

The Role of Geography and Agriculture in the Establishment of Property Rights

Mark Bagley
Supervisor: Joakim Gullstrand
Date: 4th June 2009

ABSTRACT

The subject of institutions and their impact upon economic growth has been widely explored by a variety of literature. What has often been ignored, however, is the topic of how institutions arise in the first place. This paper thus takes the view that institutions are shaped by geography, and specifically, the agricultural sector. It is found that there exists some statistical and legal evidence to support such a view.

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INTRODUCTION

This paper will analyse the relationship between geography, and via its influence on agricultural productivity, its impact and influence upon institutions, namely in terms of property rights. It has long been argued that property rights have a role in providing security to an individual who is faced with investment decisions, and is therefore a deciding factor in the determinants of economic growth. This paper will argue that such institutions are born endogenously, via the evolution of the agricultural sector. Specifically, they are established in a legal context upon the expansion of agricultural resources, as such an expansion leads to the increased land values and enhanced investment potential of agricultural producers. Such phenomena have perpetuated repeatedly throughout human history. It is in this context that this paper will examine the evolution of property rights during green revolution India.

The paper is structured as follows. Section one introduces some definitions of institutions for the use of this paper. Section two describes the relationship between geography, institutions, and economic growth, particularly the pre- historical establishment of agriculture and its relationship with the birth of states and bureaucracy. Section three examines the final stage in the establishment of property rights, which this paper will refer to as the *synapse*, and will relate this to the green revolution in India. The last section concludes.

1. DEFINING INSTITUTIONS

According to Greif (2006: 30), “an institution is a system of rules, beliefs, norms, and organizations that together generate a regularity of social behaviour... [they are] composed of man-made, nonphysical factors that are exogenous to each individual whose behaviour they influence”. Not all rules, beliefs, and norms fulfil these requirements, however. If a legal rule, constitutional provision, or a moral code does not influence the behaviour of individuals, then they cannot be considered institutions. Some institutions may be a structure beyond the control of the individuals whose behaviour they influence, and other institutions reflect the actions of these individuals (Greif 2006: 41).

Institutions must also be *reproduced* in order to persist through time. This is what gives institutions their characteristic of *persistence*, in which the rules and beliefs that have guided individuals are not refuted by observed behaviour and outcomes (Greif 2006: 161). According to Lewis (1969: 41-42), “Each new action in conformity to the

regularity adds to our experience of general conformity...our experience of general conformity in the past leads us, by the force of precedent, to expect a like conformity in the future...and so it goes...we're here because we're here because we're here because we're here. Once the process gets started, we have a metastable, self-perpetuating system of preferences, expectations, and actions capable of persisting indefinitely". This *persistence* contributes to an *institutional trajectory*, as argued by Greif (2006: 187: 216), and gives some explanation why some legal frameworks, although inefficient in some areas of the world, persist to this day.

The idea of property rights discussed in an institutional context was pioneered by North (1990) and Hayami and Ruttan (1985). Such ideas may be contributed to Adam Smith, in which he writes (1937: 862), "Commerce and manufacturing can seldom flourish long in any state which does not enjoy a regular administration of justice, in which the people do not feel themselves secure in the possession of their property, in which the faith of contracts is not supported by law, and in which the authority of the state is not supposed to be regularly employed in enforcing the payment of debts from all those who are able to pay. Commerce and manufactures, in short, can seldom flourish in any state in which there is not a certain degree of confidence in the justice of government". Summed up, property rights provide maximum security when and individual has rights to a piece of land "on a continuous basis, free from imposition or interference from outside sources, as well as ability to reap the benefits of labour and capital invested in that land, either in use or upon transfer to another holder (Place et al 1994: 19). Once land rights are established, according to Brasselle et al. (2002: 374), investments in that land increase for three reasons. Firstly, there is the *assurance effect*. Tenure security increases the return on long-term land improvements and conservation measures, and thus farmers have a higher incentive to undertake investment. Secondly there is the *realizability effect*, which is, due to the fact that land is easier to sell or rent, it is thus easier to make improvements to the property, which in turn enhances it. Thirdly, because land titles allow the use of land as collateral, this allows access to credit and enables the farmer to finance investments, both in the short-term and the long-term. This is referred to as the *collateralisation effect*.

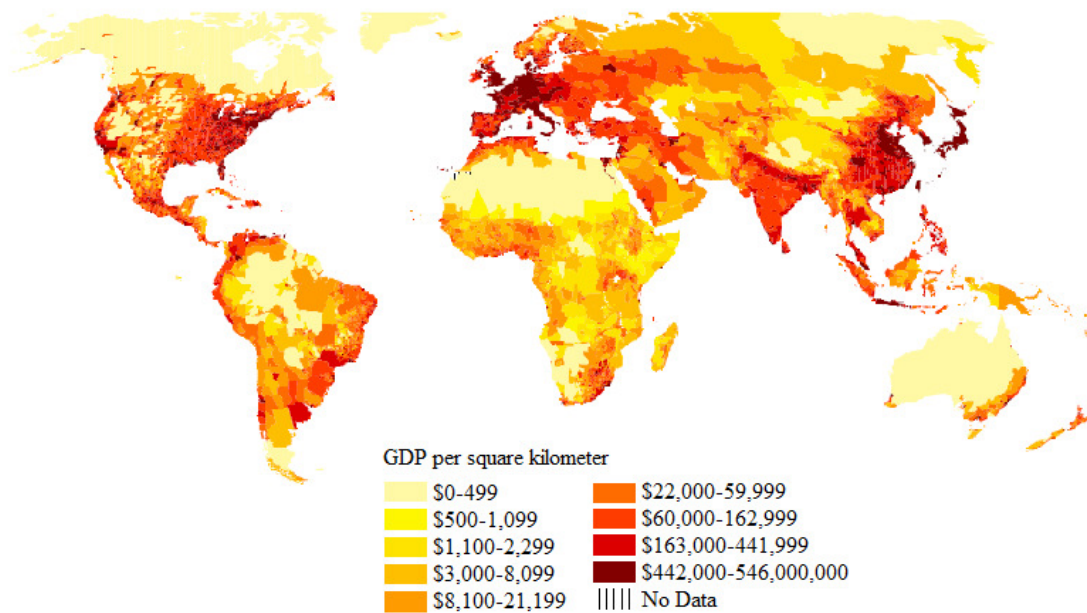
2. GEOGRAPHY, INSTITUTIONS, AND ECONOMIC GROWTH

The steps toward the formation of property rights in an agricultural context should ideally be discussed in both a historical as well as a modern context. This gives some reasoning to why some areas of the world, due to their geographical freedoms, have had a 'head start' toward the formation of property rights, while others areas still struggle with bureaucratic constraints to investment.

2.1 Geography and Economic Growth: Some Observed Linkages

According to Gallup et al. (1999: 180), it has been well documented that there is a strong relationship between geography and economic development. Firstly, nearly all countries in the geographic tropics are poor, and almost all countries in the mid and high latitudes are rich. Furthermore, coastal countries tend to have higher levels of per capita GDP than that of landlocked countries. Outside of Europe, none of the current 29 landlocked countries enjoy high incomes. With regard to population density (which may provide an indication of urban development and/or cumulative transportation costs), there is no straight forward relationship. Some densely populated areas are rich (such as Western Europe) whereas other densely populated areas are poor (such as China, India, and Indonesia). Likewise, some sparsely populated areas are rich (Australia and New Zealand), whereas others are poor (the Sahel in Africa).

Figure 1: GDP Density



When analysing the world map in terms of GDP density (calculated by GDP per capita multiplied by population density, measured in terms of GDP per square kilometre, illustrated in figure 1), it may be seen that the coastal, temperate countries of the northern hemisphere have the world's highest GDP densities, of this area, the world's four core economic zones of the western world (Western Europe, North East Asia, and the Eastern and Western seabords of the U.S. and Canada) are located within it (Gallup et al. 1999: 180). Such a map is descriptive not for reflecting the wealth or regions per se but rather where *money is*. Table 1 illustrates the relationship between geography and some of these variables. Sub-Saharan Africa has one of the lowest GDP's per capita as well having the highest percentage of land located in the tropics. Much of the population is landlocked (as well as only 21% of the population being within 100 km of a coast or an ocean navigable river. Western Europe, on the other hand, is located completely outside the tropics and has the highest average GDP per capita on the list: 89% of the population is located within 100km of a coast or an ocean navigable river.

Table 1: Characteristics of Selected Regions (2007 Figures)

<i>Region</i>	<i>Sub Saharan Africa</i>	<i>Western Europe</i>	<i>East Asia</i>	<i>South Asia</i>	<i>Latin America</i>
<i>GDP per capita (US\$)</i>	1059	37870	2283	948	6450
<i>Population (millions)</i>	800.0	324.2	1912.4	1522.0	560.6
<i>Land area (millions of sq. km)</i>	24	3	14	4	20
<i>Land in tropics (%)</i>	91	0	30	40	73
<i>Population within 100 km of coast (%)</i>	19	53	43	23	42
<i>Landlocked population (%)</i>	28	4	0	2	3
<i>Distance to core market (km)</i>	6237	922	3396	5744	4651
<i>Coastal density (population per sq. km)</i>	40	109	301	387	52
<i>Interior density (population per sq. km)</i>	22	125	91	287	18

Source: Gallup et al. (1999: 183), World Bank (2009)

Gallup et al. (1999: 184) links the relationship between climate and the limitations of agricultural productivity. However, a relationship between coastal regions, and their role in ocean-faring trade, is also explored. It must be stated, however, that these figures and variables are based upon historical economic theory of trade dynamics, as well as that of production possibilities of temperate zones compared to that of tropical zones. Although not discounting such discussions, the topic of this paper is to investigate not the direct impact of geography upon economic growth, but to outline a possible indirect pathway where institutions are affected first. In order to draw this connection, however, a theoretical background outlining the relationship between institutions (namely that of property rights) and agricultural production will first be explored in a historical context. By exploring this historical relationship, we may then begin to see how institutions may be altered in a modern-day framework. The reasoning for this strategy will be discussed in later sections.

2.2 Historical Determinants of Agricultural Production, Growth, and Institutions

Depending on the geographical region, food production may have arisen completely independently (which was the case in the Fertile Crescent, China, Mesoamerica, the Andes, and the Eastern United States), or may have depended on the arrival of founder crops from other regions. Irrespective of the process, local peoples had a tendency of gradually phasing out their diet of wild foods, mostly due to population pressures and changing climates, and slowly phasing in a more sedentary, agricultural lifestyle (Diamond 1997: 98, 101-102, 110).

For the geographical regions where food production had arisen independently, however, it was neither a *discovery*, nor an *invention*. The first people who adopted food production could not have been making a conscious choice or consciously striving toward farming as a goal, due to the fact that they had never seen farming and had no way of knowing what it would be like. Instead, food production *evolved*, and without awareness of their consequences. In a stepwise manner that occurred over a period of thousands of years, the diverse types of hunting and gathering activities diminished in favour of the more reliable crop foods (Diamond 1997: 105-107). The reasoning for this lies with a decision process regarding time and effort. An individual producer may be met with the daily dilemma of either tending to their crops (which would *predictably* yield *many* fruits and vegetables in the *future*), gathering fish

(which would *predictably* yield *little* meat *today*), or hunting animals (which would *possibly* yield *a lot* of meat today, but more likely nothing). Humans, like all animals, make effort-allocation decisions by concentrating first on their favourite foods, i.e. the ones with the highest payoff. If these are unavailable, then they shift to less and less preferred foods (Diamond 1997: 107). Thus, *ceteris paribus*, people seek to maximise their return of calories, protein, etc. by seeking food that yields the most return with the greatest certainty in the least time and effort, while simultaneously seeking to minimise their risk of starvation. It has often been suggested that the first attempts at agriculture was in effect an insurance policy against possible starvation in the future.

The role of technology should be mentioned here, as it not only had a role in a historical context of agricultural transition but also in terms of Green Revolutions seen today. During the time of the transition to agricultural lifestyles, agricultural tools such as sickles, baskets, grinding slabs, roasting techniques, and storage pits were developed for the exploitation of wild plants and cereals, and were in turn a requirement for large scale agricultural production (Diamond 1997: 111). In all, the end result is an “autocatalytic process”, a reverse feedback loop that accelerates itself from the point it begins. As the rise in population densities gave way to more people demanding more food, crop production became and ever more profitable and rewarding lifestyle. More and more of a region’s population were able to become sedentary, and birth spacing became shortened. Increased population growth gave way to more demand for crop production.

The philosopher Jean-Jacques Rousseau speculated that states and institutions are formed by a rational decision that is reached when people, after calculating their self-interest, came to the agreement that they would be better off in a state than in simpler societies, and thus ultimately did away with their simpler societies. However such evidence of state formation has been contrary to observation and historical records, and states have instead often formed as a result of either conquest or external pressure. Building on this school of thought, a related theory, often referred to as “hydraulic theory”, suggests that states emerged from the calculated and foreseen advantages that a large-scale irrigation system would bring, and any such state in turn requires a centralised bureaucracy in order to construct and maintain it. Similar to the arguments surrounding the origins of crop production, as argued above, though there was no such system within a thousand miles to illustrate such advantages at the time. However, hydraulic theory is still popular with many economists, due to the fact that

large scale irrigation systems began to be constructed around the time that states started to emerge (namely in Mesopotamia, North China, and Mexico). According to Diamond (1997: 283), however, hydraulic theory addresses the final stage in the evolution of complex societies and bureaucracies, and fails to illustrate the progression of political structure (from bands to tribes and chiefdoms, etc.) up until the prospect of large scale irrigation networks became a reality. Furthermore, small-scale irrigation systems already existed before the rise of states.

It has been instead argued that societal and bureaucratic complexity is intrinsically linked with the size of the regional population. Combined with the fact that states need to nourish their citizens by food production, Diamond (1997: 284-285) has speculated that intensive food production is the cause of population growth, which in turn triggers a complex society complete with ever developing political structures. Neither entity came first. Via means of autocatalysis, intensified food production and societal complexity stimulated each other. In other words, population growth leads to societal complexity, while societal complexity in turn leads to intensified food production and hence further population growth. Once a “complex society” has been formed, they are then capable of collectively organising public works (such as the above mentioned irrigation systems), long distance trade (which facilitates the importing of metals used for better agricultural tools), as well as the ability to formulate division of labour into economic specialists. Contrary to “hydraulic theory” as discussed above, it has been this process that has been well documented via means of historical records and archaeological evidence. Diamond (1997: 285) lists three ways in which food production contributes to the specific features of complex societies:

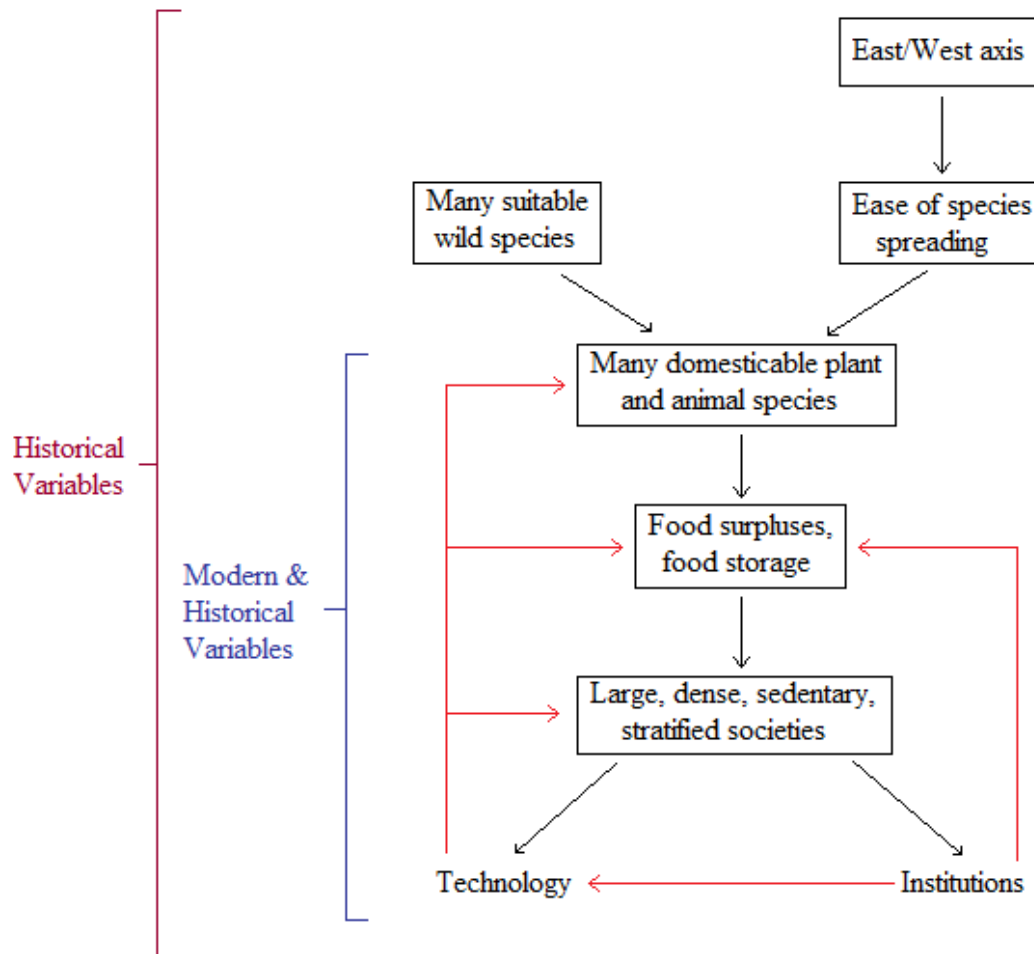
1. Food production involves seasonally pulsed inputs of labour. When the harvest has been stored, the farmer’s labour becomes available for a centralised political authority to harness, whether in the form of building public works that could feed more mouths, or to undertake wars of conquest to form larger political entities.
2. Food production may be organized so as to generate stored food surpluses, which permit economic specialization and social stratification. The surpluses can be used to feed all tiers of a complex society; the chiefs, and other non-food producing specialists; and the farmers themselves, during times that they are drafted to construct public works.

3. Food production requires people to adopt sedentary living, which is a prerequisite for accumulation substantial possessions, developing elaborate technology and crafts, and constructing public works.

Before the adoption of crops, societies tended to be relatively egalitarian, and lacked full time bureaucrats and hereditary chiefs. This is due to the fact that all able-bodied people are obliged to devote the majority of their time acquiring food.

However, according Diamond (1997: 90), “once food is stockpiled, a political elite can then gain control of food produced by others, assert the right of taxation, escape the need to feed itself, and engage full-time in political activities”. It is thus at this point where, during the transition to a completely sedentary lifestyle as a result of agricultural production, institutions, specifically in the form of property rights, have the opportunity to be established and take effect. The relationship between geography and institutions is illustrated in figure 2.

Figure 2: The Reverse-Feedback Loop of Geography, Agriculture, and Institutions



Source: Mainly inspired by Diamond (1997: 87), with some modifications

Acemoglu et al. (2001: 1369) takes the view that, “it is quite likely that rich economies choose or can afford better institutions”. They outline a theory of institutional difference among countries colonized by Europeans, and exploit this theory to derive a possible source of exogenous variation. The theory is as follows. Firstly, there were different types of colonisation policies which created different sets of institutions. At one extreme, European powers set up “extractive states”, which may be exemplified by the Belgian colonisation of the Congo. The institutions established in extractive states did not introduce much protection for private property, and did not provide checks and balances against government expropriation. This was due to the main purpose of the extractive state, which was to transfer as much of the resources of the colonised country to the coloniser. At the other extreme, many

Europeans migrated and settled down in a number of colonies, which are referred to as “New Europes”. In this case the settlers instead tried to replicate European institutions, with a strong emphasis on both private property rights and checks against government power. This occurred in areas such as Australia, New Zealand, Canada and the United States. Secondly, whether or not an “extractive state” or a “New Europe” was set up depended entirely upon the feasibility of the settlements. In places where the disease environment was not favourable to European settlement, the formation of the extractive state was more likely. Thirdly, the colonial state and institutions persisted in most cases well after independence (Acemoglu et al. 2001: 1370). This concurs with the characteristic of *institutional trajectories* as outlined in section one. The mortality rates of colonisers are then used as an instrument for determining the type of current institutions in these countries.

While not criticizing the effect of diseases such as Malaria had an influence on the settlement decisions of colonisers, or the fact that this contributed to the type of institutional bundle colonial powers set up during these times, Acemoglu et al. (2001) have taken the view that the ideal type of formal institutions are the ones created and introduced by European powers. Furthermore, the view that “rich economies choose or can afford better institutions” runs contrary to the view of this paper that such institutions have *evolved* from the primary sector and up. Rich economies have prospered due to the investment opportunities afforded by institutions that have grown out of a geographical environment, as such a geographical environment *warrants* their development. It has been documented that such “ideal” institutional bundles have been formally adopted and enforced in various parts of the world, rich or poor, with greatly differing rates of success. Such examples will be discussed later.

Mwangi and Ostrom (2009), while criticizing the theory of Hardin’s (1968) “tragedy of the commons”, point out that institutions, and especially institutions that involve the interaction between people and the surrounding countryside, have long been ingrained into human society. Hardin (1968) presumed that pastoralists sharing a common agricultural terrain could not establish their own rules and norms to extract themselves from the tragedy of overuse, and thus they could not govern themselves. However, Mwangi and Ostrom (2009), by using data spanning from British colonial rule up until today, investigate the interaction patterns of the varying governance institutions concerning ecology and agricultural pastures in Kenya’s Maasailand. They demonstrate that governance structures have long supported social and

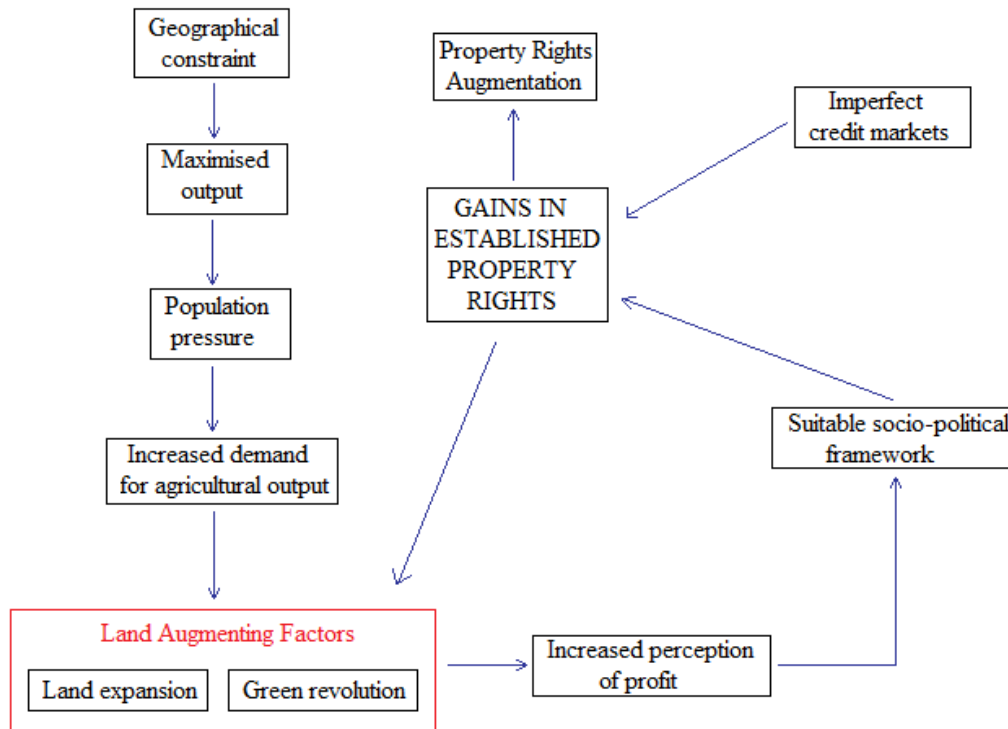
ecological resilience, as well as being resilient to introduced technologies. They also propose that, “human decisions at all tiers are affected by the cultural values of the individuals involved, the resources they possess, the information they obtain, the incentives and disincentives they face, the internal learning and choice processes used, and the time horizon involved”. Furthermore, “individuals learn from their experiences and from culturally transmitted experiences” (Mwangi and Ostrom 2009: 198).

Grimm and Klasen (2008), by comparing a cross-sample of villages on the Indonesian Island of Sulawesi, theorise that the introduction of land titles on the micro level is driven by geography. They propose that the immigration to these villages is driven by the geographical features of these villages. The villages with a relatively high level of immigration in turn experience population pressure on increasingly scarce land resources. Increasing population density and its associated land pressure, as argued by Klasen and Nestman (2006), leads to conflict about the distribution of land, which in turn induces these village to regulate their land market and exact land rights, which clarify property relations and reduce tensions. These land rights in turn increase investments in agricultural technology, which enhances agricultural growth and economic development. As mentioned, the degree to which the process is exacerbated depends on the geographic traits of the land, specifically traits that relate to the agricultural return the land provide. This may include land form (fields on steep slopes require much more labour input for the same return on flat fields, as well as being much harder to irrigate), soil quality, and rainfall (Grimm and Klasen 2008: 4). By employing a system of nested equations and controlling for potential endogeneity problems and unobserved heterogeneity, Grimm and Klasen (2008) found strong empirical support for their hypothesis.

3. THE SYNAPSE

This section will argue that the final stage in the establishment in property rights is brought about by the increased value of land, which in turn is caused by the introduction of land- augmenting technology. This is illustrated diagrammatically in figure 3.

Figure 3: The Synapse



3.1 The Three Sector Hypothesis

The three sector hypothesis was first proposed by Fourastié (1954), and divides economies into three sectors of activity. The primary sector is mostly concerned with agriculture and the extraction of raw materials, the secondary sector is predominantly composed of manufacturing, while the tertiary sector involves the service industry. It is widely viewed that most countries share a common trajectory from progressing from an economy largely based upon the primary sector, or *traditional civilizations*, and on towards economies based predominantly on the secondary or tertiary sectors, known as the *transitional period* and *tertiary civilizations* respectively. This progression may be seen in table 2.

Table 2: The Three Sector Hypothesis

<i>Phase</i>	<i>Traditional Civilizations</i>	<i>Transitional Period</i>	<i>Tertiary Civilizations</i>
<i>Primary</i>	70%	20%	10%
<i>Secondary</i>	20%	50%	20%
<i>Tertiary</i>	10%	30%	70%

Source: Fourastié (1954)

The majority of the world's poor reside in rural areas and attribute the majority of their income from that of agriculture. Thus, as illustrated by Datt and Ravallion (1996) and Grim et al. (2007), sustainable income growth requires improvements in agricultural productivity. This is relevant for not only for populations employed within the agricultural sector but also for the income growth potential of regions and countries as a whole.

It can be argued that an economy should ideally have a well developed primary sector in order to progress fully on to its transitional period. This paper takes the view that property rights are first established in the primary sector, while an economy is in its first or second phase, before such property rights evolve into the secondary or tertiary sectors. Thus, property rights are developed from the agricultural sector and up.

3.2 The Clearances

The Highland and Lowland clearances were a period of agricultural expansion in Scotland during the 18th and 19th centuries. They were characterised by the “clearing and deforestation of Scotland, as well as the eviction of incumbent tenants or crofters (a *croft* is a type of traditional farm community that relies on the sharing of land inputs), in order to establish pastures for sheep farming. The reasoning for this was due to the demand for wool (the industrial revolution was taking off during this time), as well as to alleviate the wide-spread hunger that resulted from the recent population boom in the United Kingdom. Although the clearances were a markedly bloody and controversial affair, it was perpetuated by a group of clan chiefs, whom acted as landlords to the crafting communities. These clan chiefs had a large amount of political connections with the Edinburgh government, which in turn was able to introduce property laws regarding the ownership of agricultural lands (Richards 1982).

It was these laws that have evolved into many forms of property law within the United Kingdom today, as well as having a role in the exported institutional bundles seen in economies throughout the developing world. The 18th century establishment of property rights to clan chiefs may also explain why Britain had a ‘head start’ in institutional development.

The establishment of property rights may thus be seen as a function of agricultural expansion. The next sections of this paper will explain this using firstly the Bardhan (1979) model, which analyses the effect of land- augmenting technology upon sharecropping, as well as discussing the results found by Brasselle et al. (2002). The green revolution in India will then be used in order to explain how an increased perception in profit, due to land- augmenting technology, contributes to the evolution and formation of property rights.

3.3 Sharecropping and Bardhan’s (1979) Model

Sharecropping is the sharing of a tenant’s output in some pre-assigned proportion between the landlord and the tenant. A rational landowner that wishes to maximise his/her earnings from a land lease will always prefer a fixed rent contract as opposed to sharecropping. Furthermore, sharecropping leads to an undersupply of the tenant’s inputs (Ray 1998: 428). This is why sharecropping contracts are said to give rise to Marshallian inefficiency.

Despite this inefficiency, sharecropping is nonetheless prevalent in the real world. Sharecropping contracts are observed primarily in Asia, where it comprises 30% of tenancy in Thailand, 50% in India, 60% in Indonesia, and 90% of farmed land in Bangladesh (Ray 1998: 419). The prevalence of sharecropping contracts, despite their inefficiency, is known as the Marshallian puzzle of sharecropping.

The reason for their prevalence is due to uncertainty in agricultural production. When land is predominantly leased from large landowners to smaller landowners (which implies a relatively wealthy landlord and a relatively poor tenant), the landlord will have less attachment to his/her wealth than that of the tenant, and will therefore be less risk-averse (Ray 1998: 433). Thus, a poorer tenant will have the incentive to adhere to a sharecropping contract as the dividing of the final harvest irrespective of its size is a less risky option compared to the risks of eviction and debt as a result of non- payment.

Bardhan (1979) sets up a model in order to analyse the impact upon a traditional sharecropping tenure system as a result of the introduction of land- improving factors. It is assumed that there are two seasons in the crop cycle. Season one, known as the 'lean' season, involves land preparation, sowing, and so on. Season two involves the harvesting of crops. Land and labour produce "saplings" at the end of season one, and "saplings" and labour produce crop output at the end of season two. From a labour prospective, season one is when the market wage does not clear the labour market due to unemployment, and season two is where there is full employment and the wage rate is competitively determined. From the point of view of the credit market, season one is when the landless tenant is dependent on the landlord for credit to finance his subsistence consumption, and season two is when the landless tenant pays back the loan along with interest at the end of the harvest. Due to the fact that interest rates are high, the length of time for required for the amortisation of income is important. The landless tenant knows that as a wage labourer, he/she can receive a wage income immediately in season one, but as a tenant he/she has to wait until the crop is harvested at the end of season two. Likewise, the landlord knows that if he/she increases the hiring of labour in season one, he will reduce the credit needs of his borrowers.

A 50:50 crop share is assumed, a rate of which has been an unchanged phenomenon over the past few centuries. At this 50:50 rental rate, the landlord decides how much land to lease out to sharecroppers. As tenants do not participate in this decision, a certain degree of monopoly power is exercised on behalf of the landlord. In terms of India, this is not an unrealistic proposition due to the presence of, according to Bardhan (1979: 49), "acute tenurial insecurity, heavy demographic pressures on the land, and a highly skewed distribution of ownership". There is therefore a scenario in which the excess demand in the land-lease market at the conventional rental share, the land rationing of which is performed by the monopolistic landlord.

Let $Q(BA,L)$ be defined as the number of "saplings" produced at the end of season one, where L is labour (which is entirely hired), A is land area, and B is the land-augmenting improvement factor, which, in the case of this paper, will reflect such green revolution attributes. It may also reflect the increase in the effective supply of land, which tends to be one of the more prominent forms of technological progress in the traditional agriculture of densely populated peasant economies. Land increases

become relevant in pre-modern land-augmenting improvement factors, such as that of the highland and lowland clearances in the United Kingdom. Of land area, \bar{A} represents to total area owned by the landlord, and A_t is the land leased out. Thus, $A = \bar{A} - A_t$ is the remaining land available for the landlord to cultivate. $Q_t(BA_t, L_t)$ is the number of “saplings” produced at the end of season one on the sharecropping tenant’s farm, where L_t is the amount of labour the sharecropper uses (Bardhan 1979: 49).

Assuming that one unit of “saplings” produces one unit of crop harvest; the landlord’s income at the end of the crop cycle, Y , may be expressed as equation (1).

$$Y = [1 - \beta w_2] Q(BA, L) + r Q_t(BA_t, L_t) + iC - (1 + i)w_1 L \quad (1)$$

The conventional, often 50:50 crop share is denoted by r , i represents the interest rate, w_1 is the given wage rate in season one, and w_2 is the competitively determined wage rate in season two. B is the amount of harvesting labour used per unit of “saplings”, and C is the amount of subsistence consumption of the landless tenant family that is financed by the landlord by means of credit. It may therefore be seen that the landlord has three sources of income:

1. Rental income from the leased out land
2. Income from self-operated land, less wages paid in the two seasons
3. Interest income

Accordingly, the tenant’s income at the end of the crop cycle, Y_t , may be expressed in equation (2).

$$Y_t = (1 - r)Q_t(BA_t, L_t) + (1 + i)w_1 \mu (1 - L_t) + w_2(1 - \beta Q_t) - iC \quad (2)$$

In season one; the wage rate w_1 does not clear the labour market. In that season the tenant is prepared to supply $(1 - L_t)$ of wage labour, but will only expect a fraction μ of it to get wage employment on the landlord’s farm. The rest will be unemployed (Bardhan 1979: 50).

Assuming that the landlord cannot control the tenant’s use of labour intensity per acre, a_t , he maximises his income with respect to his decision variables A_t and L (as $A_t = (L_t a_t)/B$, the landlord can control A_t , but not a_t). Maximising the landlord’s income Y with respect to these variables, we obtain equations (3) and (4).

$$r \frac{q_t}{a_t}(a_t) - [1 - \beta w_2] q'(a) = 0 \quad (3)$$

$$[1 - \beta w_2] [q(a) - q'(a)a] - (1+i)w_1 = 0 \quad (4)$$

From (3) and (4), and after simplification we obtain:

$$\frac{\partial A_t}{\partial B} = -\frac{A_t}{B} \quad (5)$$

$$\frac{\partial L}{\partial B} = \frac{\bar{A}}{a} \quad (6)$$

Using the equilibrium condition of full employment in season two (7):

$$\beta A(BA, L) = 1 - \beta Q_i(BA_t, L_t) \quad (7)$$

And the standard walrasian stability condition, K :

$$K = \frac{\partial [Q + Q_i]}{\partial w_2} = B \frac{\partial A_t}{\partial w_2} (q'_t - q') + (q - q'a) \frac{\partial L}{\partial w_2} + (q_t - q'_t a_t) \frac{\partial L_t}{\partial w_2} < 0 \quad (8)$$

We have:

$$\frac{dw_2}{dB} = -\frac{1}{K} \left[\frac{q}{a} \bar{A} + 2 \frac{A_t}{a_t} (q_t - q'_t a_t) \right] > 0 \quad (9)$$

Thus, an increase in the land-augmenting improvement factor, B , increases the equilibrium wage rate. From (9):

$$\frac{dA_t}{dB} = \frac{\partial A_t}{\partial B} + \frac{\partial A_t}{\partial w_2} \frac{dw_2}{dB} \quad (10)$$

Equation (10) suggests that we have two conflicting influences of the land-augmenting factor on the extent of land leased out by the landlord. The second term on the right hand side is negative, which would suggest that the self-cultivation on the behalf of the landlord would be more profitable. However by doing this, the landlord hires labour in season two by a rate of w_2 . This wage rate is not a constant

but in fact increases, which would induce the landlord to self-cultivate less and lease out more land. Using equation (11), where J is the Jacobian of equation (3):

$$\frac{\partial A_t}{\partial w_2} = \frac{-\beta}{J} [1 - \beta w_2] \frac{a}{L} q(a) q''(a) > 0 \quad (11)$$

We thus find that the latter effect, that is an increase in the leasing out of land to sharecroppers, dominates (Bardhan 1979: 52).

However, (Bardhan 1979: 52) also adds that, if we were to assume that land-augmenting technical progress requires the purchase of inputs or services, and the market for which was imperfect, a different result may be obtained. This may be due to the landlord having better connections and access to the government subsidised distribution of agricultural technology, or due to landless tenants having fewer channels of cheap credit open to them in which to buy such inputs. As a result, the landlord will have a differential advantage over the tenant. It would therefore be easy to prove that, the larger the degree of imperfection in the market for these inputs, the lower is the percentage of area under tenancy (unless the landlord takes up cost-sharing with the sharecropping tenant).

Bardhan (1979) found conflicting results when studying the effects of land-augmenting factors upon India. According to the time series evidence, there is a decline in the incidence of tenancy along with agricultural progress. However, when examining the cross-sectoral data, there is evidence that the agriculturally better off regions have a larger proportion of area under tenancy than that of the less well off regions. In sum, it was found that firstly, the percentage of area under tenancy will be higher in areas where the land improvement is higher. Secondly, the larger the degree of imperfection in the market for inputs, such as that of high-yielding seeds, the lower the percentage of the area under tenancy. Thirdly, the larger the labour-intensity of the crop harvested, the higher the percentage under tenancy. Fourth, the percentage of area under tenancy will be smaller in areas with higher interest rates on credit. It was lastly found that, the larger the extent of unemployment facing landless households, the higher the rate of sharecropping tenancy (Bardhan 1979: 48, 53).

The reasoning for using the Bardhan (1979) model, as well as its results, is to demonstrate that the increase in the demand and implementation of property rights may be a function of the investment and profit perceptions of the agricultural

producer. This paper is not about *who* gains property rights and the alleviation of poverty and inequality, but rather *how* property rights come about in their own right, irrespective of who benefits from them. There has been a wide array of literature demonstrating that green revolutions may have in fact a negative effect on equality, depending on the structure of transactions involved before their implementation. In the case of India, this was sharecropping. According to Knox and Agnew (1989), citing evidence by Schejtman (1982), Joshi (1982), Jones (1982) and Hewitt de Alcantara (1976), “where capital- intensive agriculture is introduced into areas with an uneven distribution of resources it exacerbates the condition of the rural poor by marginalizing subsistence systems, such as sharecropping, and encouraging the polarization of land control between a class of capitalist farmers on the one hand and the mass of the rural population on the other”. Osmani (1993) also notes the exacerbating effect of agricultural technology on poverty, albeit with a larger focus on the mechanization of labour.

3.4 Profit Realization, Investment Incentives, and Legal Change

With a higher realization of profits on behalf of the crop-producing landlord, an increase in investment incentives may then be realised. Brasselle et al. (2002) uses the following estimation equation:

$$I^* = \alpha + \beta\hat{R} + \gamma X + u \quad (12)$$

I^* represents the level of investment, R is an observed variable measuring land rights, X is a distinct vector of exogenous variables, and u represents the uncorrelated residuals. Property rights were measured upon the following ten observable variables:

1. The right to chose which crop to grow
2. The right to put one’s land into fallow and to recultivate it once the fallow is over”
3. The right to bring improvements to the land
4. The right to freely dispose of crop output
5. The right to prevent the grazing of other’s livestock
6. The right to lend the land among traditional lines
7. The right to give it
8. To bequeath it

9. To rent it against cash
10. The right to sell (this variable was not included in the Brasselle et al. (2002) study as, due to cultural and familial constraints in Burkina Faso, it is rarely observed)

When studying the effect upon investment among agricultural households in Burkina Faso, it was found that there was a lack of the *assurance effect*, as discussed in section one of this paper. However Brasselle et al. (2002) examined the impact of introduced property rights upon investment variables. It may be argued that it is in fact the other way round, and, due to the increased realisation of profitability as found in the Bardhan (1979) model, the establishment of property rights are instead a result of the increase in investability, which in turn result from an increase in land-augmenting factors.

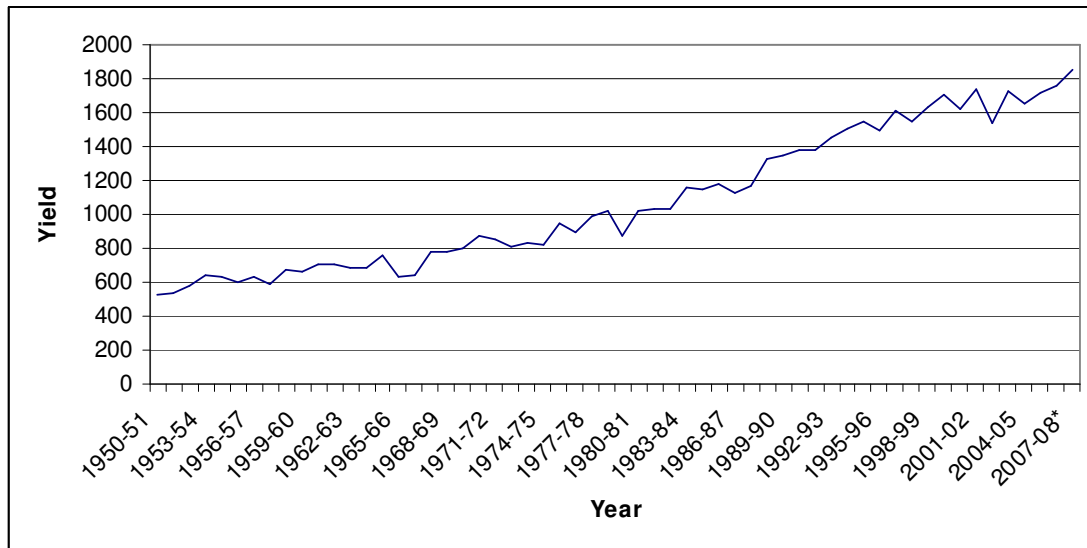
As discussed in section two, institutions must *evolve* within an economy in order to function efficiently, as opposed to being introduced and enforced. Other authors have arrived at similar results to that of Brasselle et al. (2002). Besley (1995) looked at two regions in Ghana, and found that for only one of them land rights had a positive impact upon investment. Jacoby and Minten (2007) analysed the case of Madagascar, and again found that land title had no significant effect on plot- specific investment. However, Broeck et al. (2007) found that property rights had a positive impact in Vietnam. They found that such effects only occur if land titles are exclusive and provide ownership rights in addition to user rights. Property rights would be formalized only when the return on investment on land is high, coupled with the existence of collateralized lending exists. They explain that such conditions are likely to apply in many regions in Latin American and Asia, but less so in Sub- Saharan Africa, where the return on investment tends to be quite low.

3.5 The Green Revolution in India

The green revolution in India initially took off during the early 1960s, and was marked by the introduction of High-Yielding Varieties (HYVs) of crops, which tend to have a better responsiveness to plant nutrients from both soil and the action of sunlight through photosynthesis. This increased nutrient uptake required greater structural strength, which was embodied by the dwarf and semi- dwarf varieties of the original crop. These varieties were stockier and more robust, which allowed the absorption of more nutrients into the grain itself. Thus, HYV crops were characterised

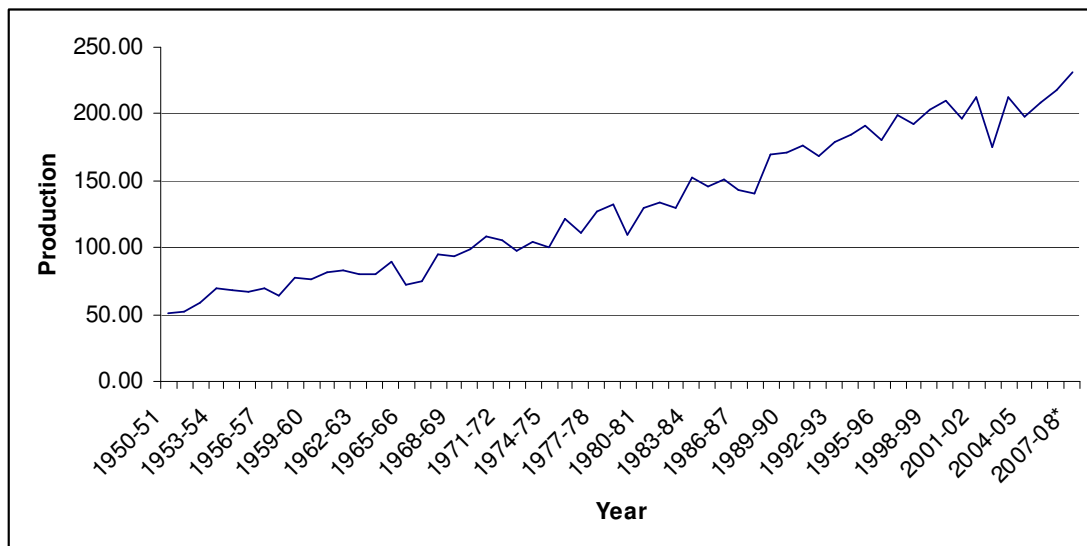
by heavier grain clusters without ‘lodging’ (i.e. collapsing) and were able to withstand high winds and rough treatment from human hands or machines (Pearse 1980: 9). This led to higher yields per unit of area. Figure 4 and figure 5 illustrate the increases in crop yield and crop production in India from 1950-2008, respectively.

Figure 4: Agricultural yields in India (Kg/Hectare) 1950-2008



Source: Directory of Economics and Statistics (2008)

Figure 5: Agricultural production (millions of tonnes) in India, 1950-2008

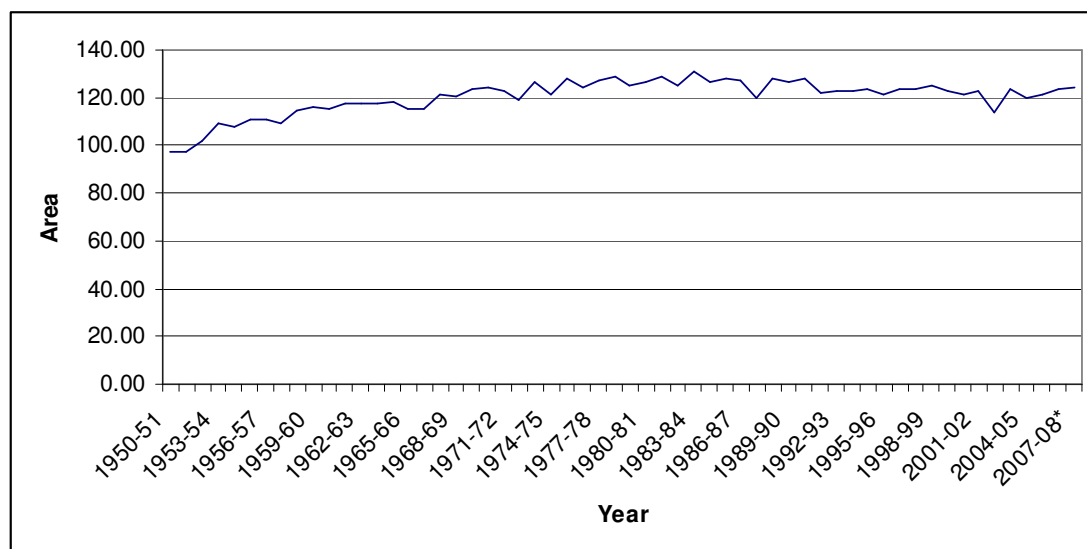


Source: Directory of Economics and Statistics (2008)

Crop yield increased from just over 500 kg per hectare to roughly 1800 kg per hectare from 1950 to 2008. Likewise, crop production increased from around 50 million

tonnes in 1950 to 225 million tonnes in 2008. This enormous expansion of agricultural production turned India from a country with wide-spread starvation into a net exporter of food. The area under agricultural production increased over this period, albeit at a more conservative 20% during the same time period (seen on figure 5). It may thus be observed that the increase in crop production was predominantly due to the increases in crop yields (as a result of high yielding varieties), rather than area expansion.

Figure 5: Area under agricultural production (millions of hectares) in India, 1950-2008



Source: Directory of Economics and Statistics (2008)

Gill (1989) examines the history of land reform in the Punjab (a state in northwest India which was one of the major sources of agricultural growth during the green revolution). Shortly after the partition of India, a major part of the land (roughly 48%) was under tenant cultivation. The majority of these tenants were tenants-at-will (those who have no security of tenure). Sharecropping was therefore the most prominent method of payment of rent, and land was concentrated in few hands. After India's independence, a series of land reforms were introduced in order to encourage modernization. These were as follows (Gill 1989: 79), the final stages of which were established with the Punjab Security of Land Tenures Act 1953:

1. The abolition of intermediaries
2. Tenancy reforms
3. Ceiling on land holdings

4. The consolidation of land holdings

However, the land reforms devised in the 1950's and extended in later periods, that were initially supposed to change the obsolete land relations that were obstructing growth, had an opposite effect on the demographic they were supposed to help. Table 3 shows the distribution of land tenure in Punjab in 1970-71 and 1980-81. The number and area of holdings that were wholly owned had actually increased over a ten year period, whereas the number and area of rented holdings decreased.

Table 3: Percentage Distribution of Land Tenure in Punjab in 1970-71 and 1980-81

1970-1971				1980-1981			
Number of Holdings		Area of Holdings		Number of Holdings		Area of Holdings	
Wholly Owned	Wholly of Partly Rented	Wholly Owned	Wholly of Partly Rented	Wholly Owned	Wholly of Partly Rented	Wholly Owned	Wholly of Partly Rented
80.81	19.19	82.41	17.59	82.03	17.97	78.77	21.23

Source: Gill (1989: 82)

The Punjab Land Reforms Act 1972, which involved the collection of surplus (i.e. unused) land and redistributing it among landless tenants, had the opposite effect. It was found that these surpluses were being acquired by influential person via restricted auctions, and subsequently resulted in the eviction of previous tenants. It was found that the very elite of Punjab society that had put such land reform acts into law were reversing the process of land reform itself (Gill 1989: 82). Thus, once land relations were in tune with the new mode of production, further implementations of land reform had long since lost their original social significance and were instead instruments in providing security tenure to the original landlords themselves. It should be noted that, upon the implementation of land reform in the 1950's, although themselves were property rights, they were not in effect *institutions*, as they had not swayed the behaviour of the society that they were originally designed to influence.

CONCLUSION

This paper has argued that property rights are established via their evolution in the agricultural sector, which in turn is endogenous with respect to the geographical constraints it is situated in. Therefore, it is argued that institutions are endogenous and arise upon the interaction of society with the agricultural sector, specifically by means of population pressure. Although it has been long established that property rights are instrumental in promoting long-term economic growth, this may in fact be largely indirect, as it has been shown that the establishment of property rights as a result of agricultural expansion have first led to increases in inequality due to the misallocation of resources. More research into that area is therefore needed. However, upon agricultural expansion, there exist opportunities for increased profit and investment, and this is the key to how property rights get established in an economy.

Many authors have long argued that institutions are exogenous, and have taken the view that the ideal institution is one that may be introduced into an economy, based on the previous successes of such institutional bundles. While such strategies have occasionally proved successful, the *origins* of such ideal institutional bundles have often been an ignored topic. Property rights arise as a *response* to the economic and demographic pressures, and in terms of developing economies, this occurs in the sector that is of the most prominence, and that is the agricultural sector. Such property right may then be augmented into subsequent sectors as the economy evolves along the three sector hypothesis. Furthermore, an economy will be generally constrained in evolving along this path if absences of property rights prevail.

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