

Does geography matter to institutional choice? A comparative study of ancient commons

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ABSTRACT

This paper examines the effects of geography on institutional choice. Can variations in geography explain institutional variations and if so, in what ways? This question is explored with a comparative study of ancient commons based on fieldwork in two regions in Northern Philippines with markedly varying physical geography and institutional arrangements. The study finds that, indeed, geography matters in the choice of institutions governing the commons and goes about to explain how this matters. This conclusion has several implications to the literature on evolutionary, environmental and economic geography. First, the mediated and conditional effects of geography on institutions puts to rest the generalizability of arguments about environmental determinism on one hand and institutional triumphalism on the other. Second, the paper introduces the idea of institutional Darwinism i.e. institutional choice in the commons evolves in response to geography induced selection pressures. Institutions in turn affect selection pressures and production system implying an endogenous relationship. Third, the paper illustrates the application of a comparative case study approach to institutional and evolutionary economic geography which can tease out the nuances of history, contexts, selection pressures and choices which otherwise is lost in the conventional instrumental variable approach in regression models. Finally, the paper hopes to start a conversation between geographers on one hand and on the other hand scholars studying the evolution of institutions governing the commons.

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1. Introduction

This paper examines the effects of geography on institutional choice. Can variations in geography explain institutional variations and if so, in what ways? This question is explored with a comparative study of ancient commons in three regions in Northern Philippines with markedly varying physical geography and institutional configurations.

This question is important in four respects. First, while economic and institutional geographers have extensively debated the relationship between geography and institutions, for instance in the special issue of *Geoforum* in 2000, scholars remain divided on the subject as ever. This division stems in part from differences in analytic approaches, for example the neo-classical, institutional and evolutionary approaches (see [Boschma and Frenken, 2006, 2011](#)). Economists studying the subject are likewise as divided as geographers, for instance [Acemoglu et al. \(2001\)](#), [Easterly and Levine \(2002\)](#), [Rodrik et al. \(2002\)](#) and [Sachs \(2003\)](#).

Second, the study of the relationship between institutions and geography, curiously, has not attracted the interest of scholars who study institutions governing the commons. For instance,

scholars of the commons do not often consider physical geography as an important variable in the study of institutions governing the commons. Instead, they have been more generally concerned with static variables posited as drivers of institutions for collective action, for example, group size ([Potete and Ostrom, 2004](#); [Araral, 2009](#)), inequality and scarcity ([Bardhan, 2005](#)), market pressures ([Agrawal and Yadama, 1997](#)), among others. On the other hand and also curiously, geographers are rarely interested in the study of the commons even though this is evidently an important subject closely associated with geography. This paper hopes to start a conversation between geographers on one hand and scholars of institutions governing the commons on the other.

Third, this paper provides a more nuanced view on the relationship between geography and institutions using an anthropological and comparative approach. This nuanced approach differs from the conventional econometrics approach commonly used by economists. For instance, [Acemoglu et al. \(2001\)](#), [Easterly and Levine \(2002\)](#) and [Rodrik et al. \(2002\)](#) purport to show using cross country regressions that the effects of geography on income per capita is mediated “predominantly or exclusively through the choice of institutions, with little direct effect of geography on income”. [Rodrik et al. \(2002\)](#) go onto argue that institutions trump geography and trade as determinants of incomes but with two caveats: (1) geography has a strong effect on the quality of institutions

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and (2) the instrumental variable that economists use as a measure of institutions – settler mortality – is problematic because it does not make a theory. This paper addresses the limitations of the instrumental variable approach with a more nuanced view based on an anthropological and comparative approach. It follows Coase's (2007) advice that “if you want to study a horse go out in the barnyard rather than imagine a horse with a formal model”.¹

Fourth and finally, this paper builds on the hypothesis by Sachs (2003) that “many of the reasons why geography seems to have affected institutional choices in the past (e.g. the suitability of locations for European technologies, the disease environment and risks to survival of immigrants, the productivity of agriculture, the transport costs between far-flung regions and major markets) are indeed based on *direct* effects of geography on production systems, human health, and environmental sustainability, and many of those very same channels would still be likely to apply today.” This paper qualitatively tests the hypotheses that the effects of geography on institutional choices is mediated by production systems.

The paper has five parts. The next part describes the analytic framework followed by an explanation of the rationale for the selection of the case study and a description of the methods for data collection and analysis. This is followed by a discussion and comparison of the three case studies. The concluding section summarizes the insights from the study and their theoretical, practical and methodological implications.

2. Literature, hypotheses and operational framework

Within the literature on geography, the most relevant for this paper are the debates stemming out of environmental, economic and agricultural geography. Singh and Dillon (2004) provide a cogent review of the on-going debates of different models in this literature, namely environmental determinism, possibilism and interactionism. Environmental determinism suggests that variations in the structure and functioning of agriculture can be explained by variations in physical geography such as terrain, soil condition, climate, access to water and forest resources, among others. Critics of environmental determinism generally argue that it ignores economic, social, historical and institutional factors but for its adherents, for instance Singh and Dillon (2004), physical geography has a decisive effect on the structure and functioning of agriculture.

Environmental possibilism on the other hand suggests that variations in the structure and functioning of agriculture vary with economic factors such as production and transport costs and price of farm outputs. In this model, physical geography is not taken into consideration although conceivably input and output prices are correlated with the distance to factor markets. Finally, environmental interactionism provides a balance between environmental determinism and possibilism by suggesting that these two factors are more likely to have an interaction effect on the structure and functioning of agriculture.

Following Sachs (2003) and the notion of environmental interactionism, this paper explores the hypotheses that variations in physical geography can explain institutional variations as mediated by the production system (Fig. 1). The intuition is that physical geography presents opportunities as well as risks to a production system and actors make institutional choices in response to these risks and opportunities.

My explanatory variable – geography – is defined in terms of physical geography in a sense used as a factor of production although I acknowledge that geographers use the concept more broadly. Operationally, I refer to physical geography in terms of

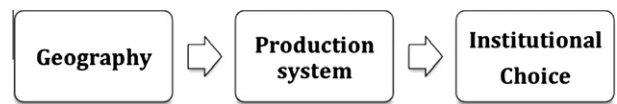


Fig. 1. Conceptual framework.

climate, topography and hydrology or availability of water, all of which are crucial factors in an agriculture production system. By agriculture production system, I refer to an irrigated rice farming system, which requires inputs of land, water, labor and capital. For analytic purposes, I parse out physical geography and property rights from a production system to highlight their roles although strictly speaking they are part and parcel of a production system.

My dependent variable, institutions, refers to the “formal and informal rules of the game” (North, 1990). In particular, my focus is on the institutions governing the commons, in particular the system of property rights including their enforcement mechanisms. I refer to property rights in the sense used by Commons (1990) referring to a bundle of rights to a benefit stream, in this case the control for land and water resources. These bundle of rights can range from access rights, usufruct rights to ownership rights including the right to alienate or sell the resource to a third party.

3. Data and methodology

3.1. Data and variables

To qualitatively test my hypothesis, I need evidence showing that (1) physical geography and institutional configurations vary with each other; (2) this variation is mediated by the production system; (3) the production system explicitly depends on institutional choices; (4) the production system has been functioning overtime to control for the effects of time; and (5) the population in the region come from the same ethnolinguistic groups to control for the effects of culture on institutional choice. To meet the first and second conditions, I examined three case studies, each of which vary in terms of their physical geography and institutional features but controlling for the type of production system, time and culture.

To meet the third condition, I chose to study irrigation systems as my unit of analysis because it is a production system, which explicitly depends on institutional choices. As Ostrom (1998) puts it, “an irrigation system is the specimen of an institutional scholar what a fruit fly is to an evolutionary biologist.” This is because an irrigation system as a type of a production system explicitly requires a rule ordered system to allow for the study of how geography affects institutional choice and how these effects are mediated by the production system.

Fourth, to control for the effects of time and hence the evolutionary institutional path dependence, I chose to study ancient irrigation systems – in this case the 2000-year old Ifugao rice terraces and the 400-year old zangjera irrigation system while comparing their institutional features with the most common form of property rights in the Philippines as represented by the 50 year-old Magat River Integrated Irrigation System in Cagayan Valley.

Finally, because institutions are essentially mental constructs represented in the form of language, we also need to control for the possible effects of culture. In this paper, I control for the effects of culture by studying the same set of ethno linguistic group, the Ilocanos, who inhabit the Northern regions of the Philippines. As a counterfactual, a comparison is also made with other regions in the Philippines with large concentrations of Ilocano migrant settlers to see if they have also brought with them their informal institutions.

¹ Personal conversation with Ronald Coase, March 29, 2007, Chicago.

3.2. Data collection

Various methods of data collection were employed for this study but all relied on historical records, which is central in the study of the evolution of institutions. For instance, in the zangjeras case study, data collection involved a series of fieldwork from May to August 2008. The team was composed on the author and a field research assistant from the National Irrigation Authority Ilocos Norte Provincial Office. The president and officers of the Vintar-Bacarra Federation of Irrigation Associations as well as staff of the Irrigation Office were interviewed for the study.

Fieldwork involved key informant interviews and focus group discussion with farmer leaders and personnel of the government irrigation agency, walkabouts in the irrigation farms, ground photo-documentation, use of satellite imageries, as well as a review of historical and secondary records. The zangjera case study would not have been possible without the previous studies by Siy (1980).

Similarly, for the Ifugao case study, an extensive archival research was undertaken at the University of the Philippines (Baguio), which has the largest collection of the most authoritative studies on the Ifugaos (see Araral, *forthcoming*). The archival research focused on the works of experts of the Ifugao society and their rice terraces such as Conklin (1980) and Barton (1919). Fieldwork covered the municipalities and districts of Banaue, Batad, Asipulo, Hengyon and Mayaoyao. Data collection involved focus group discussion with indigenous knowledge experts, *mumbaki* (village priests), NGOs and officials of local government. The aerial photography by Conklin and Javellana (2008) provided a visualization of the physical geography of the rice terraces.

For the Cagayan valley case study, data collection involved primarily secondary data from the National Irrigation Authority (NIA), which has a database of the physical and institutional features of the irrigation system – the Magat River Integrated Irrigation System (MRIIS). Satellite imageries were also collected to visualize the physical geography of the region.

3.3. Analytic approach

My analytic approach involves (1) comparing the physical and institutional variations of the three case studies; (2) describing and analyzing the effects of physical geography on institutional choices; and (3) controlling for the effects of production system, culture and time. This approach is essentially an inductive methodology or what Boschma and Frenken (2006) refer to as appreciative theorizing. While small-n comparative case studies are limited in terms of their external validity, they are strong in terms of internal validity. They are crucial if the goal, as in the case of this paper, is qualitative hypothesis testing as part of a broader theoretical research agenda, which is to explain how geography affects institutional choice, particularly the choice of property rights that govern the commons.

4. Comparative case study

4.1. Overview of the case studies

Table 1 provides a summary of the variations in the physical geography and institutional features of the three case studies, namely: the Zangjeras, the Cagayan Valley and the Ifugao Rice Terraces. These case studies clearly vary in terms of their physical geography: their hydrology and water storage, topography, vulnerability to floods, droughts and typhoons and dependence on forest/watershed. They likewise vary in terms of institutional features such as the size of land holdings, the system of property rights

(the dependent main variable of interest in this study) and their key features and the functional rationale for their choice. The relevant details of the case studies are discussed in Sections 4.2–4.4.

The physical and demographic features of the case studies are visualized in Figs. 2–5 in terms of satellite imageries and aerial photography. The case studies are all located in the Northern most part of the Philippines (Fig. 2) within a few hundred kilometers of each other.

4.2. The zangjeras case study

4.2.1. History, demography and physical geography

Various authors have described the history, demography and physical geography of the zangjeras as follows (Siy, 1980; Coward, 1979). The zangjera, a Spanish term, refers to a cooperative irrigation society found only in the Ilocos Provinces in Northern Philippines and have been around since the early 16th century. The Ilocos Provinces are one of the most densely populated regions in the Philippine but has the least arable land per capita. For instance, three fourths of all arable lands are under 0.3 ha compared with the national average of 1.45 ha.

The physical geography of the zangjeras can be challenging. Araral (*forthcoming*) and Siy (1980) described these challenges in the following terms. First, the zangjeras are located “along a narrow strip of land – a flood plain – squeezed between the Cordillera mountain range (the headwaters of the Ifugao terraces) on the east and the South China Sea to the west.” Second, the production system of the zangjeras – irrigated farming – depends on an “unsteady, unpredictable and destructive river. The watershed on Vintar river is “vast and steep, which drains in the narrow and flat plains of the Ilocos region before draining in the South China Sea.” Satellite imagery (Fig. 3) shows that the river “constantly shifts course making the task of constructing and maintaining the brush dam difficult.”

Third, as Araral (2012) documents, frequent typhoons (average of 9 a year) and flooding regularly afflicts the Ilocos Region. These typhoons cause the rivers to “swell and easily wash away brush dams and wreak havoc to farms as a result of flooding”. Because of the breadth of the river – 100 m long – the only feasible way to control water is through the use of temporary brush dams which are made up entirely of sand, bamboo, banana leaves and rocks. Maintaining the brush dam after every typhoon requires the mobilization of substantial amount of labor.

Finally, during the dry months of January to April, water is very scarce in the zangjera averaging a paltry 2.6 mm compared to the 367 mm during the wet/typhoon season of June–September. Consequently, during the dry months, the availability of water among the zangjeras is highly variable with the upstream areas consistently receiving adequate water compared with the downstream. During the dry months, farmers in the zangjera would have to devise mechanisms how to allocate this scarce water among its members.

4.2.2. Effects of geography on institutional choice

A distinguishing and unique institutional feature of the zangjera is its *atar* property system, which is found only in the Ilocos region and nowhere else in the world. The *atar* system works as follows. At the time the zangjera irrigation is constructed, the rights to cultivate the land are given to the members who contributed to its development in the form of *atar* – or membership shares. Each *atar* is equivalent to one hectare of land. Thus, a 20 ha irrigated farm would have the equivalent of 20 *atar* shares. A farmer who gets half a hectare gets 0.5 *atar* share. More importantly, the *atar* share corresponds also to the obligations of the shareholder. Thus, an *atar* holder who holds 1/20th of the benefits from the system (in terms of land area cultivated and water received) is also expected to

Table 1
Variations in physical geography and institutional features of the 3 case studies.

Physical geography	Zangjeras	Cagayan Valley	Ifugao
Production system	Irrigated farming	Irrigated farming	Irrigated farming
Water storage	None/river run off	Dam	Watersheds
Topography	Flood plains	Valley	Mountainous
Vulnerability to flooding and droughts	High	Low	Low
Vulnerability to typhoons	High	High	Low-moderate
Dependence on forest/watershed	Low	Low	High
<i>Institutional/demographic/ethnographic features</i>			
Average size of land holdings (hectares)	0.3 ha	1.3 ha	<1 ha
System of property rights	Atar (shareholding); Equal bilateral inheritance;	Private property	Primogeniture property rights
Key feature	Fairness and flexibility in the allocation of land rights and obligations among members;	Private ownership of land	Land is inherited by the eldest son
Hypothesized rationale for institutional choice	To mobilize labor quickly and fairly in response to flooding; redistribute risks in times of flooding and drought	Private ownership	To preserve the ecological integrity of the watershed; size of land holding is a coveted status symbol to signal strength of the clan
Tradability of land rights	Yes	Yes	No
Divisibility of land rights	Yes through fractionalization of atar shares	Yes through deed of absolute sale of land ownership	No
Examples of similar property rights around the world	None/unique to Ilocos region of the Philippines	Common in the Philippines and worldwide	Medieval Britain, Russia, India, France, Germany, other European countries
Population density	High	Moderate	Low
Dominant ethnic group	Ilocano	Ilocano/Ibanag	Ifugao

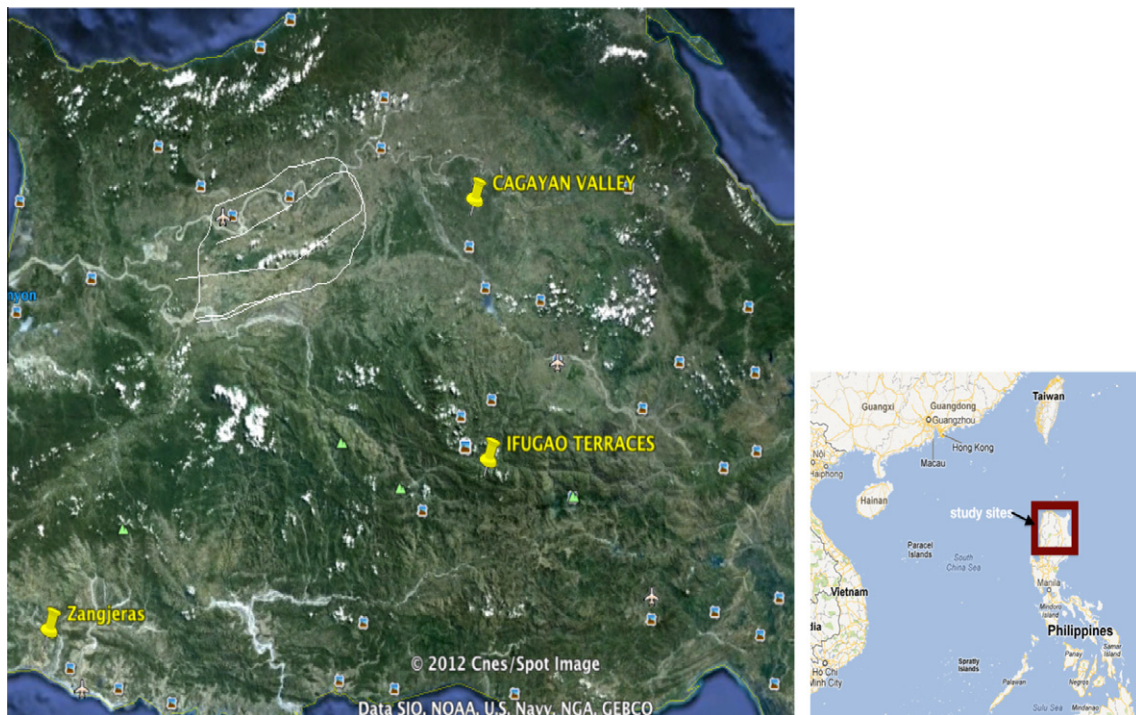


Fig. 2. Relative location of the three case studies. Clockwise: Cagayan Valley, Ifugao Terraces and the Zangjeras (bottom left corner). Source: Google Earth.

contribute roughly 1/20th of the costs (labor, materials, cash). While the actual obligations would vary depending on the need, it will remain consistently the same overtime as a proportion of total costs as well as remain the same relative to other shares. Even if the atar shares are divided and subdivided as a result of leasing or inheritance, the amount of obligation stays the same relative to other shares. In this sense, the atar system is highly flexible to

changing conditions, is fair to all because of the costs and benefits are in the same proportion and is self regulating with low transaction costs because it is easily understood and transparent.

In summary, the atar is an ingenious form of property system characterized by several principles of institutional design: flexibility, fairness and legitimacy, appropriateness and low transaction cost (also see Siy, 1980). I argue that these principles of



Fig. 3. Satellite photo of the zangjera farmlands traversed by the Bacarra-Vintar River. Note the densely populated town center, small farm holdings and the heavily silted, expansive river, which makes a permanent dam infeasible. Heavy siltation and a monsoon climate is the main source of persistent flooding in the zangjeras, requires a reliable method of mobilizing labor for constant repair. During periods of drought, the zangjeras need a fair system to allocate scarce water. The atar system of property rights evolved to solve these twin problems. Source: Google Earth.



Fig. 4. Satellite photo of irrigated farmlands in the Cagayan Valley served by the Magat Reservoir (top left corner). The Valley does not face the problems of flooding, droughts and land scarcity unlike in the zangjeras. For this reason, there was no pressure for the local population to devise ingenious institutions to adapt to their physical environment. Source: Google Earth.

institutional design evolved out of the need to mitigate the risks of unpredictable water supply (flooding and drought) that directly affects the production system (irrigated farming) in the zangjeras. The way it works can be summarized as follows.

First, during times of flooding, there is always a need for the constant repair of the irrigation facilities and the brush dam. This would require a mechanism to regularly mobilize labor. For such a system to be sustainable overtime, it would have to meet three requirements: (1) flexibility i.e. labor requirements would vary depending on the severity of flooding; (2) fairness i.e. to ensure that individual members do not free ride in their contribution of labor to repair the infrastructure damaged by the floods, the allocation of labor costs and benefits would have to be fair; and (3) self-regulating i.e. the cost of mobilizing labor and enforcing compliance with organizational rules would have to be low cost – easily understood and with low enforcement costs – to be robust over the long term. It is in this sense that the effects of physical geography on institutional choice is mediated by the production system.

During times of drought, farmers in the zangjera adapt by shifting to crops that can cope during times of water scarcity. This is made possible because of the following institutional arrangements in the zangjera. First, when the zangjera was originally formed, the parcels of land of the founding members were distributed such that some parcels were located upstream, some midstream while others are located downstream. This way, when water is only available upstream during the dry months, the costs and benefits are fairly distributed among the members. This also gives everyone an incentive to more efficiently utilize water to ensure that their parcels at the tail end of the system are irrigated.

Second, the distribution of fertile and less fertile parts of the farm is also made equitable with this formula of rights allocation. Third, if there is not enough water for the whole system, the zangjera may decide not to irrigate particular blocks such that the farm size of all farmers are reduced proportionately since all will have parcels of land in that block. Finally, the atar shares in the zangjera are distributed as parcels of long strips of land perpendicular to the water source to enable farmers to better control water. This was

designed to give them more freedom to select cropping patterns or schedules which suits his/her own capabilities and needs without having to conform to decisions of neighboring farmers since water does not have to flow from those parcels into his own. As a result, at any given time, the zangjeras can afford to have a diverse array of crops in different stages of growth as well as flooded parcels next to unflooded fields.

Therefore, this ingenious configuration of land parcels and the distribution of atar shares allow farmers to diversify their risks from pests, flooding, drought, prices, soil quality and hence make them highly adaptive to vulnerabilities. This is a second illustration of how the effects of physical geography (drought) on institutional choice (equitable allocation rules for land and water) are mediated by the need to mitigate the risks in the production system.

4.3. Cagayan valley region

4.3.1. History and physical geography

The Cagayan valley region in northern Philippines is one of the country's rice granaries. The valley is kept productive year round by, among others, the reliable Magat River Integrated Irrigation System (MRIIS). It was built by the government some 50 years ago and the largest of its kind in the Philippines with a service area of 83,000 ha. The Magat watershed has headwaters originating in the mountainous region supporting the Ifugao rice terraces to the east. The physical features of the valley are illustrated in Fig. 4.

Because of the reservoir, the valley is not vulnerable to flooding and droughts unlike the floodplains in the arid region of the zangjeras. Consequently, farmers do not see the necessity for similar cooperative societies like the zangjera nor they see the need for flexible labor arrangements and flexible property systems such as the atar system of property rights.

4.3.2. Institutional choice and the effects of geography

As Table 1 above has shown, the institutional features of the Cagayan Valley region are markedly different from that of the Zangjeras and the Ifugaos. First, the average size of land holdings per household, at 1.3 ha, is about four times that of the 0.3 ha in the zangjeras. Unlike the zangjeras whereby the population has long been settled and where land is scarce, the population of the valley grew alongside the growth of agriculture where land was more abundant.

Second, and more importantly, the system of property rights in Cagayan Valley – private ownership of property – is typical for the rest of the Philippines, which is divisible through a deed of absolute sale. This is markedly different from the zangjeras in the Ilocos Region, which are owned collectively as a club with limited tradability and are not physically divisible but can only be traded in terms of shareholder rights.

These variations in the system of property rights is all the more notable because the population in both regions come from the same ethnolinguistic group, the Ilocanos, who also depend on irrigated rice farming as the foundation of their economy. However, the system of property rights and practices on inheritance in both regions are quite distinct from each other. In other regions of the Philippines where the Ilocanos also settled, for instance in the frontier provinces of Mindoro and Cotabato where land and water are not scarce, the atar system and the zangjeras are noticeably absent thus corroborating the hypothesis on the effects of geography on institutional choice.

4.4. The Ifugao rice terraces

4.4.1. History and physical geography

The Ifugao rice terraces are located in the mountainous region of northern Philippines, bordering the Cagayan Valley to the east



Fig. 5. Aerial photo of an illustrative sample of the 4000 square kilometer Ifugao Rice Terraces nestled along steep mountain slopes. The terrace embankments stretch some 20,000 km (halfway around the world) of which 7000 km are stone walled. Photo by Department of Tourism (2008), Banauue District, Ifugao Province.

and the Ilocos region to the west (see Fig. 2 above). The Ifugao rice terraces – a world heritage site – have been around in the last 2000 years. The UNESCO (1995) inscription reads as follows:

For over 2,000 years, the high rice fields of Ifugao have followed the contours of the mountains. The fruit of knowledge passed on from one generation to the next, of sacred traditions and a delicate social balance, they helped form a delicate landscape of great beauty that expresses conquered and conserved harmony between the human-kind and the environment – UNESCO, 1995.

Conklin (1980) reports that the terraces occupy an area of about 4000 square kilometers in mountainous slopes as steep as 70° and as high as 5000 feet and with terrace embankments stretching some 20,000 km, equal to the distance halfway around the world, of which 7000 km are stone walled. Fig. 5 provides a visualization of the physical geography of an example of one of these rice terraces.

As Conklin (1980) adds, “operating and maintaining the terraces is a complex feat of structural and hydraulic engineering that requires constant repair, extension, restructuring and dynamic recycling of resources while trying to surmount a variety of uncertainties and shocks.” These challenges include (1) “unpredictable earthquakes of varying magnitudes, the Philippines being earthquake prone, which as a result often damage streams that feed the terraces and lead to their collapse; (2) frequent landslides due to monsoons and cloudbursts, as the Philippines averages 26 typhoons a year; (3) numerous pests and diseases associated with farming and (4) inherent conflicts over scarce resources such land, water and forests.” Under these conditions, rice farming can indeed be a risky feat. As I will argue in the next section, the Ifugaos have fashioned a set of informal institutions – woven into their culture – to overcome these geography induced risks.

4.4.2. Effects of physical geography on institutional choice

A key institutional feature of the Ifugao society is their property law which is based on the principle of primogeniture rights i.e. – the first born acquires the right to inherit the entire or substantial part of property of his parents while younger siblings would have to develop or acquire their own properties (Conklin, 1980). I argue that the mountainous physical geography in the Ifugao region influenced the development of the primogeniture system property rights in the following ways (see Araral, 2011).

First, for the rice terraces to function properly and sustainably overtime, they need sufficient year round water supply to prevent the drying and cracking of the soil. Year round water supply in turn

depends on the functioning of the life support system for the rice terraces – the *muyongs* or family forests and woodlots – which are located above the upper most part of the rice terraces. The *muyongs* are maintained as forest cover for the watersheds that supply the water needed to irrigate the terraces as well as a source of fuel-wood, timber and food.

Second, in order to maintain the integrity of the *muyongs*, an entire area is to be inherited and cannot be subdivided into a smaller area. If the *muyongs* are fragmented, it could spell problems for the sustainability of the terraces. Finally, the primogeniture system of property rights is central to maintaining kinship as the primary basis for social relations among the Ifugaos and a mechanism for balancing power among competing interests in the Ifugao society. As Barton (1919) notes:

It is preferable for the Ifugaos that a family has at least a powerful member around whom the kin may rally and to whom they may look for aid than to have the family property split into insignificant parcels that would affect little the property of all. The unity of the family is primordial and must be preserved at all times and at all cost.

The primogeniture principle of property rights, however, is not unique to the Ifugaos and was in fact commonly found in ancient laws in Athens, England, France, Germany, and other European countries. The rationale behind this principle was often associated with the need to keep the original land intact to support the mandatory military conscription of the eldest son during medieval times. However, in the case of the Ifugao rice terraces, their primogeniture system of property rights evolved independent of the European influence, mainly because the Ifugao people were never colonized during the Spanish era in the Philippines. The need to maintain the ecological integrity of the watershed to support the functioning of the terraces and the need to maintain kinship as basis of social order are more likely to be the rationale behind the primogeniture property rights in the Ifugao region. It is in this sense that physical geography affects institutional choice through its direct effect on the Ifugao rice production system.

5. Conclusion and implications

This paper sought to examine the effects of physical geography on institutional choice. Using three case studies and controlling for the effects of production system, time and culture, this paper compared how institutional choice varies with physical geography and whether this variation is mediated through the production system.

The study finds that, indeed, variations in physical geography are associated with institutional variations and that this variation is mediated through the production system. Physical geography presents risks and opportunities for a production system – for example flooding and droughts – and that actors devise institutions to mitigate these risks or take advantage of these opportunities to achieve their production functions.

In the Ilocos region, this is evidenced by the evolution of the zangjera cooperative society, the ingenious design of the atar system of property rights and the equitable allocation of land and water rights, all of which can be regarded as mechanisms to mitigate production risks posed by flooding and droughts. In the Ifugao mountainous region, the Ifugao farmers developed the primogeniture system of property rights, which cannot be divided nor traded or sold to outsiders. Its rationale is to protect the integrity of the forest and watershed in order to sustain the precarious functioning of the rice terraces over a long period of time (and hence mitigate the risks of drought). In Cagayan Valley, the Magat Reservoir effectively mitigated the risks of flooding and drought and hence there was no need for institutional mechanisms such as a cooperative

society or ingenious systems of property rights like those found in the Zangjeras and the Ifugaos. These three examples have therefore shown how variations in physical geography are associated with variations in the institutional features of the same type of production system and ethno linguistic group.

These findings and tentative conclusions from the study have several implications in terms of the current debates on geography and institutions in general and institutions governing the commons in particular. First, the mediated and conditional effects of geography on institutions puts into question the generalizability of arguments about environmental determinism on one hand and institutional triumphalism on the other. Rather, as this paper has shown, albeit in a small-n comparative analysis, the effects of physical geography on institutional choice can be mediated through the production system. This contingent outcome in turn could be argued to be a product of a historical process or as Dosi (1997) puts it: “the explanation to why something exists intimately rests on how it became what it is”. This observation is consistent with the main argument of scholars of evolutionary economic geography, for instance Boschma and Frenken (2011), “that variations in economic activity across space can be understood as an outcome of largely contingent, yet path dependent, historical processes.” In this view, institutions matter in evolutionary economic geography for their conditioning – rather than determining – effect on firm (or household) behavior and regional development.

Second, institutional choices evolve as a mechanism to mitigate risks or take advantage of opportunities. Here, the idea of institutional Darwinism might be of relevance i.e. institutional choices in the commons are a function of, among others, geography induced selection pressures. In the cases studied in this paper, the selection pressure stems from persistent cycles of flooding and drought, which poses significant risks to the production system (farming) in a region, which influences the choice of institutions and in turn affects the production system and geography (Fig. 6). For instance, the primogeniture property system among the Ifugaos is key to maintaining the ecological integrity of the forests and watersheds to prevent droughts, which is central to the survival of the 2000-year old rice terraces. Similarly, the formation of the zangjera cooperative society and their atar system of property rights helps them to adjust to the selection pressures of flooding and droughts which ensures the robustness of the production system.

Second, if indeed institutions governing the commons have an endogenous and evolutionary effect on production systems and physical geography, then scholars need to develop analytic approaches to study these relationships. This paper has shown one such approach – a comparative case study approach – which can tease out the nuances of history, contexts, selection pressures and choices which otherwise is lost in the conventional instrumental variable approach favored by economists.

Finally, this paper hoped to start a conversation between geographers on one hand and on the other hand scholars studying the evolution of institutions governing the commons. The findings of the paper that institutional diversity in the commons can plausibly be explained by diversity of physical geography, suggest that scholars of the commons and geography should work together to

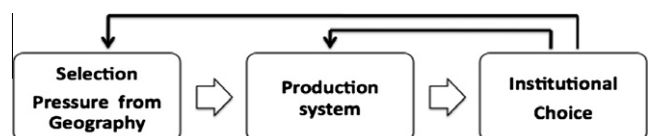


Fig. 6. The endogenous effects of institutions on production system and geography.

further advance our understanding of this important relationship. For a start, it could help account for a puzzle posed by Boschma and Frenken (2006, 2011) on the relationship between evolutionary and institutional economic geography as well as partly answer Ostrom's (1990) puzzle on the diversity of institutions governing the commons worldwide.

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