

Creating Institutions for Survival: Games Against Nature in Premodern Iceland

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CREATING INSTITUTIONS FOR SURVIVAL: GAMES AGAINST NATURE IN PREMODERN ICELAND

I. Introduction

We are concerned here with the creation of non-market institutions for reducing the cost of risk in poor agrarian societies that operate at low levels of technology without the benefits of insurance, credit and other intertemporal markets.¹ Institutions, the formal and informal rules that order and constrain human relations, affect three critical aspects of economic performance: the distribution of wealth, the joint value of resources or aggregate output, and the variability over time in individual and communal income and consumption.² Here we examine primarily the role of agrarian institutions in containing risk or variations in income and consumption, while realizing that institutional adjustment at one margin typically involves a sacrifice (opportunity cost) at some other margins. It is conceivable, for instance, that that informal insurance arrangements in traditional agrarian societies may stand in the way of economic development, as we shall consider below.

The paper's theoretical approach is based on the new economics of institutions, which emphasizes the role of property rights and transaction costs, whereas the empirical section explores the case of premodern Iceland.³ Premodern Iceland is of interest for the economics of institutions for several reasons. First, Iceland's isolated population remained culturally homogeneous, and emigration was inconsequential, from the end of the settlement early in the tenth century A.D. until late in the 19th century. Similarly, the technologies and methods of production did not change substantially for a comparable period.⁴ Therefore, the Icelandic

¹ For an introduction to the literature on traditional systems of social security in developing countries, see the various contributions in Ahmad et al., eds. (1991).

² Only to the extent that they are enforced and obeyed do institutions constrain behavior. Following North (1990), we use the term *institutions* to refer to formal and informal rules and their enforcement characteristics.

³ Eggertsson (1990) surveys the new economics of institutions.

⁴ For an account in English (with an anthropological flavor) of Icelandic society 1400-1800, see Hastrup (1990). Hastrup provides an extended bibliography. Gunnarsson (1983), Chapter 1, provides an excellent short account of the structure of premodern Icelandic society. Gunnarsson's pioneering reinterpretation of the economic history of Iceland has inspired and influenced my thinking.

case provides an opportunity to test the implications for institutional change of technological stationarity in a small homogeneous society and answer the question whether stationarity and homogeneity undermine inefficient institutions by facilitating learning, bargaining, side-payments and collective action.⁵ Second, as premodern Iceland was located at the margin of the habitable world, the opportunity cost of decisions based on unrealistic ideological values or inappropriate models of the environment could be very high. It has been argued that nature forces societies that live close to extinction to adjust their set of institution to their production set and reach a high degree of static efficiency in terms of their resources and technology.⁶ The study of institutional arrangements in traditional Iceland provides an opportunity to explore these issues. Third, the institutional structure of premodern Iceland is a curious hybrid of considerable interest. Already in the age of the Commonwealth (or Free State), 930-1262, the Icelanders had developed relatively sophisticated local and national governance structures and written laws which relied on self-enforcement.⁷ The local communes, called *hreppar* (singular, *hreppur*), which were given considerable autonomy, are of particular interest as instruments of self-governance. From 1262 until the twentieth century Iceland belonged to the crown of first Norway and then Denmark. The country's remoteness and high costs of communications created interesting agency problems between the crown and its agents in Iceland.⁸

The economic history of Iceland is one of stagnation stretching perhaps more than 600 years from the last period of the Commonwealth era and into the 19th century. During this extended period, the size of the population appears to have fluctuated around 50,000

⁵ The work of many scholars of the information and transaction cost school suggests an affirmative answer. However, Olson (1982) has made the opposite case, arguing that stability breeds special interest organizations. North's (1990,1993) recent emphasis on path dependence, which he relates to mental models and systems of beliefs partly rooted in culture, is consistent with the long-term survival of inefficient institutions in a stable environment.

⁶ Posner (1980) has made a case for the static allocative efficiency of primitive societies. North (1990) emphasizes that agents are capable of learning and tend to adjust their systems of beliefs and mental models, when they receive strong unambiguous feedbacks from actions based on unrealistic beliefs. McGovern (1981) provides a fascinating account (largely based on archeological data) of the seemingly unrealistic mental models of the Norse settlements in Greenland (c. AD 985-1500). The mysterious extinction of these settlements continues to puzzle scholars.

⁷ Johannesson (1974), Miller (1990), Friedman 1979.

⁸ Gustafsson (1985) provides an account (in Swedish) of the nature of such agency problems in Iceland of the 18th century.

individuals, the primitive agricultural and fishing technology did not advance, and the economy's productive assets may have shrunk.⁹ We intend in a series of studies to look at aspects of the institutional structure of Icelandic society during the country's long period of decline, particularly in the 17th to 19th centuries which provide relatively reliable data.¹⁰ The present study explores how premodern Iceland used various institutional arrangements to lower the cost of life-threatening risks. We both analyze the system's general features and explore in some detail a specific cases of alleged institutional failure: the lack of adequate institutions for governing the storage of fodder and the management of livestock size. Here we examine a debate that lasted for centuries concerning the long-term storage of fodder as a means to prevent the periodic starving to death of domestic animal, a problem that plagued Icelandic farming as late as the early 20th century.

The paper is divided into the six sections. The section that follows introduces the theory of non-market institutions for pooling and sharing risks in poor agrarian societies. The analysis is in terms of the economics of information and transaction costs. The third section outlines the economic environment and the structure of property rights — or the main elements of the production and institution sets — in premodern Iceland, particularly in the 18th and 19th century. The main sources of risk are identified. The fourth section analyzes various non-market institutions that influenced the level and distribution of risks in traditional Iceland. Our sources include the ancient lawbooks of Iceland, *Gragas*, which contains the laws of the Commonwealth, and *Jónsbók* from 1281, which remained partly in effect into the 20th century, along with more recent royal decrees, laws and regulations. We examine social rules and custom concerning mutual assistance in the local communes, institutions restricting both the fertility and the mobility of labor, and the structure and risk-sharing characteristics of private contracts for land, livestock and labor. The fifth section considers the great storage debate and the alleged failure to create institutions to smooth climate-related fluctuations in livestock size. The sixth section sums up.

⁹ The earliest reliable population figures are from the census of 1703. In that year the Icelanders numbered 50,358.

¹⁰ A study of the country's communal mountain pastures has already been published (Eggertsson, 1992).

II. Risk and institutions for survival in poor agrarian societies

i. General and specific risks

In poor agrarian societies, exogenous unpredictable shocks caused by natural disasters, the incidence of disease, variations in climate or adverse market conditions can reduce consumption to a point where lives are threatened, unless arrangements are made to lower the cost of these risks and smooth consumption across the population and across time. In economic theory the natural medium for smoothing consumption are intertemporal markets, such as the markets for insurance credit and futures.¹¹ However, usually the institutions of intertemporal markets are not economically viable in traditional agrarian societies for the following two reasons.¹² First, the risks faced by individual economic units frequently have a high positive covariance, which removes much of the gains from pooling and sharing risks; second, in these settings the enforcement of intertemporal contracts involves high transaction costs.

Positive correlation between risks is found, for instance, when all economic units in a community belong to the same climatic zone or when proximity makes all people and animals vulnerable contiguous diseases. When the geographic scope of economic interactions is increased, the correlation between risks usually becomes weaker, but transaction costs, such as moral hazard, increase (Binswanger and Rosenzweig, 1986). Transaction costs tend to be relatively low at the local level, because of the prevalence of repeated interaction, reputation effects and norms of cooperation (Ostrom *et al*, forthcoming). As the spatial scope of transactions is expanded, the costs of measuring and enforcing performance tends to increase. However, in traditional rural environments, the potential trade-off between covariance and

¹¹ Hirshleifer and Riley (1992) provide an excellent survey of the formal neoclassical theory of behavior under risk.

¹² The new economics of institutions now contains a substantial body of literature that examines the logic of agrarian institutions. Newbery (1989) combines the economics of risk and the information-transaction costs perspective in a lucid survey of the theory of agricultural institutions for insurance and stabilization. Also using the transaction-cost framework, Binswanger and Rosenzweig (1986) lay out a general theory of economic institutions in traditional rural areas. Binswanger and McIntire (1987) explore the structure of land-abundant tropical agriculture, and Binswanger, McIntire & Udry (1989) analyze institutions in semi-arid African agriculture. Bromley and Chavas (1989) analyze risk and transactions in the semiarid tropics. Fafchamps (1992) analyzes mutual insurance networks in preindustrial societies in terms of information and transaction problems. Also see Stiglitz (1989). Cheung (1969,1970) made pioneering contributions to the study of agricultural contracts in terms of risk and transaction costs.

incentive/transaction problems frequently does not yield any domain where the institutions of intertemporal markets would be viable. When insurance, credit or futures markets are unavailable, rural communities cope with risk by relying on various non-market institutions and individual adjustments in production and/or consumption (Newbery, 1989; Binswanger & Rosenzweig, 1986).

Not all risks are covariate or *general risks*. Agrarian communities also face uncorrelated or *specific risks*, individual mishaps such as accidents, non-epidemic diseases, accidental fires or the drowning of farm animals. The cost of specific risks can be reduced by pooling and sharing these risks within various local groups. One such group is the extended family, and the transaction cost approach suggests that variations in family size and responsibilities can be explained as responses to different risk environments (Rosenzweig, 1988; Pollak, 1985). In addition, informal insurance schemes frequently cover the labor force of a farm, the members of an agricultural village or township and even members of larger organizational units. However, primitive technologies of measurement and limits on formal enforcement, tend to confine non-market networks of reciprocal obligations to close-knit groups.

Before turning to ways of coping with general risks in an isolated, low income agricultural society, it is important to realize that the nature and extent of risks is related to the general equilibrium properties of the economic system. Variations in real income or yield involve both prices and quantities of outputs, and the prices of inputs and consumption goods. For instance, if the price elasticity of demand for cash crops is equal to -1, the gross nominal income of the cultivators is unaffected by a bad harvest. (Newbery, 1989.). Therefore, producers can use the choice of products, methods of production and location to reduce their risks.

Consider a community of farmers on an island, all operating in the same climatic zone and facing a high positive yield covariance. Although yield risks cannot be pooled, the producers (farmers) can reduce their risks by diversifying their efforts and reallocate some inputs to coastal fisheries or to a new crop. If the correlation between outcomes in the new and the old activities is less than 1, the farmers have reduced their overall risks, but not without a cost. If diversification of effort reduces expected wealth (and, therefore, would not

be undertaken in a risk-free world) because of lost gains from specialization, the farmers pay an implicit premium for more security. In a static world specialization tends to increase risk but in a dynamic context specialization is associated with changes, such as technological improvements and increases in wealth and market size, which often introduce new and more efficient ways of coping with risk.

ii. Labor contracts and risk

Traditional agricultural communities are unlikely to fully stabilize real incomes or output and, where economic units consume a large share of their own outputs, output fluctuations easily translate into comparable fluctuations in consumption. However, traditional households are often able to smooth their consumption by storing food (and other essential commodities) over the agricultural cycle or even for more extended periods, but the feasibility of storage depends on the physical characteristics of the commodities, climate, and technologies. Storage can also be extended to inputs (such as crops which are used as animal fodder) to reduce fluctuations in their availability.

Individuals who have few assets other than their labor power and no access to formal credit institutions, usually are not able themselves to pool risks or store commodities. However, when labor is scarce, such individuals can contract with wealthier individuals and exchange their labor services for a steady flow of food over the agricultural cycle or even longer periods. Long-term contracts of agricultural workers in many rural societies are *linked* or *tied contracts*, combining not only the transfer of labor power but credit and social security (Bardhan, 1983 and 1989). In an arrangement resembling futures contracts, the laborers commit labor services at a predetermined price over the agricultural cycle (or longer), particularly during the peak season(s), when the farmers fear labor shortages (Newbery, 1989). In return the laborers receive a steady flow of income/consumption unaffected by the agricultural cycle and exogenous shocks (to the extent that the farmer can cope with large shocks). The workers often receive the bulk of their pay in kind and are rewarded with food and lodging even when incapacitated by illness or accidents. The logic of linking contracts (rather than negotiating separate contracts for credit, peak-season labor, support during illnesses, and so on) is found in the low monitoring and enforcement costs of linked

contracts. The employers can monitor and control the behavior of their laborers more cheaply than other creditors. In addition, agricultural labor contracts often are reinforced by paternalism, which creates strong bonds between the two sides and further lowers the cost of enforcement.¹³

iii. Tenancy contracts

The structure of tenancy contracts, just as the structure of labor contracts, affects the distribution of risk between the contracting parties (Cheung, 1969). Extensive literature has emerged exploring the risk attributes of alternative contractual arrangements.¹⁴ The impact on risk sharing of simple or pure contractual forms is not controversial in the literature.¹⁵ A fixed-wage contract leaves the risk entirely with the entrepreneur, a fixed-feat contract places the risk with the tenant, a share contract shares the risks, and a piece-rate contract divides the production risk but assigns the price risk to the entrepreneur. However, these results have been qualified in various ways. For instance, by combining a fixed-rent contract and a wage contract, the contracting parties are able to share the risk in any proportions they desire (Stiglitz, 1974). In practice the structure of contracts is often more complex than implied by the formal theory, for instance including clauses for protecting the value of the assets at stake (Cheung, 1970).

In premodern Iceland tenancy contracts were predominantly of the fixed-rent variety. Although pure fixed-rent contracts assign all risks to the tenants, the literature cites cases from various parts of the world where landlords (informally) reduced the rent in times of severe exogenous shock, thus sharing the risk with their tenants.(Platteau, 1991;129)..In fixed-rent contracts the tenant is the residual claimant, which makes the form suitable for landlords who are not in position to monitor those who work their land. It has also been argued that fixed-rent contracts tend to select capable farmers, at least when the rent is determined by supply and demand. However, fixed-rent tenants potentially have an incentive to abuse the resources

¹³ Platteau (1991; 132) discusses the role of paternalism in agricultural contracts.

¹⁴ Surveys are provided in Newbery (1975), Hart & Holstrom (1987), and Platteau & Nugent (1992).

¹⁵ Platteau and Nugent (1992), in their Figure 1, rate four types of pure contracts (fixed-wage, piece-rate, fixed-rent and share contracts) in terms of their vulnerability to five types of shirking and the division of production and price risks between the contracting parties.

at their disposal, which is a particularly relevant consideration in livestock tenancy (when tenants rent some of their livestock), unless special measures are taken to protect the resources (Newbery, 1975; 115-120; Binswanger & McIntire 1987; 80-81).

The institutions used by traditional communities to cope with risk may diminish and redirect effort and investments and lower static and dynamic efficiency. For instance, if the families in an agricultural village decide to cope with specific risks by equally sharing user rights to the land and its yield, they are likely to face serious shirking problems. Similarly, the use of diversification in production to reduce risks leaves unexplored gains from specialization. For instance, our island community of the previous example might forego static and dynamic efficiency by refusing to legitimize a specialized fishing industry and requiring that fisheries be solely a part-time activity of farm households.

iv. Unexplained institutional diversity

Finally we emphasize that, in its current state, the risk-transaction cost approach is only able to explain in broad outline the institutional structures of poor agrarian societies. The relative strength of the approach lies in its ability to analyze the static and dynamic implications for economic performance of alternative institutions, rather than explain what type of institutions emerge in specific locations. Platteau (1991), in his extensive survey of traditional systems of social security and hunger in Third World village societies, rightly concludes that:

Any inquiry into the concrete socio-economic organization of traditional (precapitalist) rural societies can only lead to more scientific humility, owing to the bewildering variety of the organizational forms encountered (Platteau, 1991; 155).

The institutional diversity, which Platteau refers to in his comment above, is the biggest unresolved puzzle of the economics of institutions. Fafchamps (1992; 1993) has explored these issues in terms of repeated game theory. Self-enforced mutual insurance arrangements in traditional societies can be modeled as repeated game, perhaps with self-interest and altruism reinforcing each other. However, repeated game theory fails as a complete theory of institutions because it does not predict any specific outcomes but suggests

an infinite number of (mostly Pareto inefficient) equilibrium solutions, which is not inconsistent with Platteau's findings (Fafchamps, 1993; 5). At the current state of knowledge, a deterministic theory of institutions is not on the horizon, although aspects of institutional change can be modeled in formal terms (Fafchamps, 1993; 28).

III. The choice set and sources of risk in premodern Iceland

At any point in time economic actors face a choice set which defines their economic opportunities. The choice set is derived from the actors' *production set*, which reflects the resources (including climate) and technologies of their environment, and from the *institution set* which portrays their property rights, namely the institutions which order constrain their behavior.¹⁶ From the time of the Commonwealth (930-1262) until the late 19th century, when decked sail vessels (and later trawlers) were introduced and a specialized fishing industry took off, the choice set of a typical economic actor in Iceland changed remarkably little (Magnusson, 1985; Chapter 2). The basic structure of property rights and the technologies and methods of production remained essentially the same. In fact the choice set may have shrunk somewhat with a long-term decline in temperatures, soil erosion, loss of technical skills, and more restrictive property rights. Historians report a decline in economic performance, reflected in a deteriorating capital stock and falling levels of production, with the decline reaching the low point toward the end of the 18th century¹⁷

The premodern Icelanders practiced sedentary pastoralism, raising sheep, cattle, and horses, engaging in fisheries only on the side, in an environment that has been described as the limits of European farming (Vasey, 1991; 344)¹⁸ The homesteads, mostly operated by-tenant farmers, were scattered through coastal lowlands and fjord valleys around the island and generally did not form agricultural villages.¹⁹ Higher grounds were used jointly as pastures in the summer but further up, in the country's vast central region, the land was barren and of no value for farming.²⁰

¹⁶ The institution set influences the relative prices and availability of potential inputs, outputs, forms of organization and technology. Also note that the institution set of actors differs from one person to another, and therefore their opportunity sets also differ.

¹⁷ See Hastrup (1990) for an account in English (by a Danish anthropologist) of social and economic developments in Iceland 1400-1800 and an extensive bibliography.

¹⁸ "Iceland's climate is extraordinarily marginal with respect to agriculture. Its summers are barely warm enough or long enough for either natural herbage or cultivated grasses to provide fodder for livestock." (Bergthórsson, 1987;7)

¹⁹ Iorvaldur Thoroddsen (1919, 1921), writing in Icelandic, is still the best source for the history of Icelandic agriculture.

²⁰ Eggertsson (1992) examines the economic history of property rights in the Icelandic mountain pastures.

In the summer the sheep roamed unsupervised in the vast mountain pastures and grazed home fields during the remainder of the year.²¹ In Icelandic farming the main crop was hay, which was used primarily as feed for dairy cattle.²² The sheep (and horses) were fed hay only when snow and ice prevented grazing on the winter pastures. Typically hay reserves did not permit extensive periods of feeding and in hard years the animals died from hunger in large numbers. The evidence shows that loss of livestock through starvation was closely related to a short-term drop in temperature, which increased the feed requirements of the livestock, reduced grass growth, and often kept ice and snow on the fields until late spring or early summer.²³ Further, Ogilvie (1981; 278), in a statistical study based on Annals and various other written sources, concludes that the country's frequent famines and human death from hunger "almost always occurred during (or immediately after) cold spells..."

It is clear that climatic fluctuations were the major source of risk in Iceland's marginal agriculture (along with epidemics and volcanic eruptions) but it is not as clear whether in terms of risk the country is one or more climatic zones. An authority on climate in Iceland states that "Climatic variations, especially longer-term changes in temperature, tend to affect the whole country at the same time, varying regionally only in terms of their magnitude." (Bergthórsson, 1987; 13).²⁴ However, the data also show that the northern and eastern regions have lower temperature and larger variations in climate than do the southern and western regions.²⁵ Ogilvie (1981; 291) found that "in certain periods the climate was

²¹ Historians believe that the cattle raising was a relatively important aspect of Icelandic farming during the centuries immediately following the settlement in the late ninth century. Later sheep farming became the farmers' main concern and our story is primarily a sheep story.

²² As of the 15th century, the Icelanders did not grow and had to import cereals.

²³ Ogilvie (1981) uses data from Annals and other sources for the period 1601-1780 to establish a statistical relationship between a short-term drop in temperature, on the one hand, and poor hay harvest and loss of farm animals on the other. Also, Bergthórsson (1985) provides indirect evidence by using 20th century data to estimate the impact of a drop in mean annual temperature on grass growth (on modern cultivated fields). Bergthórsson finds that a temperature reduction of 1 degree Centigrade reduces grass growth by some 30%.

²⁴ Twentieth century data reveal a strong positive correlation between fluctuations in temperatures in the country's four regions (Björnsson & Helgadóttir, 1987;50).

²⁵ Although short-term and long-term drops in temperature had disastrous consequences for premodern Iceland, warm ocean currents make the climate milder than suggested by the country's northerly location (between latitudes 63°23'N and 66°32'N).

distinctly different in different regions." Mild and severe years were regionally variable. Gunnarsson (1980) argues that Iceland is essentially two ecological regions, the north and east and the south and west. For instance precipitation, which in Iceland can affect the quality and quantity of hay, is much greater in the south and the west than in the north and east.²⁶ It is also important to note that alternative thawing and freezing in spring (winter kill) can seriously affect the productivity of hay fields and such very short-term temperature fluctuations need not occur simultaneously throughout the country.

Although all studies find a strong positive correlation between hay yield and temperature, there is only a weak correlation between temperature and the output of the (part-time) fisheries (Ogilvie, 1981). Therefore, farmers who diversified into coastal fisheries lowered their risk. However, the farmers only engaged in fishing in winter when labor was abundant, and in winter the important cod fisheries were off the south and west coasts of the country. In summer the cod migrated north and east but coastal fisheries did not develop on any scale in these regions. Although a considerable number of farmers and farm laborers of the north and east left their regions in the winter to go fishing, fisheries were obviously a more important part of the economy of the south and the west. In addition to these regional differences, conditions could vary between individual farm districts and even between individual farms within a district. For instance, snow would collect more easily and stay longer in certain districts or on the fields of particular farms than elsewhere.

In our study of the institutional responses to risk, we are not so much concerned with differences in average conditions across economic units, who presumably adjust the organization of production and consumption to such differences, as with the covariance in outcomes for different regions and districts. The reading of the evidence suggests that the climate in Iceland imposed both specific and general risks on the farm community. In the case of supply shocks caused by cool spells that affected the whole country, the pooling of risks would not be an appropriate solution, even if it could have been organized. In the Icelandic context, the storing of commodities and inputs was one of the few methods available to cope with general risks.

²⁶ The problem with precipitation in Iceland is usually too much rain rather than drought.

IV. Institutions for survival

i. Coping with specific risks: kinship and communes

Specific risks in premodern Iceland included accidents and illness in people and domestic animals, freak fires and isolated acts of nature such as avalanches and violent storms. The community also had to find ways to provide for the elderly and for children whose parents no longer could feed them. The social insurance system that served Iceland for nearly 1,000 years was rooted in the laws and custom of the Commonwealth, 930-1292, and reflected sophisticated concern for incentive problems, such as adverse selection and moral hazard.²⁷

As is customary in traditional societies, primary responsibility for the poor was placed with their close of kin, and kinship was defined broadly.²⁸ The law linked responsibilities for supporting an indigent relative to the wealth of potential supporters and to the closeness of their relationship to the needy individual. If the poor had no close relatives capable of supporting them, the duty was passed on to collaterals three and four remove, provided their wealth reached a certain minimum that was defined in *Jónsbók* (1970; 101-102) Outside the family, about 160 local communes, *hreppar*, were the centerpiece of the social safety net.²⁹ *Gragas* specified that each commune had to contain at least 20 adjacent

²⁷ *Gragas*, the laws of the Commonwealth, is a primary source of the social insurance system for the first centuries of Icelandic history. The laws of the Commonwealth were probably put in writing as early as the 11th or 12th century. The surviving manuscripts were written in 1250-1280, when the Icelandic experience with private enforcement of law had come to an end. In 1281 the Icelandic Althing (parliament) ratified a new legal code which Magnús Hálfonarsson, King of Norway and Iceland, had presented. The new lawbook, known as *Jonsbok*, was extensively modeled on *Gragas* and served the Icelanders throughout the premodern era. Frequent attempts to revise *Jónsbók* were not successful. For instance, the king of Denmark and Iceland appointed committees as late as 1839 and 1841 for revising the lawbook but in vain. Substantial part of *Jonsbok's* agricultural law survived into the 20th century (Thoroddsen, II, 382-383). As *Jonsbok* became increasingly obsolete, Danish-Norwegian laws were introduced in certain areas, along with regulations and edicts emanating from Copenhagen. "AH this caused much confusion and by the 18th century, rather few people knew what the prevailing laws of the land were." (Lárusson, 1958; 215)

²⁸ in *Gragas* kinship was defined to reach an individual's collaterals of fifth remove. (*Gragas*, 1992; 82)

²⁹ In the Census of 1703, the *hreppar* numbered 163, and the country's population was 50,358. The average population of a *hreppur* was some 309 persons and about 80% of the *hreppar* had a population of 100-500 individuals. The number of *hreppar* during the Commonwealth period was probably 150. (Björnsson, 1972; 93, 126).

farms of tax-paying farmers. Membership in a commune was compulsory and non-attendance at meetings was punished with a fine.³⁰ Free riding was not an option. The communes, which were partly self-governing and run by the members of a board selected by the farmers, emerged during the Commonwealth period to collect the tithe, provide relief for the poor, and control utilization of the common mountain pastures.³¹ According to the law, the communes retained one-fourth of the tithe for distribution to the poor

In each commune, the households, or *bit*, which usually contained a primary family and their laborers or servants, carried extensive responsibilities for each others welfare. According to both *Gragas* and *Jonsbok*, paupers without family support were assigned to households in their commune for specific periods of time, the length of stay in each location being proportional to the farmer's net wealth. A 1305 amendment of *Jonsbok* lightened the burden of the rich. The number of days that farmers were required to house paupers was no longer simply proportional to their wealth (*Jonsbok*, 1970; 291). Instead the "tax" became regressive and the marginal rate fell to zero when a farmer's wealth reached a certain level.³²

When a farm household experienced economic troubles that appeared to be temporary, the commune provided subsidies. When the difficulties appeared to be serious and prolonged, the commune responded by breaking up the family (without dissolving the marriage) and dividing family members among households in the community. Children were placed either with relatives or close friends or assigned to alien households. If a foster child reached maturity and left some wealth at the time of death, in order to cover the costs (without interest) of upbringing, the law gave his or her assigned foster parents priority claim on the estate. These privileges were not extended to an individual who "for the sake of God," volunteered to foster a child because "God would reward him." (*Jónsbók* (1970; 105)

The law dealt explicitly with damages caused by accidental fire. *Gragas* (1992; 188-189) stipulates that the members of a commune compensate the owner of a

³⁰ *Gragas* (1992; 105) gave people until noon to show up or they were fined 3 *merkur*, which corresponded to more than 70 meters of homespun woolen cloth (*vadmal*) of about 1 meter in width.

³¹ In Iceland the tithe was introduced in 1096 as a 1 percent tax on wealth.

³² The cutoff point was put at 200 hundreds, but a hundred was a unit of measurement which corresponded to 120 ells (about .59 meters) of *vadmal* (home spun woolen cloth) or one mature cow or six ewes.

farmhouse in the community, if the house is damaged by accidental fire. To cope with moral hazard, the insurance (i) was limited to three major units of the house (plus a chapel, if it existed), (ii) covered one-half of the damages, and (iii) the same person could be compensated only three times. By the time of *Jónsbók*, tenancy had become a common arrangement and the lawbook divides the cost of accidental house fires between the tenant and the landlord, with the tenants share being two-thirds (*Jonsbok*, 1970; 158).³³ *Gragas* similarly guarded against moral hazard in providing insurance against pestilence in livestock. One-fourth of the cattle had to perish before the owner could seek compensation from the commune, which only compensated one half of the damages. The farmers in a commune were required to contribute no more than one percent of their wealth to compensate for lost livestock., and, therefore, if the loss of cattle was widespread, the available compensation could amount to less than half the damages (*Gragas*, 1992; 188).

ii. Protecting the system: population control

The laws and custom of premodern Iceland reflected a preoccupation of those in authority with adverse selection, a fear that the system of mutual aid might attract free riders. An amendment of *Jónsbók* from 1305 is an early and draconian expression of this concern. The law states that, if poor people leave their children in a commune and then run away to another district, "it is appropriate to arrest such a man and bring him back, in ropes if needed, and then tie the child onto his back and have him walk it out of the commune." (*Jónsbók*, 1970; 291, my translation). In general, a large body of both formal and informal institutions had the role of protecting the social insurance system against threat of opportunism. We limit our discussion to two of the most significant issues, population control and restrictions on industrial organization.

One of the concerns of the communal authorities was that individuals of little or no means, specifically landless farm workers, might pile up children that could heavily burden the welfare system. Iceland never had formal laws where the right to marry was limited to farmers, but such informal constraints existed and, in effect, the purchase or rental

³³ Thoroddsen, (1919; 34) reports that during the calamities of 18th century landlords tried to place all the risk of house fires on their tenants. A new law of 1884 explicitly divided the responsibilities between the two parties.

of a farmstead became a precondition for family life. Informal institutions often have dramatic consequences: In the census of 1703 some 90 percent of all male heads of *bu*, but only 2 percent of farm laborers, were married men or widowers. Gunnarsson, (1983; Chapter I) comparing Icelandic demography with the case of Sweden since the 18th century, shows that the Icelandic population had surprisingly low marriage and birth rates and both ratios were positively related to the economic situation. For instance, in 1703 some 44 percent of all Icelandic women 50 years old over had never been married (Gunnarsson, 1983; 16).³⁴

iii. Protecting the system: restricting specialization

Another feature of Icelandic society, which (in part) can be interpreted as a side effect of the social insurance system, are persistent and successful attempts to freeze the traditional industrial organization of the economy and prevent experimentation with new activities, particularly independent fisheries. The freeze was based on the belief that fanning alone could produce a steady flow of food and, therefore, everyone should be tied to a farm household, either as a farmer (tenant or landlord) or a laborer, and other activities than fanning, such as fishing, should be practiced only as a part-time activity. The prevailing view was that independent non-farm activities were inviable and non-farm sectors would sooner or later release hungry hordes onto the households in the agricultural communes. Evidence of these concerns is found already in *Gragas*, which forbids establishing households without livestock, except with the permission of farmers in the commune, who then become responsible for maintaining non-farm households in times of need (*Gragas*, 1992; 104) In the course of Icelandic history the ties to the land were tightened in times of crisis but in the latter half of the 19th century, with growing prosperity and expanding population, these restrictions broke down.

Gunnarsson (1983) has argued that the rules preserving the traditional industrial organization of Iceland were motivated by the narrow self-interest of elite landowners in an attempt to protect their power base and the access to cheap labor. The question, why the landowners (a small number of private persons, and agents the church and the crown) were trapped in low-productivity agriculture and unable to invest in a specialized ,

³⁴ Also see Gunnarsson (1980b).

high-productivity fishing industry, has not been carefully analyzed.³⁵ However, the two explanations of the freeze, social insurance and the preservation of power, may be complementary. The social insurance system of the Commonwealth was probably economically rational in the beginning but with time the system may have trapped the Icelanders in a low-income equilibrium path which nearly led to their extinction.

iv. System failures: drifters and beggars

The policy of tying all individuals to specific farm households was only partly successful. Temporary workers existed, although they were not favored by the system, and drifters roaming the countryside were a constant source of worries for the farming community. *Gragas* treated vagrant beggars harshly, forbidding the farmers to feed them and allowed drifters to be castrated "even though it may cause disability or death." (*Gragas*, 1992; 108, my translation). *Jónsbók* was more lenient toward beggars and drifters and required farmers to feed and house vagrant beggars for one night and help them travel to their next destination. Farmers, who indirectly caused the death of vagrants by either refusing to house them or leaving them in desolate places, had to pay full compensation to the families of the diseased (*Jónsbók*, 1970, 107-108).

Thoroddsen (1922; 265-372) traces the history of drifters and beggars through the premodern era and emphasizes how in hard times they could become a major burden on the farm community, which frequently gave rise to stringent legislative and regulatory actions to control vagrancy. The problem was that the Icelanders lacked a sophisticated system at the national level to cope with severe exogenous shocks, such as epidemics and volcanic eruptions, which devastated whole districts, and left individuals to fend for themselves outside the social safety net of the communes.³⁶ Yet, the social system was relatively effective. The census of 1703 puts the total population at 50,358 individuals. Thereof were 6,789 paupers placed for maintenance with private households, and 617

³⁵ In the last years of the 17th century some 52 percent of the land was privately owned, the church owned about 32 percent and the Crown the remaining 16 percent. Private ownership was concentrated in relatively few individuals. Private owners of land numbered about 1,200 and of these some 7 percent (84 owners) possessed 45 percent of all private land in terms of its value. (Lárusson, 82; 38)

³⁶ For instance, Thoroddsen (1922; 322) reports that in 1751 a clergyman from the eastern region, along with his parishioners, roamed begging through the countryside.

individuals receiving welfare payments. In addition there is a category of 3,122 individuals labeled as relatives and private dependents, which excludes own children but includes the farmers' parents and other relatives. Foster children number 911. Finally vagrant beggars number only 394.³⁷ However, Thoroddsen's (1922; 317) estimates (on the basis of adjusted census figures) that in 1703 some 1,000 beggars roamed the country side, dividing their attention between the country's 8191 households.

v. Land contracts and the insurance system

In section II we discussed how contracts for land affect the allocation of risk. By the time of *Jónsbók* (1281) tenancy was already prevalent in Icelandic agriculture and its importance grew with time. In the 1703 census some 85 percent of all farmers owned no land at all and some 96 percent of all heads of households were tenants³⁸ Throughout the premodern era fixed-rent contracts were the dominant arrangement. The use of fixed-rent contracts, which in formal theory assign all risks to the tenants, may appear to be inconsistent with the traditional (*ad hoc*) assumption that risk aversion is inversely related to wealth. Therefore, it might be argued that both rich landowners (private persons, the church and the Crown) and poor tenants could have gained by using alternative contractual forms which assign more risk to the landlords. However, fixed-rent contracts can be modified in various ways. For instance, it is not unlikely that landlords may have made downward adjustments in the rent when their tenants were hit hard by exogenous random shocks, although such adjustments were not institutionalized but subject to the discretion of each landlord. In the case of general risks, market forces would compel a reduction in rents as the demand for land would temporarily fall. Teitsson (1973; 136) reports conclusive evidence of reductions in rent in the wake of the notorious "*Famine of the Mist*" (1784-1785), which followed an immense volcanic eruption in the Laka Craters (1783) that seriously damaged vegetation in Iceland and in various ways was felt around the globe.³⁹ Similarly, Lárusson (1982; 25-36)

³⁷ *Mannialid 1703* [The Census of 1703], p. 19 & 23. Also see discussion in Hastrup (1990) pp 102-112.

³⁸ Source Lárusson, 1967 & 1982, Cited in Magnusson, 1985, p.31, and Gisli Gunnarsson, 1987, p. 17.

³⁹ Teitsson (1973; 136) provides evidence that shocks that killed livestock caused a greater reduction in rents than epidemics, such as smallpox epidemics, which spared the animals but devastated the elderly and the weak. The livestock was the tenants' critical asset and, in fact, the yield from the animals was in part used to pay the rent.

in a careful study of the old land registers of the 17th and 18th centuries provides clear evidence for adjustments in rents (including livestock rents) following large-scale shocks. Finally, it should be remembered that the communes already provided a relatively efficient system for coping with risks.

However, there were other considerations than risk. Usually Icelandic farmsteads were scattered, and not collected in villages, and landowners frequently held property in several districts. The potential cost of closely monitoring farm operations at separate locations in a sparsely populated country with a difficult terrain and poor communications was a serious consideration.⁴⁰ Fixed-rent contracts had the advantage of making the tenants residual claimants, which minimized the need for monitoring by the landlords. Also, fixed rent contracts self-select efficient farmers, to the extent that the rent reflects market forces.⁴¹

The economics of contract suggest that with fixed rent the tenants have an incentive to abuse the rented resource. However, with its primary emphasis on hay making and grazing, Icelandic farming used relatively robust assets which made the dissipation of agricultural resources a lesser issue than it might be in another context, although overgrazing was a serious concern. To lower the owners' measurement and enforcement costs, the law relied on the communes for providing assessors for evaluating the status of the property each time a farmstead was passed from one tenant to another. The outgoing tenant was then required to compensate for damages and for what was judged excessive depreciation of the assets (Thoroddsen, 1919; 34).

vi. Livestock contracts and the insurance system

Early in the country's history the use of livestock tenancy, an arrangement notorious for moral hazard problems (Binswanger & Rosenzweig, 1986), became common practice in Iceland. In the early periods, tenants apparently were not required to rent livestock

⁴⁰ Iceland is 103,000 km².

⁴¹ Thoroddsen (1919, 1921), in his massive history of Icelandic agriculture, gives the general impression that the rent of land was responsive to economic forces, in spite of attempts by landlords to introduce floors for rent when the relative value of land declined. Lárusson's (1985) careful empirical study of land registers of the 17th and 18th century also supports the notion of flexible rents.

from their landlords (or forbidden to rent cattle and sheep from an alternative owner) but gradually many landowners tied the provision of land to the rent of livestock.⁴² In a land register compiled at the beginning of the 18th century, about one-third of the livestock in the country was leased.⁴³

In livestock tenancy, just as in land rentals, fixed-rent contracts were predominant, but under the traditional arrangements the owners carried the risk of animals dying from pests, from giving birth or from attracting lightnings (*Jonsbok*, 1970; 225). The tenants should to carry all other risks. Although the structure of the livestock contracts made economic sense, in that it assigned to the wealthy landlords certain critically important types of risks involving relatively low measurement costs, one would expect that the landlords' ability to provide insurance would be seriously strained in the case of general risks. In 1762 Iceland's sheep was struck by a pest that was not brought under control until 1779. The authorities, attempting to limit the spread of the epidemic, slaughtered all sheep in whole districts and in all some 280,000 sheep were lost (Thoroddsen, 1919; 401). As would be expected, the landowners refused to cover the full cost of the disease, as the law required them to do, and the tenants appealed to the Danish authorities, which settled the dispute by dividing the burden between the two sides.⁴⁴ Similar disputes arouse following a comparable sheep epidemic in the 19th century and generally the enforcement of the livestock contracts was a continuous source of dispute between landlords and tenants (Lárusson, 1982; 28).

The rent for livestock was higher than the land rent, often twice as high or more. (Teitsson, 1973; 134; Magnússon, 1985; 32). Through the ages many students of Icelandic history have interpreted the differential between the two types of rent as an attempt by landlords to raise the overall rent from their farmsteads, presumably because the livestock

⁴² Thoroddsen (1919; 49) reports that tied contracts involving land and livestock may have become common only toward the 15th century. The economics of information suggests that tying the rent of land and livestock economized on monitoring costs.

⁴³ Larusson, Bjorn (1961; 62), cited in Teitsson (1973). Butter was a popular medium for paying the livestock rent and an important medium of exchange in domestic transactions. For instance, at the beginning of the 19th century Danish military officers who surveyed the Icelandic coastline paid their way in butter. Wealthy landowners, such as the two bishoprics, owned vast quantities of butter that were piled up like blocks of gold in special storerooms, startling foreign observers in previous centuries. Usually no salt was added to the butter which had a sour taste. Butter was a supplement to dried fish which was an important staple in the Icelandic diet. (Thoroddsen, 1919; 56-58.)

⁴⁴ Gustafsson (1985; Chapter 6) analyzes the dispute and its resolution.

rent was more flexible than the land rent.⁴⁵ Alternatively, the discussion above suggests that (at least in part) the rent differential may have reflected a risk premium in the livestock contracts.

However, there is one important margin where livestock contracts may have created perverse incentives. It can be argued that the tenants had an incentive to gamble with the survival of their flocks, although as residual claimants it was in general in their interest to treat the animals well. The gamble would involve attempts to seek wealth and independence by maximizing the size of the herds without making cautious preparations for feeding the animals in winter and counting on mild climate. Poor tenants were not able to compensate for large-scale losses of livestock and, therefore, the owners in fact carried (much of) the risk from such a gamble but did not share the benefits. We return to these considerations in section V.

vii. Coping with general risk: the storage of food

In their relative isolation of the premodern age, the storage of food and fodder was the principal recourse open to Icelanders for coping with general risk. The farm households knew how to preserve food and there is ample evidence that food was systematically stored (Thoroddsen, 1919,1922). In principle, storage was decentralized and managed by each *bit*.

In poor societies with substantial inequalities in wealth, individuals who have few resources except their own unskilled labor, and no access to credit, are not well placed to store essential commodities to meet the calamities that may strike their community. However, when labor services are scarce, employers may be ready to provide storage (and a steady flow of consumption goods) in return for labor services.⁴⁶ As we have stated, the general thrust of labor legislation in the premodern period was to tie all laborers in the country to a specific farm household in a one-year renewable contract (Gunnarsson (1983); Chapter 2. Magnusson, 1985; Chapter 2). Although casual or seasonal labor always existed, it had a relatively small role in the economy, and for a time (1783-1863) the law even forbade, but did

⁴⁵ Larusson (1982; 25-36) study of 17th and 18th century land registers shows that both types of rent adjusted downward in response to major disasters.

⁴⁶ See our discussion of these issues in section II.

not fully uproot, wage labor. In the census of 1703 casual laborers numbered only 371, while laborers on long-term contracts were 8,953. In order to discourage wage labor, the law required individuals to possess considerable wealth, more than three times the amount needed to establish a legitimate farm household, before they would be granted the status of casual or migrant worker.⁴⁷

In the long-term labor contracts, a large share (some 80-90 percent) of the payment received by male laborers took the form of food, clothing and housing, while female farm workers typically only received food, housing and some clothing (Gunnarsson, 1983; 23). The flow of essential consumption commodities remained relatively stable through the year, although the workers' marginal productivity varied greatly by season.⁴⁸ The farmers were not permitted to dismiss workers within the contract period, even when they no longer needed their labor, for instance because cold spells or sheep epidemics temporarily paralyzed farm activities. Also, sick workers could not be dismissed. Finally, workers who had stayed for a long time with the same employer became permanent members of the household. A law of 1722 assigned lifetime tenure to workers who had served 15 years with the same employer.⁴⁹ Thus, long-term labor contracts provided men and women of limited wealth some insurance against both specific and general risks.⁵⁰

⁴⁷ Gunnarsson, 1983; 21. The minimum wealth required to be a fanner was equal to 3 cows but wage laborers had to be worth 10 cows to be legitimized by the authorities. Casual workers typically divided their time between fishing for farmers in the south and west during the winter season and in the hay-making season working for farmers wherever labor was needed.

⁴⁸ However, in winter, the slack season, the farmers often sent their workers away to the Fishing districts of the south and the west. Typically, the workers received no extra payment on these dangerous expeditions and the farmer collected the catch (Thoroddsen, 1922; 359-360).

⁴⁹ The law required employers to maintain workers of long standing so long as they lived, except the farmers could rid themselves of workers suffering from leprosy (Thoroddsen, 1922; 325).

⁵⁰ Premodern Iceland was unusual for its relatively large servant population (Gunnarsson, 1983; 22). Even poor tenants employed men and women laborers at considerable risk to themselves, although the communes and (and to some extent their tenure contracts) insured the farmers against (specific) risks. In order to create a more flexible household, one that could expand and contract with their fluctuating fortunes, the farmers sent their children early away from home to work as laborers on other farms. The children were replaced according to circumstances by hired labor on a one-year contract. See, Pinson (1992) who has studied the evolution of rural households in an Icelandic commune (Hólahreppur) 1703-1974.

V. Storage of fodder: Institutional failure?

i. Background

In the 18th century the deplorable and deteriorating economic conditions in Iceland, which threatened the nation's survival, gave rise to an urgent debate on reforms that involved both local intellectuals and government servants in Iceland and Copenhagen.⁵¹ The debate, which continued in the 19th century, did not focus on fundamental changes in the country's social security system but concentrated on ways to increase the capital stock and productivity in farming and also to diversify the economy by developing the fisheries and introducing light industry. However, there was one important exception to the limited attention paid to the country's informal insurance system. In order to prevent the periodic mass starvation of farm animals that had plagued Icelandic agriculture since the Settlement, a number of reformers vigorously recommended institutional change designed to encouraging long-term storage of fodder and the careful matching of livestock and available fodder.⁵²

In the 19th and early 20th century, responding to pressures that mounted after each episode of starvation, the Icelandic legislature (Althing) passed several laws dealing with the

⁵¹ For instance, in the 18th century concern with reforms led the government in Copenhagen to twice appoint high-level commissions for study the economic problems of Iceland. The First Royal Commission (Landsnefndin fyrri) served 1770-71, and the second commission was appointed in 1785, following the *Famine of the Mist*.

⁵² According to the sagas, the initial event in Iceland's agricultural history concerns one of the very first Norsemen to winter in the country, Raven-Floki, so named because he used ravens for aid in navigation. Flóki neglected to use the summer to make hay for his animals and was forced to return to Norway because his livestock perished during the first winter in the new country, which he named Iceland.

Thoroddsen (1919; 357) identifies Pall Vidalin (1667-1727) as the first person in Iceland to express in writing recommendations for public control over the size of livestock of individual farmers in relation to their hay supplies. Vidalin recommended strict punishments for farmers who ignored recommendations to downsize their flocks. In 1702 Vidalin, along with Ami Magnusson, had been appointed by the Danish king to describe and register all property (including rental terms) in Iceland and make recommendations for economic reforms. The First Royal Commission, 1770-71, (see note 51) recommended that the farmers in each parish establish a communal hay storage facility operated by commune leaders. Farmers, who rejected official recommendations and took risks by keeping imprudently large livestock in view of their supplies of hay, were to be punished (Thoroddsen, 1919; 358). None of these and other reform recommendations of the period became law. The discussion extended into the twentieth century. The most prominent figure toward the end of the debate, which began with Hrafna-Flóki, was Torfi Bjarnason, an agronomist educated in Scotland who, in the late 19th and early 20th century, wrote six passionate articles promoting the storage of fodder. Torfi Bjarnason established and headed the first agricultural school in Iceland (in 1880) and introduced various innovations in fanning, some of which he himself had invented.

supply of fodder and livestock management. The First *starvation legislation* was enacted in 1884 and required communal authorities to ensure that farmers enter the winter season with no larger livestock than they reasonably could feed in a hard winter. The law made farmers, who ignored the communal authorities and starved their animals, subject to a fine (*Stjórnartidindi* 1884 (A); 20). A 1889 revision of the law provided for the imprisonment of offending farmers in extreme cases (*Stjórnartidindi* 1889 (A); 18-21). The *starvation laws* were very unpopular, and historians agree that the legislation did not effectively constrain behavior as farmers and law enforcement officials alike ignored it (Thoroddsen, 1919, 362; Jóhannesson, 1948; 107-108).

Our concern here is whether the inclination of the farmers to gamble with their livestock reflected a serious flaw in the institutional structure of the country's informal insurance system. However, before proceeding with the discussion we take a quick look at the magnitude of the problem. Periodically, starvation caused both death and disability to domestic animals in Iceland throughout the country's history from the time of the settlement and into the 20th century. Bjarnason (1913; 182-193) has examined the costs of starvation for the period 1800 to 1908, when in most years the total number of sheep in the whole country ranged from about 300 to 600 thousands (*Statistical Abstract of Iceland 1984*; 68-69). The cyclical nature of the time series reveals how in good years the farmers pushed to increase their flocks, only to see the animals starve to death when the climate became unfavorable. For instance, in 1800-1802 a cold spell reduced the number of sheep by three-fifths or by about 171 thousand animals, in 1881-83 the loss was even greater or 187 thousand sheep, and as late as 1906-08 the stock was reduced by some 37 thousand animals. (Bjarnason 1913; 187)⁵³. In addition to the outright loss of grown animals, Bjarnason (1913) allows for other costs such as loss of lambs (not included in the time series) and loss

⁵³ Bjarnason's (1913) estimates are a good indicator of the magnitude of the problem but his figures should be taken with a grain of salt. Bjarnason realizes that fluctuations in livestock size may have other causes than lack of fodder (such as disease, sale of live animals to England, which became common 1865-1880, or deliberate adjustment in livestock size) and attempts to adjust his estimates accordingly, but only crudely. Also, official data for livestock size are not reliable because the animals were an important part of the government's tax base and the farmers had an incentive to underestimate the size of their herds. Thoroddsen (1919; 295) reports that in the winter of 1903-1904 for medical purposes all sheep in Iceland were bathed. Although official registers report a total number for the country of only 502 thousand sheep in the fall of 1903, the veterinarian registers reveal that some 658 thousand sheep were bathed. In the fall of 1904 the official figure was back to 534 thousand.

of quality in survivors. Counting the total depreciation due to inadequate fodder of the stock of both sheep and horses, Bjarnason (1913; 190-91) estimates that for the 28 year period 1881-1908 the loss amounted to 10,602,536 krónur, which is equal in value to about 884 thousand sheep or about 13 sheep per each person in the farm community.⁵⁴

ii. Centralized or decentralized storage?

The reformers considered chiefly two solutions to the problem, centralized storage of hay and individual storage by each farmer.⁵⁵ Central storage (which, for instance, was recommended by the Royal Commission of 1770-1771) does not appear to be a sound economic proposition, if we make the reasonable assumption that there were no important economies of scale in storage.⁵⁶ Arrangements, where each farmer makes an annual contribution of hay to a central storage facility which then allocates hay to needy farmers, would involve non-trivial measurement, enforcement and transportation costs. The same criticism, but with less force, applies to arrangements where the communes contract with individual farmers to specialize in making and storing hay for the community.⁵⁷ One of the complications of storage is that hay loses its nutrition value over time. Bjarnason (1912; 269), an experienced agronomist and farmer, states that the rate of depreciation is not great in the first two or three years, if the hay is properly prepared and stored. Once five or more years have passed the nutrition value of hay usually drops substantially, although Bjarnason (109; 185) claims to have seen undamaged 15 year old hay. In any case, hay must be

⁵⁴ Again these crude estimates should be taken only as an indicator of the size of the problem. Bjarnason defines the farm community as people not living in towns.

⁵⁵ We do not consider a third possibility, which probably was impractical in premodern Iceland, namely importing grain and establishing central granaries for storing emergency fodder, because using imported grain as emergency fodder would have been much more costly than using hay. Bjarnason (1909; 182) reports that (at the beginning of the 20th century) transportation costs would add a margin of about one-third to one-half to the foreign price of grain. Similarly, because of transportation costs, the farmers received only about half the foreign price of products sold internationally. Throughout their history the Icelanders traded their products in foreign markets. In fact, four small granaries were set up in Iceland in the late 19th and early 20th century (Thoroddsen, 1919; 364-365; Bjarnason, 1912; 270-271) but costs were partly covered by emergency donations and the Treasury rather than by the local communities.

⁵⁶ Thoroddsen (1919; 358). Reformers who recommended central storage also recommended strict regulation of livestock size on each farm prior to the winter season because they feared that otherwise the farmers would free-ride by making no precautions themselves and overtax the capacity of the central storage facility.

⁵⁷ Bjarnason (1912; 265-270.)

recycled regularly, also in periods of extended favorable climate when the farmers are self-sufficient with hay, which has important cost implications for centralized storage.

iii. Attenuated property rights in hay reserves and livestock

Economic reasoning indicates, therefore, that individual households, rather than central organizations, were best placed to store fodder, which again raises the question why through the centuries most farmers neither kept long-term reserves of fodder nor planned the size of their flocks in preparation for a potentially hard winter, let alone a sequence of bad years⁵⁸. At this point we lay aside (without necessarily rejecting) two explanations of the phenomenon. The explanation favored by many reformers of the 18th century and later, was that the farmers were dazed and demoralized by their difficulties. Thoroddsen (1922; 373, my translation) refers to "the nation being overtaken by spiritual lethargy already in the fourteenth century and languishing in stupor for three or four centuries." We also do not consider explicitly the possibility that livestock planning and long-term storage, individual or collective, simply might have been an inefficient arrangement under all reasonable institutional regimes.⁵⁹

Our first point, mentioned already in the previous section, is that property rights in rented livestock probably were attenuated. The livestock contracts may have given the tenants an incentive to select options with a high variance in outcomes because the tenants benefited from favorable outcomes whereas the landlords were partly burdened with unfavorable outcomes, at least when the tenants were bankrupted. The wealthy in premodern Iceland had few choices to store and augment their assets except to invest in land and livestock, and

⁵⁸ Except that decentralized storage could not meet specific risks of individual households, such as the destruction of hay reserves in fires, avalanches and storms. In order to meet such contingencies, the commune could, for instance, contract with specific fanners to store hay.

⁵⁹ Gunnarsson (1987; 118-119) makes the case that it was rational for farmers to try to maximize the size of their flock of sheep in good years and risk losing some animals if the winter turned out to be hard. He claims that farmers concentrated on expanding their herds while the climate was favorable and switched (partly) to winter fisheries when the climate did not favor farming. Gunnarsson argues that the cost of expanding the fanners' herds was small and the consequences for the households of losing part of their herds were less severe than one might expect. He does not explicitly discuss storage. Other writers paint a bleaker picture than Gunnarsson of the consequences for the farmers of losing their animals. For Bjaraason (1913; 84) the costs to tenants may involve the loss of their farms and social status, being reduced to the status of a farm workers, or a painful future of drudgery and deprivation as tenants attempt to build new herds again. In some instances loss of the animals could bring hunger to the fanners themselves and their households.

attempts to structure contracts to prevent opportunistic behavior by the tenants probably would have been futile. However, the landlords had the option to push for regulations to promote more caution in livestock management and the evidence suggests some of them did. Many of the proposals for storage and compulsory livestock planning originated with the biggest landowner, namely the king in Copenhagen, and with Icelandic officials of the crown who usually were also large landowners (Thoroddsen 1919; 354-365). However, it is hard to believe that these powerful parties, including the church, were unable to introduce binding constraints, for instance through the communal system, if they had given the issue high priority. An alternative approach, which the owners did use, was add a high risk premium to the livestock contracts.

If the farmers were to invest in storage, they had to have secure property rights in hay reserves. However, both formal and informal property rights in hay reserves had been attenuated, probably in order to cope with specific risks (rather than general risks), which must have undermined the incentive to store fodder. According to *Jónsbók* (1970; 139-140), farmers who owned surplus hay reserves were required by law to sell their surplus if their neighbors wanted to buy it. Farmers, who were short of hay, could request that a search be carried out for surplus hay in their general area, both in their own and neighboring communes. Appointed agents would then estimate whether individual farmers in the area had stored more hay than they required for the winter. The surplus was to be sold and offered first to farmers in the same commune as the seller. Farmers who refused to sell their reserves were to be fined, the hay confiscated and potential buyers receive one-half of the fine and the hay for free. Force could be used to remove surplus hay and owners who received injuries defending their surplus fodder could not claim compensation. The king decided whether compensation was justified, if farmers were killed defending their surplus.

We are not able to tell whether this law from 1281 continued to be an effective constraint for the next 525 years or until it was abolished by a royal decree in 1806, but we note that the disincentives for long-term storage were reinforced by the tithe laws of 1096, which taxed hay reserves, if they were more than one year old (Thoroddsen; 1919; 355). However, there is ample evidence from many sources that informal institutions put tremendous pressures on owners of surplus hay to help their neighbors, when in need

(Thoroddsen, 1919; 356-357; Bjarnason, 1909; 179-80) Although a market for hay existed, late, partial or no payment was not considered a serious offense by the community.

These considerations suggest that systematic long-term storage required coordination of household behavior by the authorities at the communal level and possibly higher up.⁶⁰ Bjarnason (1913; 201-204) reports experiments with the coordination of livestock planning in two or three communes in the 19th century. The experiments did not involve direct coercion, but paid inspectors visited all farms in the communes two or three times a year and advised the farmers on planning their fodder requirements. In one instance at least, the performance of all farmers was rated and made publicly available and those who took exceptionally good care of their animals received awards. It is reported that one of these communes survived the notorious winter of 1881-82 with all the livestock unharmed, whereas in the country at large domestic animals starved to death in large numbers. However, Bjarnason (1913) notes that after only a few years the communities lost interest in these apparently successful experiments and gave them up.

In the twentieth century, when the Icelanders finally managed to end the periodic starvation of domestic animals, various new developments made the solution easier, especially improved communications, a very large increase in the hay-making and storing capacity of the farming sector, and the availability of other domestic fodder other than hay, especially fish meal from the country's new fishing industry. Fodder could also be brought from abroad at short notice. However, the initiative to solve the problem did not come from the communes, but rather from the national legislature, the central government and a new national association of farmers that obtained government subsidies to support the relief program (Bjornsson, 1979; 277-278; Johannesson, 1948; 107-114).

⁶⁰ And, of course, prior to 1806 formal law made the ownership of long-term reserves uncertain.

VI. Conclusions

i. The storage puzzle

It is indeed surprising why the communes failed to coordinate the livestock and feed plans of the farmers, if such coordination was as beneficial as the reformers claimed. Presumably, the communal authorities had the means to neutralize the informal norms of sharing which undermined the farmers' ownership rights in hay reserves, if the measures were seen as substantially improving general welfare in the community. The formal rules requiring sharing of hay reserve were abolished in 1806, as we noted in the previous section, but without noticeable change in the farmers' behavior. In fact, as early as 1746 the Danish king (unsuccessfully) issued a decree instructing communal leaders in poor districts to monitor each fall whether the hay supplies of each farmer was adequate for the livestock he or she planned to carry through the winter (Thoroddsen, 1919; 357). Finally, it is puzzling why (allegedly) successful 19th century experiments with livestock planning in two or three communes were discontinued and failed to inspire experimentation other districts. The only indication we have found, which suggests that an initiative by the communes might have been difficult, is Bjarnason's (1913; 198) claim that unanimous agreement of all farmers in a commune would have been required before communal funds could be used to coordinate livestock planning.

Institutions tend to reflect the distribution of power and wealth in a community but it is hard to envision how the stabilization of the livestock would have displeased the politically powerful landowners who owned the bulk of the animals. In the previous section we argued that attenuated property rights in livestock and fodder reserves might possibly explain the apparently reckless behavior of the tenants. However, attenuated property rights do not explain the lack of initiative, both within the communes and higher up in the governance hierarchy, and the failure to change the rules of the game. These considerations leave us with two alternative explanations: a) that livestock stabilization was not a sound economic proposition, which we find unlikely, and b) that the case is one of full-fledged institutional failure.

ii. The system as whole

The economic system of premodern Iceland can be viewed and evaluated from many angles, for instance, we can explore the causes and consequences of the unequal distribution of land, the failure to establish a specialized fishing industry or to invest in agricultural improvements. Here we take the basic structure of the economy as given and consider the effectiveness of the country's informal social security system. It is our impression that the institutional arrangements could cope reasonably well with specific risks and with small and medium size general risks, but major shocks, such as large-scale volcanic eruptions or long sequences of abnormally cold years, overwhelmed the informal insurance system. The finding is similar to Platteau's (1991) report on traditional systems of social security and hunger insurance in Third World village societies.⁶¹

The system did not prevent death from starvation. Human death in famines is a recurrent theme in Icelandic history from the early years and into the 19th century. However, although storage of food was not extensive enough to prevent famine, the evidence suggests that the farmers generally honored the contracts to share their food with unrelated household members, both laborers and the poor assigned to them by the commune. In that sense the insurance system functioned reasonably well. Thoroddsen (1922; 332) reports that usually all members of a household received similar treatment in times of severe crises, except for a propensity of some farmers to mistreat the (often elderly) paupers who had been assigned to them⁶²

At no time did nature hit Icelandic society with more force than in the 18th century, when extreme cold spells, epidemics, immense volcanic eruptions and earthquakes repeatedly preceded the death a sizable share of the human population. In an important study, Vasey (1991) has examined in detail the demographics of the *Famine of the Mist*, 1784-85, using data from parish registers, civilian and church censuses and other sources.⁶³ Some 24 percent of the population perished in the famine, which nevertheless was only the second

⁶¹ See our section II.

⁶² Thoroddsen (1922; 332) refers to a saying known in some quarters to the effect that "the times cannot be that hard yet because the assigned paupers on the farms still look fit."

⁶³ The volcanic eruption in Laka Craters, which initiated the famine, began in June 1783 and lasted into February 1784,

worst mortality crisis of the century, as more people died in the smallpox epidemic of 1707-1709 (Vasey, 1991; 344, 346).⁶⁴ Using the records of 12 parishes from all four regions of the country, Vasey was able to compare mortality rates of four social groups in each household: kin, adopted children, persons on public or private assistance, and servants. He concludes that

"one is impressed by the degree to which hardship and the risk of mortality were shared within households [during the 1784-1785 crisis]. [In parishes] where mortality was high [on average], persons on assistance and possibly servants were at high risk.⁶⁵ Surprisingly, except for elderly persons on assistance, records show that no status category was at significantly greater risk than any other in parishes where excess mortality was comparatively low or moderate "(Vasey, 1991; 349)

We have not discussed whether large-scale famines could have been averted, if higher administrative organizations, including the royal administration in Copenhagen, had operated a relief system on a national scale. However, it is clear that poor communications would have required that supplies be stored mostly in Iceland rather than Denmark. ⁶⁶

64 "This [the excess-death rate in 1784-1785] is nearly double most estimates of mortality from the Irish potato famine and comparable to some famines in seventeenth century Beauvais, France, that are thought to be among the worst local manifestations of famine in early modern Europe." (Vasey, 1991; 344) In addition to the catastrophes of 1707-1709 and 1784-1785, one in nine Icelanders perished in the famine of 1756-1757 (Iorsteinsson & Jonsson, 1991; 239).

65 In parishes with high mortality rates, only servants (laborers) in the 30-39 age interval had a poorer survival rate than kin (Vasey, 1991; 343)

66 The first recorded instance of aid from Denmark was in the famine of 1756-1757, when the king gave the Icelanders 2,000 barrels of grain. Only 1,400 barrels made it all the way to Iceland and poor communications hampered the distribution of the grain within the country (Iorsteinsson & Jonsson, 1991; 239). In the fall of 1783, when the authorities in Copenhagen learned of the eruption in Laka Craters, they sent a ship with supplies from Copenhagen in November, attempting for the first time to sail to Iceland in midwinter. The ship approached Iceland three times, coming close enough to see pillars of fire rising from the country, but each time the vessel was driven out to sea. The expedition wintered in Norway and finally arrived in Iceland in April 1784 (Iorsteinsson & Jonsson, 1991; 251).

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