources and related biotechnological knowledge reaches a cartel member. It also reduces the degree of uncertainty inherent in this information as it can be verified with other cartel members. A public resource register (ii), public notification of ABS processes and the genetic resources involved (i), and benefit reallocation of non-monetary benefits in form of joint research and development (v) contribute to economies of scale in biotechnological development as well. They may arise even

[13] Botanical medicine, cosmetics and care, horticulture, and livestock breeding.

if a country is the most developed country of the cartel. It will gain from a wider research network with an increased rate at which new developments occur. Additional side-benefits from a regional authority (iii) are possible regarding the management of cross-border affairs such as invasive species and effectiveness of regional policies like for example nature conservation zones.

4.3 Positive influence on institutional factors

The biodiversity cartel influences institutional aspects within the member countries: Neighbouring countries that build (slightly) different institutions for the same purpose enable institutional learning and adaptation and thereby enhance institutional functioning. The regional competent authority most probably reinforces institutional capacity. Joint action may create a communal spirit and trust, and property rights enjoy a stronger enforcement as the other cartel members have an incentive to recognise and support enforcing them. The cartel may build up reputation. Reputation generates "idiosyncratic exchange relations" that withstand trade disruptions better (Williamson 1979, p. 240 f.). However, it is a transaction-specific expenditure and much dependent on the customer's perception. The return, becoming a preferable trading partner, is incalculable.

The prospecting firm enjoys access to detailed public information on the cartel's genetic resources and access requests by competitors if the cartel includes public announcement of ABS processes (i) and a regional genetic resource register (ii). Moreover, biodiversity cartels which regulate access to the entire eco-region (iv) and establish a central access authority (iii) reduce the transaction costs for customers by facilitating the identification of the country of origin; especially in combination with a genetic resource register and if the requested plant is endemic in the eco-region. Similarly, the biodiversity supplying country has a higher probability to know about the bioprospecting firm from other cartel members (i, iii). This diminishes the principal-agent-problem of moral hazard, i.e. the threat that the prospecting firm undermines the contract by, for example, using the genetic material for research other than agreed upon. Far-reaching collusion reduces the information asymmetry problem on both resource demand and supply side. Transparency in biodiversity transactions lowers transaction costs in form of monitoring and enforcement costs for the host countries and in form of searching costs for the prospecting firms.

The biodiversity cartel can influence some, although probably not the most important 'institutional factors'–components of the institutional environment. The

institutional environment refers to a country's political and economic setting, which is simultaneously dependent on many factors such as corruption, delinquency, unemployment, and trust (Davis and North 1970, p. 133). More specifically, the cartel cannot, for example, provide remedy for poor statal enforcement such as control of illegal trade in genetic resources or even stealing of resources. Similarly, regional cartels do not have a direct impact on the deficiencies of national biodiversity governance institutions to which Kamau et al. (2010, p. 248) refer. They might give an additional (needed) stimulus though and reduce institutional transaction costs of implementing these institutions through economies of scale.

We summarise and give an overview in Table 1 of how different design features contribute to and facilitate a cartel's ability to appropriate benefits from collusion, assuming that all cartel agreements can be implemented credibly.

Table 1: Cartel design features (i) to (v) contributing to cartel benefits.

Benefit type	**Public notification**	**Public resource register**	**Regional authority**[◇]	**Access coordination**	**Benefit reallocation**
Market power					
Influence on market price				x	
Bargaining strength vis-à-vis customers					
Better trade conditions			x	x	
Reduced negotiation costs			x	x	
Economies of scale					
Administration			x	x	
Monitoring	x		x	x	
Enforcement	x		x	x	
Advertising		x	x		
Biotechnological development	x	x	x		x
Cross boarder affairs			x		
Institutional factors					
Communal spirit*	x	x	x	x	x
Transparency, demand side	x	x	x	x	
Transparency, supply side	x		x		

◇ The benefits realised through creating a central organisation are conditional on the institutional competencies. Here we list all potential benefits, i.e. the benefits of a sovereign regional authority.

* Communal spirit manifests itself inter alia in the mutual recognition of property rights.

5 The variability in cartel members' benefits

In this section we analyse the distribution of the total cartel benefit among cartel members. It is influenced by the members' characteristics and the cartel design. We derive two factors that largely determine a cartel member's share of benefits.

We first consider cartels that coordinate in prices: Once the cartel has attracted a trading partner, cartel members compete against each other in the process of finalising the contract between the customer and one of themselves. A cartel member is the more attractive the higher its relative biodiversity share and the lower the transaction costs for the customer, i.e. the better the institutional environment.

For cartels whose members coordinate on an internal benefit redistribution (iii) or on market shares, the relative distribution of the total cartel benefit among cartel members depends on the respective allocation rule. A total redistribution of benefits (in contrast to collusion-additional benefits) deters countries being close to a monopoly power in genetic resource trade, because the share of reallocated cartel benefits tends to be lower than their benefit without cartel formation. Benefit redistribution might attenuate the "Winner-takes-it-all-market" (ref. Section 2) but is unlikely to lead to distributional justice. Even if a cartel covering all countries that host a certain species agrees on a benefit sharing rule, this rule is likely to reflect the power asymmetries between the cartel members. A more in-depth analysis of a rule for the redistribution of benefits and internal benefit spillovers or of market share allocation regulations is beyond the scope of this paper. In the end, though, these rules mirror the relative power of cartel members. The latter depends on the cartel members' relative biodiversity richness and relative political power, which tends to be correlated with the relative institutional environment. Thus, our analysis applies also to a cartel that redistributes benefits.

A cartel member's benefit share then generally depends on the cartel member's (a) respective institutional environment and (b) relative level of biodiversity and number of species endemic in its territory as compared to the other countries of the eco-region. We classify the cartel members accordingly and give an an overview of relative cartel benefit shares in Table 2. Ceteris paribus, a relatively favourable institutional environment in comparison to other cartel members leads to higher benefits. The same applies to a ceteris paribus relatively higher biodiversity richness. The country with an institutional trade advantage or an Hecksher-Ohlin comparative advantage relating to biodiversity endowments will thus obtain the contract. Richerzhagen and Holm-Müller (2005) emphasize the importance of the institutional

Table 2: Cartel members' relative benefits

		Relative biodiversity richness	
		low	high
Relative institutional environment	unfavourable	+	++
	favourable	+++	++++

environment for attracting biodiversity trade. In our case of megadiverse countries, we assume that a relatively favourable institutional environment is more important for the magnitude of the benefit share than a comparably high biodiversity richness. A cartel member with the comparatively best institutional environment and the highest biodiversity richness will reap the highest benefits (++++). It can appropriate the largest share of the benefits collusion adds to those of bilateral trade. A country with a good institutional environment and lower biodiversity richness than another cartel member with an relatively unfavourable institutional environment will gain more from cartel formation than this other member (+++ /++). The cartel member with the poorest institutional environment and the relatively lowest biodiversity richness will hardly obtain any benefits from cartel formation (+).

6 Factors limiting a biodiversity cartel's benefits

Cartel benefits are limited by internal and external factors, which we discuss in turn in this section. They reduce the magnitude of a biodiversity cartel's appropriable benefits up to nullifying them if they cause the cartel to break-up.

6.1 Internal factors

Collusion entails new transaction costs that reduce the overall benefit from cartel formation. These are notification, coordination, and negotiation costs within the cartel, costs for enforcing the cartel agreement internally, and costs for commitment devices. Moreover there are costs of compromises as the agreement might deviate from the individual optimum.

Internal cartel stability depends largely on a cartel's own coordination success. Coordination is eased the more, the better the cartel design respects the structural differences in biodiversity endowments between members, such as taking account of differences in endemic species. Unfortunately the cartel design might ex-ante facilitate coordination, but be ex-post unattractive. Benefit redistribution (v), for

example, can serve as a stabilising element in the face of uncertainties about deviations from the expected trade distribution (Levenstein and Suslow 2006, p. 71). Once the uncertainties are revealed the regulation may become unattractive; cartel stability is challenged and depends yet again on the ability of the cartel members to flexibly coordinate themselves. State-run cartels endure the additional problem of political subject-linking. Their cartel members might take decisions which are grounded in strategical considerations independent of genetic resource trade.

Cheating by cartel members about trade agreements threatens internal stability of some cartel types, especially those cartels which regulate prices (iv) or redistribute benefits (v). Punishment possibilities for cheating are generally limited (ref. Section 3). In any case, Levenstein and Suslow (2006, p. 78) affirm in a review of empirical studies of industrial cartels that in the ever-changing cartel environment free-riding is less challenging than bargaining problems.

A further benefit limiting factor is the presently frequent choice of a complicated and burdensome access regulation. It strongly reduces the frequency of genetic resource transactions or prevents them entirely. Easy and valid access for an eco-region will render trade more attractive. It is independent of cartel formation though. Cartel formation may work in both directions: Joint action and increased information reduce the threat of moral hazard and may induce an easy access regulation to attract more buyers. However, eco-regional biodiversity cartels–exemplified by the CAN (ref. Section 7)–face the same potential trap of strict access regulation, which might even be greater due to the countries' strong belief in their cartel power.

6.2 External factors

The most important external factor threatening a biodiversity cartel is a synthetisation of a near-perfect substitute for the cartel's most important genetic resources. Substitutes limit a cartel's benefits and can even render the cartel redundant. Besides, cartel power might be threatened by material in ex-situ collections which has been obtained prior to the CBD (Richerzhagen 2011, p. 2251).

Irrespective of collusion, genetic resource trade captures only the theoretically appropriable benefits. The flow of benefits, however, that a hypothetical, global social welfare maximizing agent would consider is much broader; it also includes the genetic resource base. Eco-regional biodiversity cartels operate on the existing genetic resource market. Its members suffer from this market failure; they appropriate only parts of the value of their genetic resources.

Entry, another external threat, often challenges industrial cartels (Levenstein and Suslow 2006, p. 49), but hardly so eco-regional biodiversity cartels. Countries cannot enter the genetic resource market like any other industrial market. They have to hold the respective genetic resources naturally within their territory. The sole exceptions are countries that have so far not marketed their resources and countries that host international gene banks. The threat posed by the former is tractable as their number is restricted to the countries of the eco-region. The latter cannot freely trade the resources because they are subject to international agreements.

7 The Andean Community Biodiversity Collusion

In this section we analyse the status-quo of the Andean Community's public eco-regional biodiversity collusion which is legally based on Decisión 391 "Régimen Común sobre Acceso a los Recursos Genéticos" and Resoluciónes 414[14] and 415[15] detailing an application form and a model contract. We describe the characteristics of the CAN biodiversity collusion in Section 7.1. In Section 7.2 we assess the Andean countries' *potential* collusion benefits and in Section 7.3 their *actual* benefits.

7.1 The characteristics of the CAN biodiversity collusion

The CAN members' motivations and incentives to collude on the genetic resource market influence the biodiversity collusion's shaping, implementation success, and stability. We therefore briefly sketch these before we discuss the characteristics of the CAN biodiversity collusion as laid out in Decisión 391.

The Andean Countries' motivation to collude in regulating biodiversity access is a mixture of monetary and non-monetary incentives. Ruiz (2003, p. 11) reports that perceptions of excessive biopiracy and the related expectation of high potential commercial gains from regulated genetic resource trade largely influenced the drafting of Decisión 391: Those involved thought of bioprospecting as a "fountain of considerable richness". The CAN intends with Decisión 391 to "establish the conditions for just and equitable participation in the benefits of the access" (*Art. 2a*) and to "strengthen the negotiating capacity of the Member Countries" (*Art. 2e*).

[14] Comision del Acuerdo Cartagena (1996): Resolución 414: Adopción del modelo referencial de solicitud de acceso a recursos genéticos, Gaceta Oficial del Acuerdo de Cartagena, Año XIII, Numero 217, Lima, 05.08.1996.

[15] Comision del Acuerdo Cartagena (1996): Resolución 415: Adopción del modelo referencial de contrato de acceso a resursos genéticos, Gaceta Oficial del Acuerdo de Cartagena, Año XIII, Numero 217, Lima, 05.08.1996.

For parts of the Andean countries' populations biodiversity is of spiritual, cultural and identity conveying value. They are emotionally related to their enormous biodiversity richness. A recent manifestation is the popularity of 'Sumak Kawsay' (Good Living), which was included in the Ecuadorian Constitution in 2008. Gudynas (2011, p. 231) explains 'Sumak Kawsay' as an attitude by which people respect the intrinsic values of nature: "Good living implies a new manner of conceiving the relationship with nature, as assuring simultaneously the well-being of humans and the survival of plant species, animals, and their ecosystems." This affinity to nature is used in (inter)national political debates such as Eva Morales' speech at the Copenhagen Climate Summit in 2009, the Yasuí initiative aiming to trade 'refraining from oil drilling' against 'biodiversity payments' (Gudynas 2011, p. 240 f.) and, our focus, CAN Decisión 391. Nevertheless, other decisions indicate that it may be no more then mere lip service: new oil concessions in the Ecuadorian biodiversity rich provinces of Morona Santiago and Pastaza[16] or the copper mining concession for the project Mirador for the Chinese company Ecuacorrientes SA (ECSA) in the biosphere reserve 'Cordillera del Cóndor' in the province of Zamora Chinchipe[17].

Decisión 391 is embedded in the existing political-institutional environment of the CBD, the Cartagena Agreement, the CITES Convention, intellectual property rights and existing environmental provisions (*Art. 13, 14, 25, 31*). It is directly applicable in Colombia; Peru, Ecuador, and Bolivia drafted special national legislation (Díaz 2000, p. 10). Thus, access regulation is streamlined, but not uniform.

The CAN collusion has the following characteristics, which we discuss in the ordering of Section 3: It includes the notification of all other Competent National Authorities (*Art. 48, 49*) and the public of ABS processes (*Art. 18, 21, 27, 28*) (i). The CAN stipulates short time limits for the Competent National Authorities to notify the public after application entry (5 days, *Art. 28*), to evaluate the application after registration (30 days, *Art. 29*), and to inform the applicant after the evaluation completion (5 days, *Art. 30*).

Art. 50n calls upon the Competent National Authorities to lead a national genetic resource register (ii). Columbia created such inventory (Law 99, Art. 5). Yet *Art. 50n* neither requires additional screening and collecting activities nor a public access to the inventory.

[16] "Primeros barriles del sur oriente, para el 2017", *El Comercio*, 20.10.2012; accessed online on 12.12.2012: www.elcomercio.com/negocios/Primeros-barriles-sur-oriente-hidrocarburos-barriles-Ecuador-petroleo_0_794920663.html.

[17] "Contrato minero Mirador se firma hoy en medio de dudas", *El Universo*, Quito, 05.03.2012: accessed online on 12.12.2012: http://unvrso.ec/00031VS.

Decisión 391 inaugurates the 'Andean Committee on Genetic Resources' with *Art. 51* (iii). Alongside general coordination and recommendation tasks, it is responsible for outlining a joint database for access applications and contracts (*Art. 51c*) as well as a joint warning system for access problems (*Art. 51g*), promoting joint research and technology transfer (*Art. 51d*), and "promoting management, surveillance, control and supervision of access relating to genetic resources and their by-products that exist in two or more Member Countries" (*Art. 51f*). The Andean Committee functions as umbrella organisation of the Competent National Authorities. The latter keep their sovereignty over granting access and draft national access regulation, though subject to Decisión 391 (*Art. 5*)[18].

The CAN provides detailed genetic resource access regulation (Decisión 391 *Art. 16 - Art. 47*, Resolución 414, Resolución 415) which includes access to in-situ and ex-situ resources, their by-products and intangible components (*Art. 1, 3*)(iv). The CAN member states coordinate primarily on non-monetary or indirect prices: CAN nationals have to be part of the research, research in the country of origin has to be supported, knowledge transfer mechanisms have to be established and state of art knowledge about the resource and method in question to be transferred, and the institutional development in the country of origin and the competencies of local communities have to be supported (*Art. 17a-f*). Moreover, prospectors have to supply duplicates of collected resources and the research results to the Competent National Authority, as well as the material transfer conditions of contracts signed with other parties (*Art. 17g-i*). Only if the prospector provides the state of art information about the resource, its uses, and the associated risks, access will be granted (*Art. 22*). *Art. 35* requires a benefit sharing agreement as annex to the access contract. However, neither Decisión 391 nor the model contract specify a classification and assignment of genetic resources to benefit requirements and regulations.

The CAN members do not redistribute benefits (v). The Competent National Authority with the highest chance of attracting a bioprospector, which might simply be the fastest one, enters into contract with the agent and obtains–if existent–the entire profit. The 'Winner-takes-it-all-market' exists.

7.2 Benefits as expected per collusive agreement

We first investigate the total benefits the CAN could achieve in theory based on Decisión 391 and then their distribution among cartel members.

[18]Decisión 391 has precedence over national law (Bucher 2008, p. 112).

The CAN's total collusion benefits We discuss in turn the theoretical benefits the CAN could potentially realise from a collusion-induced increase in cartel power, economies of scale, and institutional factors (ref. Section 4). They are in discordance with actual benefits (Section 7.3).

Cartel power. The Andean countries host two biodiversity hotspots, the 'Tropical Andes Hotspot' and the 'Tumbes-Chocó-Magdalena Hotspot' (Mittermeier et al. 2004), as well as important wilderness areas. The Tropical Andes Hotspot is acknowledged in the community's name and the leading of the 35 world biodiversity hotspots[19] (Mittermeier et al. (2004); Williams et al. (2011)). It has the highest estimated number of endemic plant and vertebrate species and the second largest remaining primary vegetation area (Mittermeier et al. 2004, p. 32 f.). The entire CAN biodiversity covers 25% of global biodiversity (ERB 2002, p. 13). Considering specific screening, the CAN's market power for a specific species depends on the global distribution of that species. The CAN is able to exert a monopoly power on the market for many endemic species. In the less frequent case of random screening, a market share of a quarter of the global biodiversity market will, if complemented by bargaining strength, allow the CAN to achieve cartel power.

Economies of scale. CAN biodiversity cartel members inform each other about all ABS-related aspects including in cases of defraud (*Art. 48, 49*). Thereby they profit from a reduction in information costs regarding monitoring and enforcement activities. The CAN collusion also achieves economies of scale in administration with Resolución 414 specifying a model application form and Resolución 415 outlining a model contract. The CAN cartel is equally likely to realise economies of scale in biotechnological development. One major aim of the CAN is to foster exchange and development of technologies and scientific and technological knowledge (*Art. 2d, 8, 9*). To this end CAN members are to organise subregional trainings (*Art. 10*) under coordination of the Andean Committee (*Art. 51d*). *Art. 17c* requires mechanisms to transfer state of art knowledge about resources, which customers demand, and the method they use. Moreover, economies of scale in conservation are likely to arise from cooperation in this field (*Art. 10*).

Positive influence on institutional factors. The CAN biodiversity cartel stipulates "national, and not discriminatory, treatment" among cartel members as regards access (*Art. 11*). Moreover, Decisión 391 acknowledges the property rights of "the native, Afro-American and local communities" (*Art. 7*) and demands their recog-

[19] Biodiversity hotspots are areas hosting at least 0.5% of global plant species as endemic ones and that have diminished to 30% of its original size (Myers et al. 2000).

nition in access contracts (*Art. 34*). If implemented, both regulations have the potential to ease national as well as regional societal distress. However, there is also a risk that indigenous communities generally refuse the marketing of genetic resources they perceive as holy.

Decisión 391 increases transparency in genetic resource trade, both on demand and supply side. A CAN member country should know about prospecting activities of, compliance by and sanctions for an agent by other CAN members (*Art. 48, 49*). Information on all ABS processes and contracts is public information (*Art. 18, 21, 27*)–access applications and approvals are published in the newspaper (Art. 28, 38)–and thereby the CAN members can possibly count on additional information about the customer from the public domain. The prospecting firm has to inform the CAN contract party about the requested genetic resource (*Art. 22*). The high discovering probability created by joint CAN action and strict disclosure provisions reduces the threat of moral hazard. Similarly on the demand side, the prospecting firm enjoys transparency about the access procedure, the terms of the model contract (Resolución 415), and potential rival applicants[20] (*Art. 18, 21, 27, 28, 38*). *Art. 15* calls for "clear, effective, well-grounded and lawful" access processes and *Art. 28, 29, 30* ensure timewise procedural certainty. Furthermore, Decisión 391 includes a "national inventory of genetic resources and their by-products"(*Art. 50n*), however does not mention whether bioprospectors can obtain access to it.

The collusion members' benefits In the following we analyse the distribution of the potential collusion benefits–as resulting from our previous theoretical analysis–among the CAN member countries. The members Colombia, Ecuador, Peru, and Bolivia are all megadiverse countries, but differ in their relative biodiversity richness and their number of endemic species. They also vary in their institutional environment. The two factors in combination determine the share each member country can obtain from a potential given total benefit (ref. Section 5).

Relative biodiversity richness. Colombia, Ecuador, and Peru share the Tumbes-Chocó-Magdalena Hotspot in addition to the Tropical Andes Hotspot, which also stretches across Bolivia. Table 3 presents Groombridge and Jenkins's (2002) World Biodiversity Atlas figures for biodiversity richness and endemism of the Andean countries. Not surprisingly Bolivia has the comparatively lowest diversity in terms of biodiversity richness and endemism (0.239). Colombia scores highest (0.538),

[20] *Art. 19* allows for confidential treatment of information that "could be put to unfair commercial use by third parties" subject to restrictive conditions.

Table 3: Andean countries' biodiversity richness and endemism* (Groombridge and Jenkins 2002, p. 295 ff.)

Country△	Diversity Index ◇	Deviation from exp. richness†	Mammals			Birds			Plants	
			tot.	end.	threatened no. (%)	tot.	end.	threatened no. (%)	tot.	end.
Argentina	0.196	0.423	320	49	32 (10)	897	19	38 (4)	9,372	1,100
Bolivia	0.239	0.882	316	16	23 (7)	–	18	27 (–)	17,367	4,000
Chile	0.112	0.229	91	16	21 (23)	296	16	15 (5)	5,284	2,698
Colombia	0.538	1.685	359	34	36 (10)	1,695	67	77 (5)	51,220	15,000
Ecuador	0.353	1.519	302	25	31 (10)	1,388	37	60 (4)	19,362	4,000
Peru	0.369	1.344	460	49	47 (10)	1,538	112	71 (5)	17,144	5,356
Venezuela	0.379	1.398	323	19	25 (8)	1340	40	24 (2)	21,073	8,000

* Endemism refers here to species endemic to one particular Andean country.

△ Andean countries which are not part of the cartel are written in italics.

◇ The diversity index is the mean of biodiversity richness and endemism. It ranges from 0 - 1, where globally Brazil has the highest index value of 0.74 and Colombia ranks fifth. The calculation is given in Groombridge and Jenkins (2002, p. 295).

† The relative biodiversity richness with regard to a country's territorial size. Groombridge and Jenkins (2002, p. 296) use the Arrhenius equation for this calculation. Globally, Indonesia has the highest relative biodiversity richness with a value of 1.844, Colombia ranks second, Ecuador third, and Brazil forth with a value of 1.436.

followed by Peru (0.369) and Ecuador (0.353). Biodiversity richness per area is important for the screening costs bioprospectors face. Here Colombia ranks again first (1.685) and Bolivia last (0.882). Ecuador (1.519) though has a higher per area biodiversity richness than Peru (1.344).

Relative institutional environment. We use the Transformation Index BTI 2012[21] (Bertelsmann Stiftung 2012) to compare the institutional environment of Colombia, Ecuador, Peru, and Bolivia. We have chosen the BTI status ranking because it combines political and economic transformation measures that are relevant for our analysis[22]. Table 4 presents the status ranking calculated by the BTI 2012 for the Andean countries. Peru achieves the relatively highest status index (6.94). Colombia (6.28) ranks second, closely followed by Bolivia (6.23). Ecuador has the comparably lowest political and economic transformation index (5.39). As the index values lie close to one another the ranking should be interpreted cautiously; not only due to

[21] The BTI status index combines political (stateness, political participation, rule of law, stability of democratic institutions, and political and social integration) and economic transformation (level of socioeconomic development, organization of the market and competition, currency and price stability, private property, welfare regime, economic performance, and sustainability) criteria. A detailed explanation of the index and its method is provided in Bertelsmann Stiftung (2012) and online at www.bti-project.org (last accessed on 29.04.2013).

[22] The frequently used alternative are the governance indicators of the Worldwide Governance Indicators (WGI) project (http://info.worldbank.org/governance/wgi/index.asp, last accessed on 11.01.2013). However, they are not appropriate for our analysis as the WGI project does not aggregate the six dimensions of governance; an own aggregation would be speculative.

Table 4: The relative institutional environment of the Andean countries (BTI 2012, www.bti-project.org)

Country*	Status index	Political transformation	Economic transformation
Argentina	6.95	7.55	6.36
Bolivia	6.23	6.85	5.61
Chile	8.87	9.20	8.54
Colombia	6.28	6.05	6.50
Ecuador	5.39	5.70	5.07
Peru	6.94	6.70	7.18
Venezuela	4.47	4.40	4.54

* Andean countries which are not part of the cartel are written in italics.

the high aggregation level, but also because thresholds are likely with regard to the importance of the relative institutional environment for benefit appropriability.

Relative benefit share. Combining the scores in relative institutional environment and biodiversity richness we can deduce a very tentative ranking in benefit shares. To this end Figure 1 shows the cartel members' performance in these two dimensions in a single graph. A clear ranking in benefit shares is *not* possible. Peru and

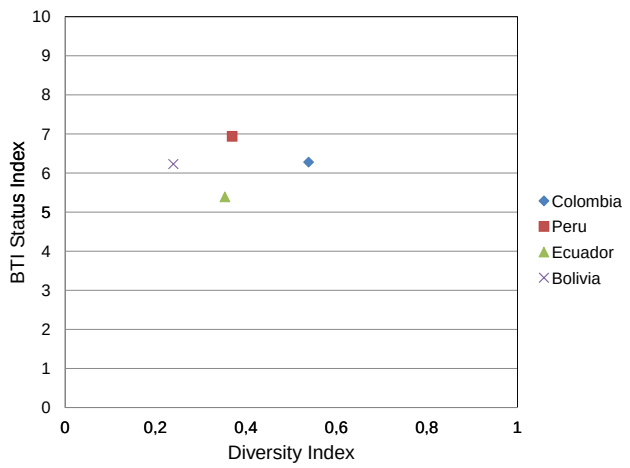

Figure 1: Relative institutional environment and biodiversity richness of the CAN cartel members (after BTI 2012 (www.bti-project.org), Groombridge and Jenkins (2002, p. 295 ff.))

Colombia have a strict dominance in benefit share appropriability over Ecuador and Bolivia. A ranking between Peru and Colombia and between Ecuador and Bolivia is speculative. If we put a higher weight on the comparative performance in institutional environment (due to the megadiversity of all countries; ref. Section 5),

we would assign a higher chance of appropriating benefits to Peru than to Colombia, as well as to Bolivia as compared to Ecuador.

Following our assessment, Chile, Argentina, and Venezuela, which belong to the same eco-region but not to the CAN, have lower chances to benefit from cartel formation than the current CAN members. In the BTI 2012 status index (BTI 2012, www.bti-project.org) Venezuela performs worst among the Andean countries (4.47). The status index is high for Argentina (6.95) and even higher for Chile (8.87), but they have comparatively very low diversity index scores (Chile 0.122, Argentina 0.196 (Groombridge and Jenkins 2002, p. 295 ff.)). The vast majority of the Tropical Andes is in effect located in the current CAN member states, and the Andes make up only a relatively small part of Venezuela's, Chile's and Argentina's total land size. With in comparison relatively low biodiversity richness and endemism they have little chance of attracting numerous prospecting firms. An Andean country with a low probability to act as contracting party will over-proportionally shoulder cooperation costs, possibly to the extend that it has no incentive for regional collusion. Chile's, Argentina's, and Venezuela's interest to collude is therefore low. Our approach is able to explain the actual composition of the CAN collusion.

7.3 Actual benefits of a cartel that is none

In this subsection we evince the discrepancy between the considerable potential benefits described previously and the limited benefits actually realised. The CAN members admit in their Regional Biodiversity Strategy (ERB 2002, p. 34) that there only "exist isolated experiences of sharing of benefits arising from access to genetic resources" and that they are "confronted by problems hindering the application of Decision 391; and this Decision, in spite of its importance, has not so far proven itself to be an effective instrument for achieving the hoped-for sharing of benefits." Ruiz (2008, p. 17) compiles 8 contracts for Colombia and 5 for Bolivia until 2007, whereby we have no information whether these are commercial contracts. Peru was involved in two commercial contract negotiations, but could not conclude them successfully[23]. Ecuador records none[24]. Viewed over one decade, these are few–if

[23]Personal communication with Ms. Maria Luisa Del Rio Mispireta (National Focal Point Peru and *Miembro del gabinete de asesores del ministro del ambiente de Peru*) on the occasion of the First meeting of the Plenary of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES-1) in Bonn on 23.01.2013.

[24]Personal communication with Dr. Wilson Rojas (National Focal Point Ecuador and Coordinator of the *Unidad Recursos Genéticos, Dirección Nacional de Biodiversidad, Ministerio del Ambiente de Ecuador*) on the same occasion and date.

not none–commercial deals and benefits compared to initial expectations.

A high market share alone does not lead to high benefits; demand has to be considered as well. The CAN drafted a complicated access regime instead of creating a favourable prospecting climate. Currently, high transaction costs negatively affect a prospecting agent's interest in trading genetic resources with the CAN. Admittedly, some reductions in transaction costs occur due to the timewise procedural certainty provided by Decisión 391 as well as the model application form (Resolución 414) and the model contract (Resolución 415). However, these are outweighed by transaction costs newly created by Decisión 391. Especially the non-monetary benefit requirements related to joint research, knowledge transfer and institutional development listed in *Art. 17* might be too complicated and costly for prospectors to deliver. Additionally, shared competencies between national authorities, local communities and the Andean Committee are perceived as a hindrance (Bucher 2008, p. 147 f.). The customers' "Country-of-Origin" identification problem is not overcome.

The high total access price is not profit maximising and Decisión 391 inefficient: Bioprospectors pay high costs due to strong and bureaucratic regulations, but the cartel members receive little of the payments - most costs are transaction cost lost for all in inefficient trade. In addition, transaction costs also rise for cartel members (further diminishing their small profits) due to negotiation, coordination, notification, and communication costs as well as costs of compromises. Ruiz (2003, p. 13) reckons that the CAN states have underestimated the latter ex-ante.

Incomplete national implementation of Decisión 391 together with a low bargaining strength due to limited cooperation might imply that the cartel power is low–and not only superimposed by overly strict access regulation. Ruiz (2008, p. 18) attests an absence of political will among the member countries to prioritise the functioning of Decisión 391. There is no cooperation between the national focal points, no benefit transfers between member countries exist and the importance of the Andean Committee is limited because it has no own finance.[25] The scarce implementation of the provisions of Decision 391 (e.g. the *First Complementary Provision* aims for funding for the Decisión) imply that economies of scale and improvements in institutional factors will be limited. It is not clear to what extend communal spirit and trust prevail among the cartel members. Missing trust explains why amendments that improve upon the known deficiencies of Decisión 391 or advancements in its implementation are absent. Ruiz (2003, p. 12) also contests the incentives for

[25]Personal communication with Ms. Maria Luisa Del Rio Mispireta and Dr. Wilson Rojas (ref. footnote 23, 24).

communitarian action. Related political motives are important as well; Venezuela, for example, resigned from the CAN in 2006 as a reaction to Colombia and Peru signing free trade agreements with the United States (Malamud 2006, p. 1). Such disputes among cartel members diminish a cartel's bargaining strength, as could also be observed in case of the OPEC cartel during the Iraq-Iran war in the early 1990s. As a result the internal stability of the cartel is weak. Altogether, the CAN biodiversity cartel resembles a paper tiger, a collusion without cartel power.

8 Conclusion

Our findings suggest that public eco-regional biodiversity cartels of megadiverse countries have the potential to increase the appropriable benefits from their biodiversity and to stimulate genetic resource trade–but do not necessarily exploit this potential. They can be anything between a paper tiger and a monopoly power on the genetic resource market. Popper's (2004, p. 60) famous observation "Institutions are like fortresses. They must be well designed *and* properly manned." summarises our results well. Cartel design and the ability to attract rather than frighten off bioprospectors are imperative for the success of a cartel. A cartel has enhanced possibilities to draft easy access legislation compared to a single country because joint action and increased information reduce the threat of moral hazard. Moreover, cartel members fear less to be played off by other countries belonging to the same eco-region. Cartels regulating either prices in form of monetary and non-monetary benefits or market shares can build up cartel power which allows them to increase their profits. Members with a relative higher biodiversity richness and–in case of megadiverse countries even more relevant–a comparatively better institutional environment appropriate a higher share of these collusion benefits.

Eco-regional biodiversity cartels change the market structure to a bilateral oligopoly or even monopoly. A win-win situation may occur: Cartel profits may rise *and* costs for the prospecting agent may decline, if the price increase is (over-)compensated by a reduction in the customer's transaction costs. Besides, the price increase is only one component of the increase in cartel profits; profits increase due to higher prices, lower transaction costs for cartel members, economies of scale and improvements in institutional aspects. Economies of scale in information, administration, monitoring, and enforcement are an important result of cartel formation and can be considerable if the cartel establishes a regional competent authority. Public notification of genetic resource deals by the central or national authorities creates transparency

in genetic resource trade on both the demand and supply side. Moreover, cartels may–although only as a potential side-effect–contribute to offsetting the political and market failures created by the CBD's ABS regulations. We therefore perceive eco-regional biodiversity cartels apriori as positive and caution against transferring the standard repudiation of cartels to the genetic resource market.

The CAN created an institutional novelty with Decisión 391, the first communitarian law on access to genetic resources. The CAN biodiversity collusion covers 25% of global biodiversity and numerous endemic species (ERB 2002, p. 13). Yet, benefits remain below expectations (ERB 2002, p. 34). The benefits from an increase in market power are nullified by overly strict and complicated regulations which frighten off prospecting agents. Decisión 391 is inefficient because most costs for bioprospectors are transaction costs which are lost for the cartel. The CAN fails to build up bargaining strength and communitarian action is absent. More fundamentally, the cartel's intentions to establish Decisión 391 on the basis of the CBD principles 'conservation and use' are blurred by political decisions to hand out mining concessions in the heart of the rainforest. The CAN is a paper tiger rather than a strong player on the genetic resource market, a collusion but no cartel. The CAN's poor performance is detrimental for its members which forgo profits, for industrial companies which have to rely on second best strategies to obtain genetic resources, and for creating awareness and finance for biodiversity in line with the CBD.

Our research provides a first appraisal of the scope of eco-regional biodiversity cartels. We acknowledge that our considerations have yet to be assessed against empirical evidence, which is currently lacking as the sole existing collusion by the CAN does not achieve cartel power. At this point the results are mainly illustrating the potential and limits of eco-regional biodiversity cartels. We perceive our paper as starting point and impulse for further reflections on eco-regional biodiversity cartels.

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