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Eco-regional Cartels on the Genetic Resource Market and the case of the Andean Community's legislation

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Eco-regional Cartels on the Genetic Resource Market and the case of the Andean Community's legislation

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Abstract

The United Nations' Convention on Biological Diversity raised expectations of high benefits in genetic resource trade with megadiverse countries. As a reaction the Andean Community (CAN) passed strict community access legislation. Against this background the main objective of this paper is to investigate whether public eco-regional 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. As a case study we examine the CAN community access legislation (Decision 391) in the light of biodiversity collusion. Our main finding is that cartels—contrary to their negative connotation—are potentially able to stimulate genetic resource trade, increase the providers' appropriable benefits from biodiversity, and reduce the costs for customers. 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 Decision 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 collusion² of megadiverse countries which increases profits through regulating access to genetic information resources. In this paper we discuss the role of eco-regional biodiversity cartels on the genetic resource market, i.e. cartels trading the product ‘genetic information resources’. We refer to the CAN biodiversity governance collusion as its presently sole³, though as we expound theoretical, example. The Andes stretch over the four CAN member countries⁴ Colombia, Ecuador, Peru, and Bolivia, as well as over 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 Diversity⁵ (CBD). The CBD codified the sovereignty of states over their genetic resources and established an Access and Benefit-Sharing (ABS) mechanism to govern biodiversity use and the fair sharing of the resulting benefits in form of a bilateral instrument. The Nagoya Protocol⁶ (NP) specifies this mechanism, which member countries have to implement nationally. Costa Rica, the Philippines, and the CAN were among the first to

¹Comision 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.

²We 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.

³There are other regional frameworks, but these either do not have collusive characteristics or are still in the drafting stage. The African Union developed a non-binding Model Law (Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources, 2001) to assist its members as a guideline in the process of drafting their national legislation (Munyi and Jonas 2013, p. 219 f.). The Group of Like-Minded Megadiverse Countries is not a cartel in the sense of this paper, although declared as such by Vogel (2007, p. 64 ff.) (ref. Section 3). The Association of South East Asian Nations (ASEAN) has developed a Framework Agreement on ABS, which “leaves each Member State to determine the nature of the country’s access instrument” (Cabrera Medaglia et al. 2012, p. 25) and is still a draft (ASEAN Centre for Biodiversity 2013). Similarly, the Central American Commission on Environment and Development drafted a Central American Protocol on Access to Genetic and Biochemical Resources and the associated Traditional Knowledge, which has been signed but not ratified by its seven member countries (Cabrera Medaglia et al. 2012, p. 80). The Himalayan Region might develop a regional framework as well (Prasad Oli and Das Gupta 2008).

⁴The Andean states established the Andean Community with the Cartagena Accord in 1969. Chile was a member until 1976, Venezuela from 1973 until 2006.

⁵United Nations (1992): Convention on Biological Diversity, 31 Int’l Leg. Mat. 818, Rio de Janeiro, 05.06.1992.

⁶United 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.

draft legislation well before the NP, because the CBD raised high expectations with megadiverse countries to reap large benefits from their biodiversity.

Time though 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 (2006)) and bioprospecting trade has not lived up to expectations in terms of contract numbers and magnitude of realised benefits (Boisvert and Vivien (2005, p. 466 f.); Pastor and Ruiz (2009, p. 8)). 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 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.

In this paper we take up the proposal of 'biodiversity cartels' made by Vogel (int. al. 1995, 1997, et al. 2000, 2007, and Ruiz et al. (2010)). They study biodiversity cartels both for genetic information resources (Vogel 2007) and for traditional knowledge associated with biological resources on the ethnobioprospecting market (Vogel et al. 2000). We share the idea, but differ in various conceptualization aspects of biodiversity cartels (ref. Section 3). Otherwise, economic research has so far merely touched upon eco-regional biodiversity cartels⁷. There are parallels to the industrial economics literature, which we transfer and adapt to eco-regional state-run biodiversity cartels⁸. From a legal perspective, Asebey and Kempenaar (1995) and Tilford (1998) study cartelization on the biodiversity market, and Rosell (1997), Ten Kate (1997), Mariaca (1999), Tafur-Dominguez (2000), Ruiz (2003), and Bucher (2008) review the content of CAN Decision 391. A related recent proposition from the field of law are regional common pools (Winter 2009); Eco-regional cartels on the genetic

⁷Reid et al. (1996) for example briefly mention genetic resource cartels in their general study of the commercial value of biodiversity prospecting. Richerzhagen (2011, p. 2254) states likewise briefly that biodiversity cartels "cannot contribute to biodiversity conservation".

⁸State-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".

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 overall conception of eco-regional biodiversity cartels as well as different cartel design elements, whose combination determines collusion strength. We analyse on a generic level how the 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. We differ from Vogel (2007) by focusing on different cartel design elements and their analysis rather than studying *a* cartel. To the best of our knowledge, we are the first to examine Decision 391 of the CAN in the light of collusion theory.

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. We outline our concept of eco-regional biodiversity cartels in Section 3. In Section 4 we analyse the benefits which megadiverse countries can obtain by forming 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

Biological resources are the carrier of genetic resources, the products traded on the genetic resource market. Genetic resources themselves are genetic blueprints of plants and essentially information. The CBD focuses on the traded material that contains genetic information codes (*Art. 2*, CBD), e.g. seeds of plants with observed healing properties exported for proliferation. Vogel (e.g. 1994), Ruiz (e.g. 2010) stress the high and even increasing importance of the pure genetic information for research and development. The genetic information is non-rival, non-exclusionary

(Vogel et al. 2000, p. 11), and its distribution difficult to control. The marginal cost of reproducing the genetic resource information is small, much smaller than the average cost of conserving the environment in which it exists (Vogel 1995, p. 66).

Countries hosting biological respectively genetic resources can act as suppliers on the global genetic resource market. Customers are commercial research institutes and industrial firms; 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). There is no strict dichotomy between providers and users; Brazil is only one example of a country which is both.

Prior to the CBD, interested firms and research institutes could obtain genetic resources without consent of and remuneration for the supplying host country. Since the CBD's entry into force in 1993 countries have sovereignty over their genetic resources (as material). A user entity has to ask a provider country for access to its resources, i.e. to obtain Prior Informed Consent (PIC). If granted, both parties negotiate the terms of access and benefit sharing (Mutually Agreed Terms, MAT). The Nagoya Protocol obliges countries *inter alia* to draft access legislation (*Art. 6*), legislation to ensure a fair and equitable benefit sharing (*Art.5*), and to create a Competent National Authority (*Art. 13*) as well as a global Clearing House Mechanism (*Art. 14*). It encourages transboundary cooperation (*Art. 11*) and prompts a discussion on a global multilateral benefit sharing mechanism for shared genetic resources or for resources for which PIC is not possible (*Art. 10*).

The benefit sharing can take various forms and may include monetary (e.g. upfront payments, royalties) and non-monetary benefits (e.g. joint R&D, technology transfer) (*Annex NP*). Benefits can be divided into two components: the remuneration of provision costs and the economic rent. 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 (*Art. 5.1 NP*) 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—while other countries likewise hosting the respective species receive no benefits for costly conservation efforts. But the market structure prompts countries to engage in undercutting the others' prices in order to secure the deal. Ruiz et al. (2010, p. 11) conclude that "for resources widely found, only suppliers who cartelize can ever hope to achieve a rent to compensate for the opportunity costs of conserving the

habitat”. If a country has a strong trade advantage—for which being a cartel member is only one source—it may be able to secure rents, otherwise it obtains merely the provision costs.

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. We therefore describe the genetic resource market structure as a bilateral oligopoly. 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, especially as a much larger number of species is endemic⁹ to the eco-region.

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-regional collusions of megadiverse countries on the genetic resource market which achieve market power. We differ from Vogel (e.g. 2007) in that we explicitly link the formation of cartels to eco-regions; Only by encompassing a set of species endemic to the collusion members’ joint territory the allied countries are able to build up market power. The Group of Like-Minded Countries, for example, is a cooperation among megadiverse countries to increase their bargaining power, but is not able to enforce monopoly rents

⁹Endemic species are species which are unique to a confined geographic location.

as it does not comprise entire eco-regions. Moreover, we assume that mega-diverse countries themselves can take the initiative to form a cartel without necessary a “multilateral accord that recognizes limited oligopolies over biodiversity” (Vogel 1995, p. 67) or a “special protocol to the CBD” (Vogel et al. 2000)–to which 66% of the CBD members would have to agree for it to become binding (Vogel 2007, p. 60). We also envisage the cartel to freely negotiate the royalty rate so that it may respect the individual resource characteristics and relative contribution to the final product instead of assuming one “royalty rate invariant regardless of source” (Vogel 2007, p. 55 f.). We study cartelization for genetic resource information without specifically addressing the traditional knowledge (TK) associated with genetic resources. Selling TK as trade secrets as proposed by Vogel et al. (2000) seems difficult as most TK has already been recorded and published by ethnologists¹⁰. A cartel could, however, act in a pro-active manner by officially publishing TK in order to attract users and obtain benefits from genetic resource information which would otherwise not have been requested or sold for a lower price. Vogel (2007, p. 58 ff.) describes a biodiversity cartel with a fix set of important attributes¹¹. We propose and discuss different optional cartel design elements.

In our conceptualization, 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) A 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.

¹⁰We personally discussed this possibility in length with Bolivia (20.11.2013). The assessment is the aforementioned. Vogel (2007, p. 51) states as well that much TK is publicly available.

¹¹They include: species disclosure obligation in IP laws, mechanism to identify countries of origin, benefit fund, TK databases at community level, mapping of biotechnology patent with TK database (if match, splitting of royalties between “Cartel of States” and “Cartel of communities”), tracking of IP holders to check upon correct payments, and a trebling of royalties on prior sales if failure to pay the rent (Vogel 2007, p. 58). These are termed the cartel’s “operational framework” in Ruiz et al. (2010, p. 6 f.).

Public notification of bioprospecting processes (i) and a public register of biological resources within the eco-region (ii) can vary in their set-up and comprehensiveness. The register might be similar to or make use of existing genetic barcode databases¹². Notably, public notification and a resource register are not exclusive to cartels, but cartels may act as a facilitator for them. If a cartel 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. In Section 4 the contribution of the central authority to raising benefits will become apparent.

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)¹³. Coordinating market shares typically implies agreeing on trade volumes (quota) or allocating bioprospecting agents (e.g. per industry sector) according to a pre-defined rule. Considering genetic resource cartels, such rule could prohibit undercutting prices of another member country that is already negotiating with the customer. A quota, however, is not feasible because, as an information good, genetic resource information can only be sold once and might than be replicated many times (Vogel et al. 2000, p. 105 f.). Thus, biodiversity cartels are 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 comparable goods like several endemic species. When a cartel's product is too heterogeneous, internal compliance control is difficult (Carlton and Perloff 2005, p. 135). 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

¹²For example 'The International Nucleotide Sequence Database Collaboration', a collaboration between the DNA Data Bank of Japan, the Nucleotide Sequence Database of the European Molecular Biology Lab, and the GenBank of the US (online: www.insdc.org, last 6.12.2013), and 'The Barcode of Life' (online: www.barcodeoflife.org, last 6.12.2013).

¹³For 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 the global and the European market, and the chlorine-chloride cartel followed the home-market-principle (Harrington 2006, p. 6, 24-26, 33).

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.

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. Cartels have to enforce their collusive agreement, but punishment possibilities are generally limited. Exclusion is not an option as 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. Potential biodiversity cartel members will to be reluctant to transfer their only recently gained 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 a treaty ('hands-tying') that specifies the restricted competencies of a common ABS authority ('union'). Evidence from industrial cartels 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).

4 The benefit potential for eco-regional 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 that uses all design options (i) to (v) to include the entire amplitude of benefits in our analysis.¹⁴

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)) 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

¹⁴We use the term eco-regional biodiversity cartel in the following to refer to such far-reaching collusion if not indicated otherwise.

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 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, i.e. it being inelastic. 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 sectors¹⁵ 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 pharmaceutical and biotechnological knowledge. The central authority is comparable to an intermediary in the bilateral trade setting—who achieve considerable higher royalty rates in negotiations (Vogel et al. 2000, p. 44). Public notification of ABS processes (i) further contributes to economies of scale in monitoring a customer's usage of genetic material and information as well

¹⁵Botanical medicine, cosmetics and care, horticulture, and livestock breeding.

as products developed thereof. Especially with technology advancing more and more in the direction of a combination of genetics and informatics (Pastor and Ruiz 2009, p. 7 f.), economies of scale in monitoring will be increasingly important. Closely related, the central authority 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 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 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 such as nature conservation zones.¹⁶

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 biodiversity supplying country has a higher probability to know about the bioprospecting firm from other cartel members, especially in case of public announcement of ABS processes (i) and a regional genetic resource register (ii). This

¹⁶We thank a reviewer from the 2nd International Conference on Environment and Natural Resources Management in Developing and Transition Economies (enrmdte), Clermont-Ferrand, 17. – 19.10.2012, for mentioning the additional side-benefits.

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. Trading with such cartel (i; ii), the prospecting firm enjoys access to detailed public information on the cartel's genetic resources and access requests by competitors. A customer has lower transaction costs for identifying the country of origin if the biodiversity cartel regulates access to the entire eco-region (iv) and establishes a central access authority (iii)—a genetic resource register (ii) eases identification even further. 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 cartel may build up reputation. As it is a transaction-specific expenditure and much dependent on the customer's perception, the return, becoming a preferable trading partner, is incalculable. Reputation generates "idiosyncratic exchange relations" that withstand trade disruptions better (Williamson 1979, p. 240 f.).

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 with an overview in Table 1 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.

5 The variability in cartel members' benefits

In this section we analyse the distribution of the total cartel benefit among cartel members and derive two factors that largely determine a member's benefit share.

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
<i>Market power</i>					
Influence on market price				x	
<i>Bargaining strength vis-à-vis customers</i>					
Better trade conditions			x	x	
Reduced negotiation costs			x	x	
<i>Economies of scale</i>					
Administration			x	x	
Monitoring	x		x	x	
Enforcement	x		x	x	
Advertising		x	x		
Biotechnological development	x	x	x		x
Cross boarder affairs			x		
<i>Institutional factors</i>					
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 truly competent regional authority.

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

The benefit distribution is influenced by the members' characteristics and the cartel design. We first consider cartels that coordinate in prices without benefit redistribution: 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 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. Here we consider customers from CBD Parties¹⁷ who have an interest in complying with the CBD in the most facile way.

For cartels whose members coordinate on an internal benefit redistribution (iii), the relative distribution of the total cartel benefit among cartel members depends

¹⁷193 countries are Parties to the CBD, 168 have signed the CBD. Andorra, the Holy See, South Sudan, and the United States of America are not a Party to the Convention (online: www.cbd.int/convention/parties/list, last 6.12.2013).

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 as they are likewise resulting from a negotiation process. The relative negotiation power 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 overview of relative cartel benefit shares in Table 2. *Ceteris paribus*, a relatively favourable

Table 2: Cartel members’ relative benefit shares

		Relative biodiversity richness	
		low	high
Relative institutional environment	unfavourable	+	++
	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 Heckscher-Ohlin comparative advantage relating to biodiversity endowments will thus obtain the contract. Richerzhagen and Holm-Müller (2005) emphasize the importance of the institutional 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 appro-

priate 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 when 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 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 the increasing importance of synthetic biology, a near-perfect substitute for the cartel's 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 that a hypothetical, global social welfare maximizing agent would consider is much broader; it includes the entire genetic resource base, not only specific genetic information resources. Eco-regional biodiversity cartels operate on the existing genetic resource market and 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 so far have 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 Decision 391 "Régimen Común sobre Acceso a los Recursos Genéticos" and Resoluciones 414¹⁸ and 415¹⁹ 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 collusion as laid out in Decision 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 Decision 391: Those involved thought of bioprospecting as a "fountain of considerable richness". The CAN intends with Decision 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*).

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. Gudy-nas (2011, p. 231) explains 'Sumak Kawsay' as an attitude by which people respect the intrinsic values of nature. 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 Decision 391. Never-

¹⁸Comision 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.

¹⁹Comision del Acuerdo Cartagena (1996): Resolución 415: Adopción del modelo referencial de contrato de acceso a recursos genéticos, Gaceta Oficial del Acuerdo de Cartagena, Año XIII, Numero 217, Lima, 05.08.1996.

theless, other decisions indicate that this may be no more than mere lip service: examples are new oil concessions in the Ecuadorian biodiversity rich provinces of Morona Santiago and Pastaza²⁰ or the copper mining concession for the project Mirador for the Chinese company Ecuacorrientes SA (ECSA) in the biosphere reserve ‘Cordillera del Cónдор’ in the province of Zamora Chinchipe²¹.

The CAN does not refer to itself as a cartel. Interestingly though, in 2002 Hugo Chavez made the headline “Venezuela hopes for OPEC-like biodiversity cartel”²². His comment might be more noise than seriousness as Venezuela resigned from the CAN in 2006 and as steps in such direction have neither been undertaken with the Group of Like-Minded Countries.

The CAN Decision 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. In the following, we discuss the CAN collusion’s characteristics in the ordering of Section 3. The CAN collusion includes the notification of all other Competent National Authorities (*Art. 48, 49*) and the public of ABS processes (*Art. 18, 21, 27, 28*) (i). It 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 is completed (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.

Decision 391 inaugurates the ‘Andean Committee on Genetic Resources’ with *Art. 51* (iii). Alongside general coordination and recommendation tasks, it is responsible for proposing an outline of 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 manage-

²⁰“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.

²¹“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>.

²²Online: www.planetark.org/dailynewsstory.cfm/newsid/17635/story.htm, last 06.12.2013

ment and control of access to shared resources (*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 Decision 391 (*Art. 5*)²³.

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 as well as 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 Decision 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 that is able to attract a bioprospector enters into contract with the agent and obtains—if existent—the entire profit (‘Winner-takes-it-all-market’).

7.2 Benefits as expected per collusive agreement

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

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.

²³Decision 391 has precedence over national law (Bucher 2008, p. 112).

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 hotspots²⁴ (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, Decision 391 acknowledges the property rights of "the native, Afro-American and local communities" (*Art. 7*) and demands their recognition 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.

Decision 391 increases transparency in genetic resource trade, both on demand and supply side. A CAN member country should know about prospecting activities

²⁴Biodiversity 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).

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 by 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 applicants²⁵ (*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, Decision 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 collusion 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), followed by Peru (0.369) and Ecuador (0.353). Biodiversity richness per area is important for the screening costs bioprospectors face. Here again Colombia ranks 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 2012²⁶

²⁵ *Art. 19* allows for confidential treatment of information that “could be put to unfair commercial use by third parties” subject to restrictive conditions.

²⁶ The BTI status index combines political (stateness, political participation, rule of law, stability

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.
<i>Argentina</i>	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
<i>Chile</i>	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
<i>Venezuela</i>	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 fourth with a value of 1.436.

(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 analysis²⁷. 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 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

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).

²⁷The 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

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

Country*	Status index	Political transformation	Economic transformation
<i>Argentina</i>	6.95	7.55	6.36
Bolivia	6.23	6.85	5.61
<i>Chile</i>	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
<i>Venezuela</i>	4.47	4.40	4.54

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

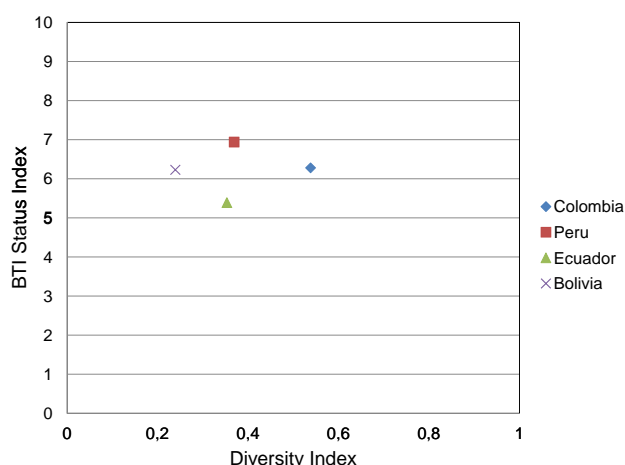


Figure 1: Relative institutional environment and biodiversity richness of the CAN cartel members (after BTI 2012 (www.bti-project.org), Groombridge and Jenkins (2002, p. 295 ff.))

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 to appropriate 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, aggregate the six dimensions of governance; an own aggregation would be speculative.

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 extent that it has no incentive for regional collusion. Chile's, Argentina's, and Venezuela's interest to collude is therefore low. Our approach is conform with 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 successfully²⁸. Ecuador records none²⁹. Viewed over one decade, these are few—if not none—commercial deals and benefits compared to initial expectations and other countries: Costa Rica, which we take as a benchmark for a successful provider country under current ABS conditions, has signed about 65 contracts with industries and universities until early 2013³⁰, from which it realised a number of monetary and

²⁸Personal communication with the National Focal Point 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.

²⁹Personal communication with the National Focal Point Ecuador on the same occasion and date.

³⁰Correspondence with the Biodiversity Commission of the University of Costa Rica on 04.05.2013.

non-monetary benefits (Gómez 2007, p. 85 f.); however, so far no royalties³¹.

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 Decision 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 Decision 391. Especially the non-monetary benefit requirements related to "participation of subregional nationals", rigorous knowledge transfer and institutional development listed in *Art. 17* might be too demanding, 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 Decision 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 Decision 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 Decision 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.³² The scarce implementation of the provisions of Decision 391 (e.g. the *First Complementary Provision* aims for funding for the Decision) imply that economies of scale and improvements in institutional factors will be limited. It is not clear to what extend communal spirit

³¹Presentation at the "Informal Meeting for the Implementation of Articles 19 and 20 of the Nagoya Protocol" in Tokyo, 25.–26.03.2013.

³²Personal communication with the National Focal Points of Peru and Ecuador (ref. footnote 28, 29).

and trust prevail among the cartel members. Missing trust explains why amendments that improve upon the known deficiencies of Decision 391 or advancements in its implementation are absent. Ruiz (2003, p. 12) also contests the incentives for 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 prices in form of monetary and non-monetary benefits can build up cartel power which allows them to increase their profits. Members with a relatively 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. 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 Decision 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. Decision 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 Decision 391 on the basis of the CBD principles 'conservation and use' are blurred by political decisions such as 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 conservation and sustainable use in line with the CBD.

Our research provides a first appraisal of the benefits 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. Our results though already illustrate the potential and limits of eco-regional biodiversity cartels.

References

- ASEAN Centre for Biodiversity (2013). *An Urgent Need: Institutionalizing Access to Genetic Resources and Benefit Sharing in Southeast Asia*, Policy Brief Series, 1 June 2013. ASEAN Centre for Biodiversity.
- Asebey, E. J. and J. D. Kempenaar (1995). Biodiversity prospecting: Fulfilling the mandate of the biodiversity convention. *Vanderbilt Journal of Transnational Law* 28(4), 703–754.
- Barrett, C. and T. J. Lybbert (2000). Is bioprospecting a viable strategy for conserving tropical ecosystems? *Ecological Economics* 34(3), 293 – 300.
- Bertelsmann Stiftung (Ed.) (2012). *Transformation Index BTI 2012. Political Management in International Comparison*. Gütersloh: Verlag Bertelsmann Stiftung.
- Boisvert, V. and F.-D. Vivien (2005). The convention on biological diversity: A conventionalist approach. *Ecological Economics* 53(4), 461–472.
- Bucher, S. (2008). *Der Schutz von genetischen Ressourcen und indigenem Wissen in Lateinamerika. Eine Untersuchung am Beispiel der Andengemeinschaft, Brasiliens und Costa Ricas*. Baden-Baden: Nomos.
- Cabrera Medaglia, J., F. Perron-Welch, and O. Rukundo (2012). *Overview of national and regional measures on access to genetic resources and benefit-sharing. Challenges and Opportunities in Implementing the Nagoya Protocol* (2nd ed.). Montreal: Centre for International Sustainable Development Law (CISDL).
- Carlton, D. W. and J. M. Perloff (2005). *Modern Industrial Organization* (4th ed.). New York: Person.
- Costello, C. and M. Ward (2006). Search, bioprospecting, and biodiversity conservation. *Journal of Environmental Economics and Management* 52(3), 615–626.
- Davis, L. and D. North (1970). Institutional change and American economic growth: A first step towards a theory of institutional innovation. *The Journal of Economic History* 30(1), 131–149.
- Díaz, C. L. (2000). Regional approaches to implementing the Convention on Biological Diversity: The case of access to genetic resources. Paper prepared for the EU Concerted Action Conference on the Effectiveness of International Environmental Agreements, Barcelona.
- ERB (2002). *Regional Biodiversity Strategy*. General Secretariat of the Andean Community.
- Gámez, R. (2007). The link between biodiversity and sustainable development: Lessons from INBio’s bioprospecting programme in Costa Rica. In R. McManis (Ed.), *Biodiversity and the Law: Intellectual Property, Biotechnology and Traditional Knowledge*, Chapter 7, pp. 77–90. London: Earthscan.

- Groombridge, B. and M. D. Jenkins (2002). *World Atlas of Biodiversity*. Berkeley/Los Angeles/London: University of California Press.
- Gudynas, E. (2011). Tensiones, contradicciones y oportunidades de la dimensión ambiental del buen vivir. In I. Farah and L. Vasapollo (Eds.), *Vivir bien: ¿Paradigma no capitalista?*, pp. 231–246. La Paz: CIDES - UMSA.
- Harrington, J. E. (2006). *How do cartels operate?*, Volume 2 of *Foundations and Trends in Microeconomics*. Delft: now Publishers.
- Holm-Müller, K., C. Richerzhagen, and S. Täuber (2005). Users of genetic resources in Germany. awareness, participation and positions regarding the Convention on Biological Diversity. BfN-Skripten 126, Bundesamt für Naturschutz, Bonn.
- Kamau, E., B. Fedder, and G. Winter (2010). The Nagoya Protocol on access to genetic resources and benefit sharing: What is new and what are the implications for provider and user countries and the scientific community? *Law, Environment and Development Journal* 6(3), 246–262.
- Kamau, E. C. and G. Winter (2009). Streamlining access procedures and standards. In E. C. Kamau and G. Winter (Eds.), *Genetic Resources, Traditional Knowledge and the Law. Solutions for Access & Benefit Sharing*, pp. 365–380. London: Earthscan.
- Komorita, S. S. (1977). Negotiating from strength and the concept of bargaining strength. *Journal for the Theory of Social Behaviour* 7(1), 65–79.
- Kronman, A. (1985). Contract law and the state of nature. *Journal of Law, Economics, and Organization* 1(1), 5 – 32.
- Levenstein, M. C. and V. Y. Suslow (2006). What determines cartel success? *Journal of Economic Literature* 44(1), 43–95.
- Malamud, C. (2006). Venezuela’s withdrawal from the Andean Community of Nations and the consequences for regional integration. *Real Instituto Elcano Working Paper* 28.
- Mariaca, J. (1999). Access to genetic resources in member countries of the Andean Community. In International Society for Horticultural Science (Ed.), *First International Symposium on Cherimoya*, Number 497 in Acta Horticulturae, pp. 367 – 374.
- Mittermeier, R. A., G. P. Robles, M. Hoffmann, J. D. Pilgrim, T. Brooks, C. G. Mittermeier, J. Lamoreux, and G. A. B. da Fonseca (2004). *Hotspots revisited: Earth’s biologically richest and most endangered ecoregions*. Mexico City: CEMEX.
- Munyi, P. and H. Jonas (2013). Implementing the Nagoya Protocol in Africa: Opportunities and challenges for African indigenous peoples and local communities. In E. Morgera,

- M. Buck, and E. Tsioumani (Eds.), *The 2010 Nagoya Protocol on Access and Benefit-Sharing in Perspective. Implications for International Law and Implementation Challenges*. Leiden, Netherlands: Martinus Nijhoff Publishers.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent (2000). Biodiversity hotspots for conservation priorities. *Nature* 403, 853–858.
- North, D. C. (1979). A framework for analyzing the state in economic history. *Explorations in Economic History* 16(3), 249–259.
- Pastor, S. and M. Ruiz (2009). The development of an international regime on access to genetic resources and equitable benefit sharing in a context of new technological developments. *Peruvian Society for Environmental Law (SPDA) IV*(10), 1–16.
- Popper, K. (1957/2004). *The Poverty of Historicism*. London: Routledge.
- Prasad Oli, K. and J. Das Gupta (2008). *Regional Framework on Access and Benefit Sharing (ABS) in the Himalayan Region*. International Centre for Integrated Mountain Development (ICIMOD).
- Reid, W. V., S. A. Laird, C. A. Meyer, R. Gámez, A. Sittenfeld, D. Janzen, M. A. Gollin, and C. Juma (1996). Biodiversity prospecting. In J. Cracraft and F. T. Grifo (Eds.), *The living planet in crisis. Biodiversity Science and Policy*, Chapter 12, pp. 142–173. New York: Columbia University Press.
- Richerzhagen, C. (2011). Effective governance of access and benefit-sharing under the convention on biological diversity. *Biodiversity and Conservation* 20, 2243–2261.
- Richerzhagen, C. and K. Holm-Müller (2005). The effectiveness of access and benefit sharing in costa rica: Implications for national and international regimes. *Ecological Economics* 53(4), 445–460.
- Rosell, M. (1997). Access to genetic resources: A critical approach to decision 391 ‘common regime on access to genetic resources’ of the commission of the cartagena agreement. *Review of European Community and International Environmental Law* 6(3), 274 – 283.
- Ruiz, M. (2003). El tratado internacional de recursos fitogenéticos y la decisión 391 de la comunidad andina de naciones: Perú, la región andina, y los centros internacionales de investigación agrícola. Lima.
- Ruiz, M. (2008). Guía Explicativa de la Decisión 391y una Propuesta Alternativa para Regular el Acceso a los Recursos Genéticos en la Sub-región Andina. SPDA; GTZ, Lima.
- Ruiz, M., J. H. Vogel, and T. Zamudio (2010). Logic should prevail: A new theoretical and operational framework for the international regime on access to genetic resources and the fair and equitable sharing of benefits. *Peruvian Society for Environmental Law (SPDA) V*(13), 1–11.

- Tafur-Dominguez, V. (2000). International environmental harmonization - Emergence and development of the Andean Community. *Pace International Law Review* 12, 283 – 317.
- Ten Kate, K. (1997). The common regime on access to genetic resources in the Andean Pact. *Biopolicy* 2(6).
- Ten Kate, K. and S. A. Laird (1999). *The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing*. London: Earthscan.
- Ten Kate, K. and S. A. Laird (2000). Biodiversity and business: Coming to terms with the ‘grand bargain’. *International Affairs* 76(2), 241–264.
- Tilford, D. S. (1998). Saving the blueprints: The international legal regime for plant resources. *Case Western Reserve Journal of International Law* 30(2&3), 373–446.
- Vogel, J. H. (1994). *Genes for Sale*. New York: Oxford University Press.
- Vogel, J. H. (1995). A market alternative to the valuation of biodiversity: The example of Ecuador. *ASC Newsletter* 23(5), 66–70.
- Vogel, J. H. (1997). The successful use of economic instruments to foster sustainable use of biodiversity: Six case studies from Latin America and the Caribbean. *White Paper commissioned by the Biodiversity Support Program on behalf of the Inter-American Commission on Biodiversity and Sustainable Development in preparation for the Summit of the Americas on Sustainable Development, Santa Cruz de la Sierra, Bolivia, 1996; Biopolicy Journal* 2, online journal – URL: <http://bioline.bdt.org.br/py>.
- Vogel, J. H. (2007). Reflecting financial and other incentives of the TMOIFGR: The biodiversity cartel. In M. Ruiz Muller and I. Lapeña (Eds.), *A Moving Target: Genetic Resources and Options for Tracking and Monitoring their International Flows*, IUCN Environmental Policy and Law Paper No. 67/3, pp. 74–74. Gland, Switzerland: IUCN.
- Vogel, J. H., R. Alarcon, M. S. Garcia, M. Morales, and R. Lindstrom (2000). *The Biodiversity Cartel. Transforming Traditional Knowledge into Trade Secrets*. Quito, Ecuador: CARE, Proyecto SUBIR.
- Williams, K. J., A. Ford, D. F. Rosauer, N. De Silva, R. Mittermeier, C. Bruce, F. W. Larsen, and C. Margules (2011). Forests of East Australia: The 35th biodiversity hotspot. In F. E. Zachos and J. C. Habel (Eds.), *Biodiversity Hotspots. Distribution and Protection of Conservation Priority Areas*, Berlin/Mannheim, pp. 295–310. Springer.
- Williamson, O. (1979). Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics* 22(2), 233–261.

Winter, G. (2009). Towards common pools of genetic resources – improving the effectiveness and justice of ABS. In E. C. Kamau and G. Winter (Eds.), *Genetic Resources, Traditional Knowledge and the Law. Solutions for Access & Benefit Sharing*, pp. 19–35. London: Earthscan.