

TRADITIONAL COOPERATION AND MODERNIZATION IN PERUVIAN COMMUNITIES

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To Emil, Stian and the children of Tambo.

One day you will meet as equals.

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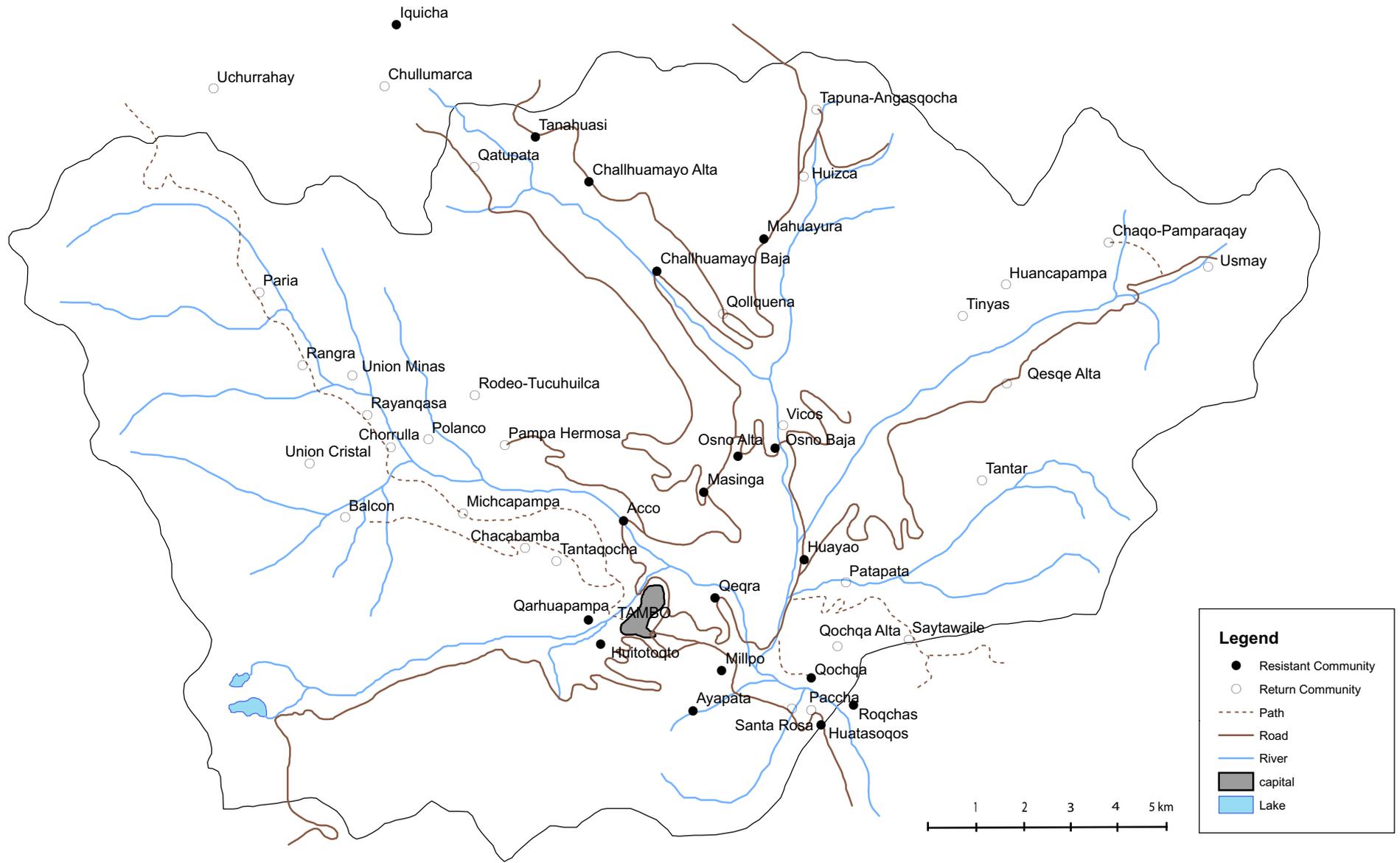
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Map 1: Peru and Department of Ayacucho, source: M. Fumerton: "From victims to heroes"

Distrito Tambo



Map 2: Return and resistant communities in the District of Tambo, La Mar Province, source: H. Wiig

Introduction

1 The research question

The high inequality of income and wealth in Latin America is, in the semi-feudal past as well as under the liberal market economy of today, taken as a fact of life. People exist in parallel worlds; the suburban rich with western income level and third world living expenses on one side and the shantytown poor who earn third world wages to cover urban needs on the other. Another contrast is the traditional life in rural areas compared to the modernity in the capital. Can modernization and market integration close these enormous gaps? This dissertation analyzes the very bottom of the income ladder to study whether a catch-up by the poor is possible.

The rural peasants in the Peruvian highland have a living standard and production system that is not very different from their pre-Hispanic ancestors. The introduction of free markets and the infrastructure improvement of the last two decades open for the integration of this marginalized and isolated majority of the population in the countryside with the modern Peruvian society. How can the poor peasants exploit these new possibilities successfully?

Modern development economics literature launches social capital and land reform as two important concepts to improve the livelihood in rural areas, see Durlauf and Fafchamps (2004), Bowles and Gintis (2002), Deininger (2003), de Janvry et al. (2001b), de Janvry et al. (2001a) and Carter and Salgado (2001). Both conditions are satisfied in the Peruvian highland. The peasants cooperate a lot and land is equally distributed. However, the extreme poverty demonstrates how they are still not able to succeed when they are connected to markets. The three articles in the dissertation consist of theoretical explorations and econometric analysis based on data from a questionnaire surveys on traditional cooperation, institutions and production that I conducted in Peruvian highland communities in order explain the slow pace of economic development.

2 Poverty and land reform

Poverty is widespread and runs deep in Latin America. The cruelty is especially striking as a small group at the top enjoys a Western standard of living. The gini coefficient for income distribution was above 52 percent for the majority of the Latin American countries in 2002 according to ECLAC (2004) (the exceptions are the "Social democracies" of Costa Rica and Uruguay, where the gini coefficient was anyhow as high as 45 percent). The gap between rich

and poor follows several dimensions in Peru: class, geography and race. Indians constitute the poor majority, while most members of the small upper class descend directly from the colonizing Spaniards. The category Mestizo refers more to a modern style of life than being of a mixed racial origin in itself. There is hence a sharp division between rural peasants of Indian origin living a traditional life organized in communities in the highlands one side, and the urban people on the other. Crossing this gap also implies a shift in cultural identity.

This division becomes apparent when looking at income figures. The analysis made by Herrera (2001) is state of the art when it comes to poverty estimation in Peru. He uses geographical differing consumption baskets on survey figures made by the Peruvian Statistical Institute (INEI) in 2000. 73 percent of the rural population in the highland is poor (the level is lower in the rural areas on the coast with 51 percent), while "only" 37 percent of the urban population is defined as poor. The difference is even larger when it comes to extreme poverty. 35 percent of the rural population, and as little as four percent of the urban population, are included in this category. In total, four out of five of those living in extreme poverty can be found in the countryside¹. This implies that the aim of reducing economic inequality and the aim of fighting poverty in the rural highland to a large extent coincide. Furthermore, the latter is probably the most efficient way to achieve the former.

High income inequality is normally due to unequal distribution of production inputs², which in a rural context where agricultural production constitutes the major component implies inequality in landownership. Land reform as a way of redistributing productive assets has been on the Latin American political agenda for centuries, sparking revolutions as farming land belonging to someone else is seen as the ultimate symbol of exploitation in a capitalist or semi-feudal system. The Mexican revolution confiscated large amounts of land from private landowners and created communities where the inhabitants have common property rights to the land (*ejidos*). Dimension of Peruvian land reform in the 1970's were similar, even though it was initiated by a military government.

¹Household consumption is measured in the local currency, Nuevo Soles. The actual consequence of monetary poverty depends on how the resources are used. Ruggeri (1999) finds the joint incidence of chronic deprivation and monetary poverty to be 54 percent. This implies chronic destitution among non-poor and no destitution among poor. Her main explanation is skewed distribution within the households as well as the choice of products the households actually consume (do you give the children milk or soda water?).

²The economic history literature often stresses how the initial distribution of natural resources, being land, minerals or oil, seem to be persistent. There is hence also an implicit effect of unequal resource distribution which runs through the (often inefficient) institutions in a society that maintain this system, see Engerman and Sokoloff (2002), Robinson (2000), Acemoglu and Robinson (2002). The typical example is the often mentioned "resource curse", i.e. a large stock of easily extractable resources makes it more important for the elite to develop a political system enabling the capture of the profits thereof.

A land reform transfers productive assets from the rich to the poor and is hence nearly by definition good for the poor. The conventional wisdom in development economics literature is that land reform also improves the overall efficiency in agriculture. Land reform hence represents a "win-win" policy opportunity since it decreases inequality and increases economic growth. The explanation for the latter is though to be the moral hazard problem in employing people in agriculture, see Deininger (2003), Carter and Salgado (2001), de Janvry et al. (2001a) and de Janvry et al. (2001b). The owner must either "burn" resources to control effort by their employees or the workers are left to decide a sub-optimal level of effort in some kind of share cropping agreement. There would be no efficiency loss in fixed rent contracts, but such contracts are normally not viable in developing countries since the landless are not able to bear the total risk involved in agriculture as discussed in Fafchamps (1999). There is actually no way a tenant could pay the agreed rent if the crop fails and therefore some kind of risk sharing with the involved negative efficiency effects is hence the only alternative.

Land is also an important instrument for saving in developing countries where credible financial markets are missing and inflation traditionally runs high. The political clout attached might also explain why people actually stock land with minor interest in actually farming it, see Deininger (2003). The resulting gap between the price of land and the resource rent on land (i.e. discounted future income of land as production input) makes it difficult for the poor to buy land in free markets, as the saving aspect is more important for the rich. The drawback of unequal land distribution is further aggravated by the fact that the rich often prefer to leave the land unused rather than renting it out to prevent future land disputes.

The Movement of Landless Workers (MST) in Brazil occupies such idle land with great success due to a double standard in the country's constitution. Private law secures private property rights, while social law instructs the owners to farm their land. The activists hence first occupy the land and then claim the property right, as the present owners do not comply with their obligations. A combination of the obvious waste of resources in idle land and the threat of popular revolt has given a renewed interest in land reforms. The approach advocated by the World Bank is somehow different from the previous land reforms. Securing property rights by giving legal entitlement to the owners constitutes the core. The main effect is expected to come by letting the more efficient peasants have access to land through a functioning land rental market, as the owners will be less afraid of land disputes³, see Deininger (2003).

³The Inter-American Development Bank (IDB) has for example financed a costly entitlement project in Peru,

The new policy also supports redistribution of land if some conditions are satisfied, e.g. voluntary market sales instead of forced confiscations. The state then pays the assumed discrepancy between land rent and the actual price on land due to the reasons given above. For example, the farmers in the Colombian scheme will only pay about 30 percent of the land-price according to Deininger (2003). There are several reasons to question the poverty alleviating efficiency of subsidizing land acquisitions. The fact that the price is higher than the long-term income possibilities implies that the financial support from the multilateral organizations can be considered a gift to the large landowners of today. The overprice will disappear over time as markets become more efficient and the country develops.

More important is the probable decline in the actual land rent itself. There is a conspicuous lack of good studies estimating the resource rent of land in agriculture, but the impression that there is a general decline. Modern inputs such as fertilizers, capital in form of machinery, human capital in the form of knowledge on new production methods and, even more significant, the marketing of products have become more important⁴, while the importance of land as a production input is considerably reduced. The overall effect of further world market liberalization is probably negative for agriculture product prices and hence the resource rent on land⁵. It will be rather ironic if the poor finally receive land in the moment it has become worthless beyond the possibility of practicing traditional self-sufficiency agriculture. Funds from governments and international donors are then probably better spent in other fields to reduce rural poverty.

A useful approach to find possible development implications of land redistribution is to study countries where this has actually taken place already. I therefore chose Peru as the empirical example for my analysis. A land reform initiated by the military regime of general Velasco in the late 1960's transferred large properties to the peasants who had actually worked the land⁶.

where legal documents of property rights for each plot in the whole country (with the exception of communitarian owned land). People who had farmed the land for the last five years were taken to be the owner, and ironically enough hence actually "punishing" owners who had rented out their land for a long period. Only the future will tell whether the owners will actually trust their formal property rights enough to start renting it out.

⁴Reardon et al. (2003) find that supermarket chains now controls between 45 and 75 percent of food retail in Latin America, up from 10-20 percent only 20 years ago. Peasants are seldom able to produce the standardized quality demanded by such chains.

⁵A typical example is the entry of Vietnam as a large player in the coffee market. The result is declining world market prices and the ruin of the Latin American coffee industry. When the larger share of the world population leaves poverty, the associated increase in demand for food might on the other hand lead to higher prices and land rents. A parallel example is the China effect on the world raw material market in the latter years.

⁶This policy has later been interpreted more as a pre-emptive strike against potential communist sympathies in the rural populations rather than reflecting a leftist agenda in the military itself. The intention was further to transform the rural elite to urban industrialists "by force".

28 percent of all arable land was redistributed according to Deininger (2003) and the reform benefited 31 percent of the rural households. It ended in 1980's, but the implemented transfers were not reversed as for example happened in Nicaragua. The defacto restrictions on land sales have led to further fragmentation as families split their property in each generation. The land reform in Peru hence plays an important background in this dissertation even though I do not analyze it directly.

3 Social capital and modernization

An equal distribution of land secures a minimal consumption level for everyone when the population is large compared to total agricultural land. Family size farms are further supposed to be technically efficient since moral hazard in labor effort is then not a problem. Equality within traditional isolated societies is hence supposed to be a good thing. However, the production and marketing technology in modern agriculture is radically different from traditional agriculture. Machinery, improved seeds and agrochemicals, irrigation, marketing and sales imply large units are more efficient than small units. An equal distribution of land is not an obstacle to such modernization if the smallholders are able to cooperate and act as one unit. This can be achieved through the market mechanism, e.g. all landowners rent out their land to one of them and then work as paid workers for him. However, this is not a very common solution due to market imperfections and institutional and sociological factors.

The other possibility is to cooperate as equal partners in farming land as a common project. Cooperatives are often defined as such cooperating units, but their structure actually resembles more a company with employees than voluntary cooperation. The community structure in the Peruvian highland opens for voluntary cooperation between the members. They share machinery, manage and maintain irrigation systems, exchange work, build infrastructure together, etc. at the same time as each plot of land is individually controlled even in the registered peasants communities with common property rights to land. A high degree of trust is needed in these cooperation schemes since the institutional powers to punish defectors are limited in many senses. The Peruvian communities are in modern jargon "rich in social capital". The simple definition of social capital, as stated in La Ferrara (2002) as "...trust, norms and networks", reflects that the content of this term is still rather blurred. When detailed legal contracts of exchange are in reality not possible to defend, e.g. due to institutional failures, surveillance and measurement problems, etc., the partners will have to trust each other to fulfill the agreement. In this situa-

tion several subgame-perfect Nash equilibria are possible. If I trust you, it pays off for you to trust me too and we enter an agreement. If I don't trust you, you will be worse off by trusting me too. Then there is no agreement and no pooling of resources to obtain efficiency. Social capital (or trust in this context) has hence a direct effect on productivity and income and can be seen as an input in economic production along more conventional production inputs like labor, physical capital, human capital and institutional capital⁷.

4 Questionnaire surveys

There is considerable faith amongst academics, international donors, governments and NGOs in the conventional view that both social capital and land reforms can spark off income growth for the poor in the third world. Furthermore, they are often considered to be interrelated phenomena. Deininger (2003), p. 124, as the leading World Bank researcher on land reforms even advocates common entitlement of land in order to secure socially desirable land use "...as long as they are a conscious choice by the group and the group has clear and transparent mechanisms for changing the land tenure regime, they are unlikely to be harmful".

This was an important reason why I choose to study two different districts in the Peruvian highland characterized by both social capital and equal land distribution after land reform. The Andes is the heartland of reciprocity according to anthropologists. Land is juridical or defacto commonly owned by the members of a community even though each household has individual user rights to a given plot. In spite of cultural, geographical and population similarities, the differences between the communities in economic activity, degree of cooperation, organizational capacity, market integration, etc. are rather large in this limited area.

I carried out my own questionnaire survey in the Peruvian highland for the analysis in this dissertation. I visited all 49 communities in the District of Tambo and made the interviews myself over a three-month period in spring 2002 in what I like to define as a "Low cost - Full control" project. This was manageable because I only made one interview, with one or a group of traditional "authorities", i.e. community council members, leaders of the self-defense commit-

⁷The economic literature has in the latter years started to analyze the explicit elements rather than the blurred social capital concept. The main idea is still that all these aspects facilitate cooperation, either separately or they are mutually re-enforcing. Strong norms of cooperation might lead to harsh punishments for defectors and they are hence trustworthy. If historical coincidence has coordinated the high trust equilibrium, then norms of trust and networks evolve more easily. The different aspect of social capital simply tends to correlate positively.

tees, respected elders, etc. in each community⁸. Through discussion they assessed agricultural production and calculated income per capita from different types of work, sales to markets, institutional aspects and not at least the degree of cooperation in the community, i.e. work exchange, infrastructure construction, assembly turn-out, etc. The main idea is that social capital is primarily a characteristic of a given society and not the individual itself. So in order to measure the effects of social capital, we have to compare average figures for whole communities and not the individual households. The "Low cost" approach hence made it possible to cover a whole set of communities in the restricted time of a fieldwork of two to three months.

The "Full control" of the researcher is the other advantage of this rather rough approach of statistics collection. By doing all the interviews myself in Spanish (only assisted once in a while in translation from Quechua by my combined local guide and research assistant) I was able to check whether the questions and answers were understood in a meaningful way. The need to mitigate the potential biases in the material that unfortunately often occur due to time pressure when research assistants do the interviews was an important reason why I chose this approach⁹. I was probably more willing to spend more time on each interview since I was both the producer and user of the data set. The low profile approach, traveling around hitch-hiking or simply walking from community to community on foot, further reduced the risk of strategic responses in order to obtain economic advantages, which is unfortunately a problem in full scale household interview team operations.

I also conducted a similar community level questionnaire survey in the district of Pazos to supplement two household level surveys from different years with variables reflecting institutions, trust and infrastructure.

⁸This community level questionnaire approach is based on Dayton-Johnson (2000) work on social and institutional capital in the Mexican irrigation communities which resembles their Peruvian counterparts in structure.

⁹The main challenge in questionnaire interviews is to *not* correct seemingly incorrect answers according to your own understanding, but rather try to ask again at a later stage in the interview. The moral hazard in using research assistants is unfortunately high. Paid helpers (without profound proper interest in finding the "truth") will often take short cuts to save time when they come across information that seemingly do not fit the picture, for example "he has a traditional outfit, so the degree of market integration can not be as high as he says". The negative correlation between being traditional and market sales later found by the researcher might hence just be a measurement error based on prejudice. A reasonable hypothesis is that the interviewer thinks it is important that data fits the ex-ante impression, in order not to be accused of doing a lousy job and hence risk loosing their employment.

5 Results

5.1 Too much cooperation

My questionnaire survey shows a large variation in the degree of traditional cooperation between the communities in the district Tambo, even though the geographical area is small; they share the same highland Quechua speaking culture and the agricultural practices are nearly identical. I chose work exchange, i.e. "I work for you now, if you work for me the same amount of time in a similar operation later", as the social capital indicator since this type of traditional cooperation is more based on trust compared to other forms of cooperation. The community council seldom uses its institutional power to punish defectors in such personal cooperation agreements and the loss of reputation is hence the main punishment channel. The variable *Work exchange* is defined as days participating in work exchange arrangements during a year by adult males. The average was 90 days during the year and the standard deviation for the communities was 76 days. This reflects that this custom has nearly fallen apart in some communities, while it constitutes the backbone in the working life of others.

The respondents in the questionnaire survey also estimated average income level aggregating different sources. I ended up using income from agricultural production since it reflects the overall living standard in the communities. Furthermore, the most important production inputs for this sector were included in the survey, which made it possible to estimate a production function. I was hence able to test the validity of the underlying assumption of the social capital literature: "The more trust and cooperation, the higher income". An econometric model explaining average agricultural income per capita gives a significant hump shaped effect of *Work exchange* when I control for land, water and other infrastructure and input variables. Starting at low levels of cooperation, income is increasing in days of *Work exchange*, but the effect peaks at 102 days. Above this level more cooperation will actually lead to lower income. The surprise is that more than 40 percent of the communities are above this level and hence have a negative marginal effect of *Work exchange*. In other words: They cooperate too much! This finding hence questions the economic rationale and validity of the ceteris paribus assumption of positive social capital effects.

There might be several reasons for such negative effect of social capital. One obvious candidate is that work exchange is some form of insurance mechanism, as people make the economically rational and conscious choice of production technique that gives a lower expected income to achieve less variation. There is however few signs of food sharing and other insurance mech-

anisms within such work exchange groups. They rather tend to look at each episode of work exchange as an independent and concluded incidence¹⁰.

A more likely source for the variation in the degree of cooperation is their level of integration with the modern society. Norms of cooperation evolved to solve coordination problems of the past and are not necessarily adjusted to kept pace with modernization and market integration processes¹¹. However, they are still alive since an individual breaking such "inefficient" norms unilaterally might find himself shut out in other tasks where cooperation is efficient. It seems reasonable to assume norms of cooperation are stronger in more traditional communities and weaker in the more modern communities. In this case "old" norms can induce cooperation in tasks that are now actually better solved alone.

To explore this hypothesis I construct a game theoretical model where I consider the effect of a negative shift in the payoff from cooperation in traditional tasks. However, norms (and punishment) that evolved to secure cooperation under the old production system are constant. An asymmetry in payoff from work exchange will lead the individual who has something to gain to propose even if the joint payoff from cooperation is negative. A refusal by the individual who got something to lose from this episode of work exchange will stop all future cooperation within this specific task and furthermore trigger some kind of punishment. He might hence still find it profitable to comply with the "call" in spite of the loss for this specific episode of work exchange. Communities where social capital previously entailed the optimal level of cooperation, might now cooperate too much.

5.2 Social capital maintains inefficient structures

The second paper is also an econometric analysis of the community questionnaire survey from Tambo. The 49 communities are divided into two types according to their experience during the war between the Shining Path guerrilla and the army. The resistant communities were populated during the violence, which lasted from the beginning of the 1980's to mid 1990's. In contrast,

¹⁰Two important inputs, capital and labor, are not included in the econometric model, but I argue in the paper that the omission does not bias the estimated effect of *Work exchange*. Capital is not an important factor in the Peruvian highland since peasants only use traditional technology. There are furthermore few teams of oxen and even then people tend to work together. The bias effects of labor might go in opposite directions. The more time people spend in the field, the less efficient work exchange becomes. The sociability effect will then on the other hand make people increasingly interested in working this way.

¹¹One example of reduced efficiency in work exchange can be the increased quality consciousness by the consumers buying products at the markets. It is then more important not to hurt the products while working in the field and the owner often takes more care than people working for him.

the return communities were abandoned completely during the conflict, but a large fraction of the refugees went back to their original communities when peace returned¹². Furthermore, it constitutes a "natural experiment" since the decision on whether to abandon the community or not in the first place, and then later whether to return, is in this context independent of income level. The estimated coefficients from this data set are hence not contaminated by the simultaneity bias that normally follows from the self-selection process involved in the migration decision¹³.

I run a simple OLS regression model to estimate the effect of the community type dummy on average per capita income level, controlling for other production inputs like land, water, infrastructure etc. The income level turns out to be significantly higher in the return community than in resistant communities. This seems like a surprising and counter-intuitive empirical result as it turns out that the war experience gave the most positive (or least negative) effect on the people who were most affected by the violence. However, a war deeply affects the structure of the society. My own field work observations and ethnographic work by other sociologist and anthropologist in this district, e.g. Monje (2000) and Fumerton (2002), indicate that return communities cooperate better and are closer knit together than in the resistant counterparts. The empirical result is consistent with this hypothesis when the dummy variable *Return* is used as a proxy for social capital. The immediate effect of social capital is hence positive, but it leads to a less centralized population and a more traditional society. This may have a negative impact on economic growth in the longer run.

There are several differences between the two types of communities when it comes to cooperation and making use of available resources. The fact that resistant communities were actually multi-communal agglomerations during the conflict raised the level of suspicion and tension between both individuals and the different community members as such. Nobody knew who the guerrilla or army informants were who might turn you in the next time either side took hold of the community. The strong notion of "collective responsibility" in the area implies "collective punishment" and people often had to suffer for what someone else from their community had done. Even to associate across groups was hence dangerous. The result was that most systems

¹²At first nobody took much notice of this refugee problem but they were later defined as Internally Displaced People (IDP) as NGOs and other became interested in their misfortune. Some, but not all, of those who fled further away (district center, department capital Ayacucho or even Lima), also returned to their original community.

¹³Being forced to leave was more dependent on geographical coincidences than the income level of the population. The selection problem is also minimal in the return decision. Nearly all communities have been reconstructed and people of all ages and different production capabilities have returned.

of both community and individual level cooperation deteriorated during the war.

This tension gave rise to the after-war dynamics. The distance to the original farming land of the refugees was not prohibitively long to keep on living where they had settled. Larger units would bring better infrastructure (electricity, roads etc.), public services (schools, medical centers, etc.) and private living conditions, as they would not have to rebuild everything. The war had actually been a golden opportunity to centralize the population to take advantage of the many economies of scale conditions that actually exist. Still, they preferred to go home. The mistrust between the groups and the lack of economically productive cooperation where they lived "pushed" them home. On the other hand, the perceived improvement of cooperation if they split up from the others and returned home to their original communities represents a "pull" effect. The very process of organizing and coordinating the return also tied the members of the given return community together. The equality in the return process also made it more tempting for the people who had fled to more distant places to return and bring with them human capital in form of knowing how to take advantage of the market mechanisms and the modern society. There were no such social capital and human capital building processes in the resistant communities. It was rather the opposite, as the original inhabitants of the *Resistant* communities look upon their fellows who had fled to distant places as cowards. They were hence not considered to be "legitimate" competitors for positions and land in the new established order when they returned after the war.

More financial help from the government and NGOs might have given the return communities an ability to purchase more production inputs (that are not explicitly included in the econometric models) than the resistant communities and more production for a given level of production inputs. On the other hand, the level of financial support was way below the level of physical destruction. It does not seem reasonable that the population was able to use any of these resources to purchase production inputs to increase income, but rather the opposite as people had to spend valuable time to rebuild their houses and infrastructure.

The positive effect of *Return* demonstrates that the segregation between groups might be necessary in order to achieve the level of trust needed for traditional cooperation. The Peruvian government chose to support the return process economically. An alternative policy might have been to make the different original communities live close to each other, far enough to separate them, but close enough to exploit economies of scale (e.g. schools). Then limited resources in the reconstruction period might have been used to productive means, e.g. irrigation systems in

the valleys rather than to reconstruct living areas from scratch. A more concentrated population will probably be more efficient in the (hopefully near) future when income rises and agriculture is mechanized. The negative effects for the return communities will even be worse if they give up their community building projects over time. The lack of productive resources and the small units will probably make economic progress difficult. If they start leaving individually, they will probably move directly to the cities since no ties with the neighboring communities exist any longer. A "golden opportunity" to reconstruct society in an efficient way with groups of communities is hence lost due to social capital.

5.3 Overcoming social capital

The last paper is an empirical analysis of the potato trading pattern of peasants in the similar highland district of Pazos about 10 hours drive north of Tambo. The research institute GRADE conducted household surveys in 1997 and 2001 in the district, recording volumes sold and the prices obtained in the markets where the products are sold¹⁴. Some wait for the intermediaries to come to the field and other brings their products to the markets, whether local, district, region or even as far as the capital itself. There is a large variation in marketing strategies between seemingly similar peasants. I hence conducted a community level questionnaire survey in the 12 communities covering community infrastructure and trust level, which is crucial because it might explain this variation in marketing strategies.

Integrated markets are a rather new phenomena in this district. President Fujimori announced a change from a centrally organized society to a completely free market economy for Peru in a TV broadcasted speech in the evening of August 10th, 1990. All subsidies and production taxes were removed overnight and it took three days before people started to trade since nobody knew what to charge for their products¹⁵. New roads and infrastructure furthermore facilitated the change from self-subsistence agriculture to market based production. The peasants are still inexperienced as to how the markets actually works and their choices are hence often based on coincidental conditions, e.g. they happen to know someone who gave them a good sales contact in distant market¹⁶. I chose to analyze access to phone service and the level of

¹⁴They interviewed 190 households in 1997. Unfortunately, they drew a new and independent sample of 244 households in 2001 since their intention was to extend the content of the survey rather than compare households over time. I was still able to construct a balanced panel of 74 households by comparing names of family members.

¹⁵Neither input prices nor the prices of the competitors were known. Most prices in the end pegged to the gasoline price, but the relative prices between products had changed considerably due to different levels of previous taxes and subsidies.

¹⁶The prices in distant markets are considerably higher than the prices in near markets, but marketing costs

trust between its members as two community level aspects that might affect market integration. Access to telephone facilitates the trading operation and the access to market information, e.g. prices and sales opportunities, while trust facilitate trade through potential aggregation of volume between the peasants, helping each other out in production, information sharing, etc. Trust might on the other hand be a result of less outside opportunities in the communities since the punishment for breaking common norms in the form of social ostracizing feels stronger the less outside opportunities exist. The introduction of the variable *Trust* in a regression model will hence give a reduced form coefficient aggregating opposite effects on the share sold to *distant markets*.

The panel structure of the surveys makes it possible to estimate the effects of a variable in a given year and then further estimate the change in the effect. People are expected to change their behavior as markets mature. More information and experience will over time reduce the importance of "coincidental" conditions, which may have led to an early start, and increase the importance of fundamental production conditions. This "Modernization hypothesis" is confirmed in the data when comparing both cross section estimates for the two years and the change in behavior by households that are included in both surveys.

In the analysis I use the econometric Heckman model that adjusts for the potential self selection bias by people who chose to participate in distant trade due to unobserved variables, included in the residual. The Probit model at the first stage shows that the availability of public telephone service (private do not exist) in the community has a constant significant positive effect on the decision to enter distant markets in both years. However, the effect of *Phone* on *Share distant markets*, i.e. share of total sales that are traded in the distant markets Huancayo and Lima, declines from 1997 to 2001. This suggests that peasants without access to phone service, and who nevertheless find a way around to participate in distant markets, do not suffer any disadvantages anymore. I also find that a higher level of *Trust* between peasants in a community imply they trade significantly less in distant markets compared to people living in less trusting communities. This negative effect is significant for the participation condition in the Probit model, which may reflect that the assumed more traditional communities still have more difficulties in entering distant markets. The estimated coefficient of *Trust* on the share

are not known. I assume there are higher profits in distant markets according to anecdotal evidence suggesting there is a lack of competition between traders and intermediaries in rural areas. The empirical literature on trader collusion is surprisingly thin and no good evidence in either direction is available neither for Peru nor any other similar country.

sold among those who do participate in distant markets however turns from negative to positive and the absolute change is considerable. This indicates that members who overcome the cultural drawback might use some of the traditional features like trust between them to be more active in distant markets than their less trusting counterparts. This effect is also supported by a simple OLS analysis on the subset of 74 households that are included in both surveys. The coefficient for *Trust* is significantly positive in the regression model explaining the change in share sold to distant markets. This implies that communities with more *Trust* have a larger positive shift in the share sold to distant markets than communities with less trust. This effect is interpreted to represent a catch-up effect since communities with more trust were less integrated initially. The "coincidental conditions" hence becomes less important as markets mature.

The importance of total volume sold for the decision to participate in distant markets rises as the coefficient value is more than three times as high in 2001 than in 1997 in the Probit part of the model. The mere existence of fixed entry costs and risk diversification should imply that peasants who sell more in total will spread on different markets. *Volume* is hence important to explain whether a household is active in the regional center or capital or not. Once they are active, then *Volume* should be less important to explain differing shares sold to distant markets. The result that *Volume* has become more important to explain if households sell to distant markets or not indicates that the economic motivation of risk spreading with fixed entry costs becomes more important as markets mature. The OLS regression on changes in shares sold to distant markets among the households included in both surveys give the same result, as the coefficient for $\Delta Volume$ is significantly positive¹⁷.

6 Summing up

I have emphasized the potential negative sides of social capital in the analysis of traditional cooperation among peasants in the Peruvian highland. This does not necessarily mean that traditional cooperation is bad for economic development, rather that policy makers and donors must be aware of the complexity of the social institutions giving rise to such cooperation. The first paper finds that some communities cooperate too much. This illustrates that "building" social capital under any circumstance is not necessarily a good thing, but neither does it mean

¹⁷The inherently volatile nature of agriculture implies volumes and prices might change considerable between years, e.g. total sales volume rose and the price decreased about 50 percent from 1997 to 2001. The apparent change in marketing strategy might hence be due to a temporal change in prices. However, since prices fell considerably in all markets does it seem natural to assume the results reflect lasting structural change in marketing strategy.

we should necessarily attempt to reduce their level of cooperation. Marginal changes are often difficult to obtain and we risk that all cooperation falls apart. In the second paper returning communities are found to have higher income even though this structure of society is assumed to be less development friendly in the long run. This illustrates that it is often necessary to divide people into subgroups where people trust each other for some historical reason in order to make people cooperate. However, it is possible to divide people in different ways. A small twist of policy from the governmental return paradigm to, for example, purchasing land for each original community side by side in the valley bottom, might have given both cooperation and a more concentrated population structure, which seems more development friendly in the longer run. The third paper finds more trusting communities to be less involved in distant trade. However, the difference described illustrates how traditional peasants might be able to learn how the modern market based economy works themselves over time. Anecdotal evidence indicates policy interventions to speed up this process in form of top-down organized attempts at coordinating sales operations can destroy the initial trust level and hence prevent bottom-up organized market sales coordination by the peasants themselves at a later stage.

None of the papers in this dissertation focus on potentially positive long run effects of traditional cooperation and social capital¹⁸ This result is more due to the characteristics of my district of empirical investigation. Other authors, under other circumstances, find positive effects of traditional cooperation for the Peruvian modernization process. One example is Stensrud (2004) who shows how emigrants from the countryside use the same trust based system of work exchange and labor coordination to build infrastructure like roads, electricity, maintain schools and soup kitchens in the new shantytowns of the large cities. My dissertation further illustrates that trust and norms might be task specific and not a description of behavior in general. There might actually be an inverse relationship between trust in traditional tasks and trust in modern market based transactions. Learning to trust in the latter might imply a reduced level of trust in the former. Hopefully, if funding is obtained task dependent trust will be a major component in my future research on the dynamics of development and modernization in underdeveloped countries.

¹⁸The econometrically estimated positive effect of Return is taken to be a short term effect.

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Too much cooperation - Work exchange in Peruvian communities

By Henrik Wiig

Abstract: The general assumption in the social capital literature is that cooperation is good for development. However, such studies often analyze tasks where, in reality, compliance depends on institutional powers. This data set of 49 Peruvian highland communities - a questionnaire survey conducted by the author - includes work exchange as an example of a truly voluntary agreement between rural peasants. A regression analysis gives a significant hump-shaped effect. Some work exchange increases income, but the marginal effect actually turns negative for the 40 percent most cooperation minded communities. A game theory model demonstrates that rational agents will cooperate too much in traditional work tasks if the prevailing norms do not change as individual solutions become more efficient during the modernization process.

Code-words: Social capital, Reciprocity, Work exchange, Collective action, Institutions, Modernization, Peru

JEL-code: C21, D7, O13, Z13

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1 Introduction

Modernization is an all-embracing and often speedy process in poor communities in developing countries. The physical world and the pattern of society around their traditional way of life might change dramatically from one decade to the other. New roads facilitate communication in and out of previously isolated societies. Artificial electric light makes it possible to work and socialize during the night. The introduction of market economies gives access to a whole new range of goods. The consumption pattern might change, but also production since the use of modern inputs like fertilizers and machinery make it possible to farm in a different way. Furthermore, marketable products often differ from their traditional counterparts. The internal life of previously relatively isolated rural communities is in a deep change, not at least because these communities are exposed to new ideas, norms and moral values through interaction with modern society at large. The pessimists in development research predict a breakdown in the "social fabric" of the community. More individualism reduces cooperation, which leads to less production, more internal conflicts, more individual risks as traditional insurance systems weather, etc. The optimists on the other hand emphasize increased productivity due to learning, specialization and trade, which in the end improves welfare in general as the material living standard rises.

Most papers in the extensive social capital (SC) literature focus on negative effects of modernization. A prominent line of thought is as follows: Contacts with the outside reduce the effect of internal sanctions, leading to an increasing number of defectors from cooperative setups, which may imply a collapse in collective action. One example is Bardhan (2000), who finds the functioning of the irrigation systems (which are based on collective action both in maintenance and administration) in a cross-section of Indian communities to be worse, the higher their trade volume compared to total income, and the shorter the distance to urban areas. Such studies on the effect of integration into the modern society on traditional forms of cooperation is interesting in itself. However, a similar economic interpretation is only possible if one assumes that cooperation is technically efficient and that the collective action inducing phenomena does not affect income negatively through other channels.

There are three important reasons to question the relevance of this traditional collective action approach if the aim is to explain income¹. (i) More individualistic norms might be dev-

¹This paper does not consider welfare in general. Other motives for cooperation, for example as an exercise of religion or to confirm the unity of the community, might increase peoples' sense of happiness. Such motives are

astating to cooperation, but at the same time nourish individual progress with a counteracting effect on the income level. (ii) The integration to modern society can reduce the ability to sanction defectors, but at the same time increase the payoff from cooperation in new fields. (iii) Cooperation can actually be unproductive, but still be maintained due to some social payoff or norms that prevent the use of more efficient individualistic production techniques. A fundamental issue is hence to assess the productivity of cooperation before I conclude anything about the desirability of collective action and social capital. The general observation that poor tend to cooperate more than rich (at same level of institutions) seems like a puzzle if SC is an important productivity factor and this opens for the paraphrased question: "If cooperation is so smart, how come you ain't rich?"

The Peruvian highlands are chosen for field research since traditional small scale farmers are often assumed to risk becoming losers in the modernization and market integration processes. I conducted a questionnaire survey on cooperation, institutional organization and income at the community level in all 49 rural communities in a highland district of Peru. An official household level agricultural survey from the same area from earlier years supplements the econometric analysis. It reveals that the estimated effect of some cooperation is positive, but the marginal effect on income decreases and actually becomes negative when cooperation becomes the normal way of working. The results reveal that 40 percent of the sample communities "cooperate too much". The negative effect of "restricted access groups" exploiting outsiders (e.g. mafia, racism) is commonly recognized in the literature. However, the results of this study imply further that "open access groups" can lead to greater cooperation than what is economically optimal. This notion of "negative SC" hence represents a new approach in the literature.

The very success of the social capital concept in social research and politics has made the assessment of its importance and productivity a pressing issue. It is now legitimate to use development aid on social activities with the expectation that improving the "social fabric" will have productive implications at a later stage. Realized investments in the main village of the survey district of this study are one example. The main "plaza" was converted from a rustic common room with lots of different uses including trade, as vividly described by Vélchez Amésquita (1961), to a recreational park with fountains and statues. paid for by municipal funds. Vegetable markets and small-scale traders are now restricted to the back streets, while the "arena" is left for military parades and Sunday strolls by the new village (state and NGO employed) middle-

not included in this analysis, since utility of non-material nature is not measurable.

class. The money has hence not just been wasted from an economic development point of view, one may speculate if it has actually led to a reduction in income generating infrastructure².

2 Theory

2.1 General discussion

The fundamental characteristics of societies that facilitate informal cooperation have in recent years been labeled social capital (SC) and loosely defined for example by La Ferrara (2002) p.1 as "...the stock of norms, trust and civic networks". It is supposed to decrease in traditional societies during the dynamic process of modernization, but the underlying reasons for its decay may actually reveal whether it can be regarded as a good or a bad thing. The introduction of formal institutions might render traditional institutions and norms superfluous. Business partners will in a modern society rely on contracts and law enforcement instead of handshakes and rumor based punishment in closed circles as described in the seminal work on Magribi traders by Greif (1993). A breakdown of SC as the third party contract enforcement improves, is then just an indication of economic development. The impact might be disastrous on the other hand if no formal institutions evolve, either before or after the decay of SC. High crime rates in urban slums are striking examples. The collapse of traditional production arrangements in the countryside might be just as destructive. A typical example of sub-optimal exploitation of common property resources is overgrazing on community lands by individually owned herds. Income generating infrastructure is hard to construct and maintain if people loose their ability to coordinate actions, as Bardhan (2000) finds in his study of irrigation communities in Southern India.

These examples illustrate how SC can both induce collective action in the creation of a public good and facilitate private exchanges between individuals. The latter is a necessary condition for a society to use its resources in an optimal way in order to exploit both specialization and economies of scale. Trust between individual contractual partners is important even in developed economies since forced compliance through the legal system is costly. Trust is even more important in order to achieve efficient production in rural areas in developing countries, where most state institutions are weak or absent. The labor market is normally thin in rural areas

²SC projects are thought not to distort markets directly and hence induce unfair competition in contrast to production related projects. Their popularity in multilateral organizations might hence be more due to the assumed lack of negative effects rather than the existence of positive ones.

of Peru, and it might be difficult to hire people on the spot market, according to Gonzales de Olarte (1994) and Blum (1995). Reciprocity then often becomes an important part of a work exchange deal even in cases when monetary compensation is paid in each individual turn. "If I work for you today, I expect you to do the same for me in the future when I call upon you", represents a normal way of thinking.

The causal chain in the economic analysis is assumed to go from trust to cooperation that improves economic efficiency and hence entails higher income. The lack of SC is by many researchers and policy makers seen as "The hidden variable" which explains the puzzle of large-scale poverty in the technically advanced and integrated world of today, e.g. Platteau (2000)³. Increasing SC at given levels of official institutional power is hence assumed to be a good thing and a pronounced goal of development-oriented policies. The first objection to this way of reasoning is the question whether it is actually more efficient to work together on a given task rather than solving it alone.

The immediate answer is that it will depend on the actual circumstances. Rational utility maximizing agents will always choose the optimal solution. But an individual who decides on whether to enter into a cooperation scheme or not, also considers non-monetary utility and future payoffs besides the immediate production effect. If the latter are large, for example due to individual preferences and norms of the society, tasks can be solved by cooperation even if the former is actually negative. The contra-intuitive result that more cooperation-minded people will actually earn less is perfectly possible.

The fundamental condition for an individual to enter a cooperation scheme is trust in partners to fulfill their agreed obligations. This can either be interpreted as higher expected payoff or as a lower coordination costs. More trust hence leads to more cooperation, *ceteris paribus*. But many sources of trust are actually not related to the SC concept at all. Furthermore, the trust inducing reasons might have a decisive impact on both monetary and non-monetary payoffs. Trust is hence not only an exogenous variable that just influences the expected cost of cooperation, but the underlying source of trust also affects the income and utility level. The notion that trust in general improves economic efficiency and increases income is hence not a trivial assumption.

³However, empirical relations between trust and income are often contaminated by a simultaneity problem, i.e. higher income makes it relatively less costly to trust someone, as demonstrated by Durlauf and Fafchamps (2004).

The following discussion of possible reasons for human action and their potential implications for cooperation is useful in order to trace the effect of trust on income. (i) A rational agent just maximizing (hedonic) utility would defect in a one-shot prisoners dilemma type of situation which characterizes what Ostrom (1990) calls "social dilemmas", i.e. situations where people are tempted by short term profits to defect from cooperation agreements. When repeated interaction is possible, the individuals will include the effect on possible future cooperation agreements and the associated payoffs when they choose whether to fulfill their agreed immediate obligations or not⁴. (ii) Institutional intervention of a third party in deals between individuals alters the individual payoff from defection, for example through monetary fines or imprisonment. (iii) Breaking existing norms of accepted behavior will similarly entail retaliation from the affected individual and/or others members of the society that implies reduced income opportunities in the future. (iv) An individual has preferences for both material and non-material payoffs. The latter also includes consequences for others. An altruist will for example include the utility of others as an element in his own utility function. The perception of oneself as a "just and good man" can further give some people utility in itself. So even if the individual knows for sure that defection in cooperation schemes is not detected and no retaliation of any kind is expected, it does not mean defection will take place.

Rational agents will take all the preceding points into consideration when making their choice of action. People are supposed to weigh the possibility of being caught and the effect of the punishment vs. the hedonic utility (the utility from material consumption) derived from their action, before they make up their minds on what to do. People's inherent preferences and customs often imply that cost-benefit analysis at the margin in "moral" matters do not take place. According to Elster (1998) such general preferences represent categorical imperatives that tell you what to do and what not to do. The very act of calculating and aggregating utility then often implies a break with your own moral⁵. Distinguishing between institutional and normative origin of retaliations to defectors in trust based cooperation schemes in developing countries is

⁴Since market integration increases the possibility area, contact between two individuals will become less frequent and induce less trust and hence less cooperation. This is interpreted as a SC-effect in the literature even if the causal mechanism is pure (hedonic) utility maximization.

⁵Elster further emphasizes how people normally internalize a norm as own preferences, often represented as feelings like "guilt". Theories within social psychology underline the dynamic and endogenous aspect of individual preferences, for example the theory of cognitive dissonance in Festinger (1957) that assumes people will tend to change preferences in order to minimize the difference between the actions they (might be "forced" to) do and feelings about it. Political changes can hence have a rather strong social engineering effect. If market economies induce and reward individual actions, then people will start perceiving individual actions as more morally defensible even if this reduces the degree of collective actions. This implies a spillover effect from (i), (ii) and (iii) to (iv) as norms and institutions slowly change.

further complicated by the blurred nature of formal boundaries of institutions and the effects often lumped together as SC in the literature⁶.

Some actions will in the end not seem rational at all under the given circumstances. The field of behavioural economics has in the latter years given strong evidence of "other" forms of rationality in experimental settings. Kahneman (2003) stresses limits to the use of all available information. The information processing of the human brain is influenced by attribute substitutions, prototypes, framing effects etc. and this gives rise to actions that might systematically depart from the expected utility maximizing optimum. The process of learning is probably important in the context of transformation from traditional rural society to a market economy in this article. People tend to act upon their experiences without processing existing information. "If it worked yesterday, I will do it again today " or "I never try out anything which is not proven to work" are common rules-of-thumb in human decision making. It will hence take some time before changes in the underlying aspects of the society actually trickle down to change people's behaviour. But when it does, large changes might come in a short time⁷. This implies that cooperation might persist for a long time after it has become an inferior solution in modern societies. This point will be thoroughly discussed in a formal game theoretical model in the next sub-section.

This discussion of different underlying reasons of human actions that make people trust each other illustrates that cooperation might give a negative income effect. Some common examples known from standard economic theory are signaling games (i.e. rewards are associated with the action itself and not only the outcome), strong preferences for social interaction rather than material consumption, lags in learning and biased perceptions of the actual world.

The second objection to the assumed productivity enhancing role of trust inducing social phenomena is their potentially negative side effects on other aspects of productivity and economic activity. One example is norms of conformity that put significant pressure on people to act like

⁶A constructive suggestion in Torsvik (2000) to the problem is to separate between Institutional SC and Civic SC. However, most types of human interaction is supported by some combination of both institutional capital and social capital aspect. Extremes in either direction is hard to find. On the one hand, even the worst criminal will take human considerations. On the other hand, only experimental economists believe in complete anonymity and hence the possibility of constructing games where the players only rely on trust. The point in my empirical study is to use work exchange as the type of cooperation that is most trust based in my communities. It is furthermore more trust based than the variables used in other empirical studies of social capital.

⁷The sudden increase in onion production for commercial sales in the late 1980's (long after markets were introduced and the access road constructed) in some of my field research communities is a typical example of copying behavior in rural areas.

others and hence facilitate cooperation since it is easier to assess what to expect from others. Negative reactions from fellow community members might counterweight expected higher income from education, trying out new business ideas, etc. Norms can hence constitute a barrier to creativity and development⁸. Individualism is thought to be a fundamental characteristic of a modern market economy, and it seems reasonable to expect that individual development is realized at the cost of collective solutions. "Knowing ones place in society" is a potential element of the conformity norms, which might constitute an effective hindrance to competition and economic efficiency⁹. Leadership in the community often follows family lines and is not contested even if the leader is incompetent. Shop owners are free to set monopoly prices since a potential competitor will be punished socially for being too ambitious.

Collective solution enhancing institutions, norms and preferences are features of the culture of a society in general and might go hand in hand with other seemingly unrelated restrictions on individual actions that are not consistent with economic maximization. The most striking examples are probably religious bans which leave resources unexploited with a negative effect on economic development, e.g. the prohibition of female participation in the work force, consumption of certain animals which induce a sub-optimal allocation of lands, etc.

2.2 Game theory model

2.2.1 Intuition

The purpose of this game theory model is to show that norms, which originally sustain an efficient level of cooperation through punishment, might induce too much cooperation after a transition of the society. I will first give an intuitive description of how the model works, and then proceed with a formal set-up.

The model is meant to capture cooperation in the form of work exchange between two

⁸The famous (conformity) Law of Jante in the novel Sandemose (1962) facilitated cooperation between traditional fishermen on the coast of Denmark, but blocked individual initiatives to improve their own livelihood through education, new business ideas, etc. Strong British labor unions coordinated strikes to improve the general working conditions and income for all, but group pressure at the same time undermined individual progress through education and career. The explicit costs of reproducing a cooperative minded culture can in a developing country context take enormous proportions. For example Rao (2002) finds expenditures on religious festivals to take 20 percent of total income in a study of Indian communities. Such spending is seen as necessary in order to be accepted and be part of the society and in the end obtain income. This money could alternatively have been used for productive investments. The need to get out of such "high cost" social equilibrium by the individuals has been used as an explanation for the protestant awakening which has swept through my field research district of Tambo in the latter decades.

⁹I am indebted to Kjetil Storesletten for this innovative hypothesis of social capital as a hindrance to competition.

individuals. There is an individual specific stochastic element to each episode of work exchange, implying that one player may gain while the other may lose from cooperation. In the model, there turns out to be multiple Nash equilibria with different degrees of cooperation in the short and medium term, i.e. a low, high and full cooperation equilibrium. The two first will not give cooperation in the long run since there exists some stochastic payoff that will lead one of the parties to refuse cooperation and hence end the game. Only the full cooperation strategy is viable in the long run.

However, the full cooperation equilibrium does not exist if the payoff from cooperation is too low. The agent will then have a short-term incentive to deviate. A punishment for the individual who deviates from cooperation in these tasks is hence collectively rational as it induces efficient cooperation. Direct punishment, for example through imprisonment, can be defined as institutional capital. Indirect forms of punishment like gossip and "guilt" as previously discussed, are aspects of social capital. Punishment will, independent of source, facilitate coordination and make full cooperation a Nash equilibrium in all tasks with positive payoff.

I assume the punishment level for a deviation from cooperation is persistent for a given task even if the payoff from cooperation changes due to aspects of modernization, e.g. market integration. It can take decades to change traditions, while the productivity of cooperation might change almost from one day to another¹⁰. Thus, such abrupt change can make the average payoff negative, yet the individual with payoff higher than the average will still propose cooperation. The individual with lower than average will still accept. Otherwise, he would suffer since there is a punishment for refusing to cooperate in tasks that traditionally have been solved by work exchange. The remainder of this chapter gives the details of the game theory model leading to the hypothesized negative relation between work exchange and income. Readers mainly interested in empirical evidence can go straight to Chapter 3.

2.2.2 Game description

The game analyzes whether two individuals, A and B , will cooperate through work exchange in various tasks $i \in \{1, 2..m\}$. A task is a specific work operation that can take place nearly continuously (food preparation), once or several times during the year (sawing, harvesting, etc.) or rarely (house construction). There are two ways to solve a given task i , either working alone

¹⁰For example the introduction of markets will increase the demand for quality. Summoned labour might work fast, but are normally less careful in handling the plants. The resulting lower quality did not matter much in the previous regime of self-sufficiency agriculture.

or by work exchange. The latter implies that one individual first helps the other to do the needed work, and then the beneficiary reciprocates by working for the other in the same task later. Each work exchange episode is defined as an episode of the game. The agreement to cooperate is an oral contract for the specific episode of the given task. If the partners wish to repeat the interaction in another episode, for example by sawing together next season too, they will have to agree on a new contract.

In practice, the content of work exchange agreements is set by norms of the community where one-to-one is the "rule of thumb", i.e. a labour hour for a labour hour. This rule actually prevents work exchange schemes between different tasks since the perceived cost of labour depends on the given task, e.g. it "costs" more sweat to hand plow than construct houses. I will hence assume work exchange will only take place within the same task in this game theory model.

The payoff from cooperation differs between the individuals in a given task i . A stochastic element, denoted $Y \in [-Y^M, Y^M]$, is added to the average payoff, denoted Π_i , for task i for each individual, i.e. individual A receives the payoff $\Pi_i - Y$ and individual B receives the payoff $\Pi_i + Y$ in a given episode of work exchange. The origin of the stochastic element can for example be that rainfall affects the peasants differently through their choice of crops and the fact that they often have plots in different places. Y is normalized to be equal for all tasks i to facilitate the presentation. I further assume that the average payoff Π_i is constant over time, i.e. equal in all episodes of the game. This implies that the efficiency of cooperation differs between tasks. Tasks are ranked according to their profitability of cooperation, i.e. $\Pi_1 > \Pi_2 > \dots > \Pi_m$. All forms of side payments are ruled out in this model due to the "one-to-one" restriction set by norms.

2.2.3 The strategies.

This is a repeated game with three subsequent steps in each episode. In the first step *Nature* draws the stochastic value Y . In the second one of the individuals put forward a cooperation proposal. For brevity, I go directly to the equilibrium strategies. Then players A and B have the following pair of strategies $S_i^P = \{S_i^{P,A}, S_i^{P,B}\}$ for task i :

$$S_i^{P,A} = \left\{ \begin{array}{l} \text{Propose if } \left\{ \begin{array}{l} (i)^P \Pi_i - Y \geq 0 \\ (ii)^P Y < 0 \\ (iii)^P \text{ all previous cooperation proposals accepted} \end{array} \right\} \\ \text{Not propose otherwise} \end{array} \right\} \quad (1)$$

$$S_i^{P,B} = \left\{ \begin{array}{l} \text{Propose if } \left\{ \begin{array}{l} (i)^P \Pi_i + Y \geq 0 \\ (ii)^P Y \geq 0 \\ (iii)^P \text{ all previous cooperation proposals accepted} \end{array} \right\} \\ \text{Not propose otherwise} \end{array} \right\} \quad (2)$$

These are necessary conditions for a proposal with the following explanation and justification:

$(i)^P$ The players will only propose cooperation in tasks i if the immediate payoff is non-negative. There is no explicit condition for total discounted stream for future payoffs. The reason is that I assume episodes where no proposals take place will just be passed in silence. It is as if it never existed. Profit maximization is hence covered by this condition, which further prevents strategic proposals, i.e. propose with the aim to induce a refusal by the other players.

$(ii)^P$ The individual with the highest immediate payoff proposes cooperation (hereafter denoted *proposer*). When the payoff are identical, i.e. $Y = 0$, individual B will propose by convention.

$(iii)^P$ The players will only propose cooperation in tasks where previous proposals by either player have always been accepted by the other. This reflects that a refusal is perceived as breaking the general agreement of cooperation by the two individuals and neither of them wishes to repeat such failure again (even though both parties might profit from cooperation in the current episode).

When a proposal has taken place, the other individual decides whether to accept (hereafter denoted *responder*). If no proposal is set forward, the "potential" *responder* will not take any action at all. The pair of *responder* strategies $S_i^R = \{S_i^{R,A}, S_i^{R,B}\}$ is as follows:

$$S_i^{R,A} = \left\{ \begin{array}{l} \text{Accept if } \left\{ \begin{array}{l} (i)^R Y \in [0, Y'_i] \\ (ii)^R \text{ all previous cooperation proposals accepted} \end{array} \right\} \\ \text{Refuse otherwise} \end{array} \right\} \quad (3)$$

$$S_i^{R,B} = \left\{ \begin{array}{l} \text{Accept if } \left\{ \begin{array}{l} (i)^R Y \in [-Y'_i, 0], \\ (ii)^R \text{ all previous cooperation proposals accepted} \end{array} \right\} \\ \text{Refuse otherwise} \end{array} \right\} \quad (4)$$

The necessary conditions in the *responder* strategies are given the following explanation and justification:

(i)^R The *responder* will accept if the expected total discounted stream of payoffs after the realization of Y in the given episode, denoted Ψ_i , is non-negative. The strategies of the players are hence directly related to Y since this constitutes the only stochastic element. The critical value where the player is equally well off by accepting or not is denoted Y'_i . This condition implies that individual A will refuse cooperation proposals if $Y \in \langle Y'_i, Y^M \rangle$ and individual B will refuse when $Y \in [-Y^M, -Y'_i \rangle$.

(ii)^R The *responder* will only accept proposals as long as there is no episode in the history of the game where a cooperation proposal by either part has been refuted by the other player. The justification is given in the parallel condition in the propose strategies.

Once the cooperation proposal is accepted, the work exchange will take place, i.e. no defection is possible. But refusing to accept cooperation proposals in a given tasks i where work exchange is the tradition, is regarded as defection to a more generalized agreement of cooperation within task i . as covered by (iii)^P and (ii)^R However, a refusal in one task is assumed not to affect the individuals' cooperation behavior in other tasks. This reflects that people tend to perceive each task as a separate arena¹¹.

¹¹Spillover between tasks will only make the argument of this game theory model stronger since marginal changes in norms is then more difficult. This might explain why some communities seems to cooperate a lot more than what seems to be economically optimal, as is shown later in the empirical chapter. However, this dimension is not included formally since it complicates the model unnecessarily. Neither do I consider interaction with other individuals if the game ends.

2.2.4 Subgame-perfect Nash equilibria

I will first deduct the critical value Y'_i in condition $(ii)^R$ and then show that the according pair of strategies S_i constitutes a subgame-perfect Nash equilibrium.

The stochastic payoff Y is included in the players' immediate payoff in a symmetrically opposite manner. The absolute value of the critical stochastic payoff element Y'_i is hence identical. I will use the example when $Y \geq 0$ in the following deduction of the critical value. This implies that individual A is the *responder* (and individual B the *proposer*). I will further suppress the individual index in order to simplify the presentation, since the expected payoff from cooperation in each future episode ex-ante, denoted Φ_i , for a task i is equal for both individuals players due to the symmetry in the stochastic element Y , i.e. $\Phi_i = \Phi_i^A = \Phi_i^B$. Given the density function $f(Y)$ for the distribution of $Y \in [-Y^M, Y^M]$, we have the following expression:

$$\Phi_i = \int_{-Y^M}^{-Y'_i} 0f(Y)dY + \int_{-Y'_i}^{Y'_i} (\Pi_i - Y) f(Y)dY + \int_{Y'_i}^{Y^M} 0f(Y)dY \quad (5)$$

There are three elements in equation (5). In the first, $Y \in [-Y^M, -Y'_i]$ and individual B will refuse cooperation, which implies that the game end with zero payoff for individual A . In the second, $Y \in [-Y'_i, Y'_i]$ and the *responder* will accept cooperation proposals, which gives the payoff $\Pi_i - Y$ for individual A . In the third, $Y \in [Y'_i, Y^M]$ and individual A will refuse to accept the cooperation proposal from individual B with zero payoff for both as the result since the game ends.

I will all throughout the analysis assume that Y is uniformly distributed on $[-Y^M, Y^M]$ with normalized $Y^M = 1$ which implies $f(Y) = \frac{1}{2}$. Then $\int_{-Y'_i}^{Y'_i} Y f(Y)dY = 0$ and the probability function $P(Y'_i) = \int_{-Y'_i}^{Y'_i} f(Y)dY = Y'_i$. Equation (5) then simplifies down to:

$$\Phi_i = Y'_i \Pi_i \quad (6)$$

The expected total discounted stream of payoffs after the realization of Y is denoted Ψ_i, δ

is the discount factor¹², is given by:

$$\begin{aligned}\Psi_i &= \Pi_i - Y + \delta\Phi_i + \delta^2P(Y^1)\Phi_i + \delta^3P(Y^1)^2\Phi_i + \dots + \delta^tP(Y^1)^{t-1}\Phi_i + \dots \\ &\Downarrow \\ \Psi_i &= \frac{1}{1 - \delta Y'_i} \Pi_i - Y\end{aligned}\tag{7}$$

We find the critical value Y'_i for task i with Π_i when $Y = Y'_i$ and $\Psi_i = 0$. From equation (7) we get:

$$\begin{aligned}\frac{1}{1 - \delta Y'_i} \Pi_i - Y'_i &= 0 \\ &\Downarrow \\ \Pi_i &= (1 - \delta Y'_i) Y'_i\end{aligned}\tag{8}$$

Equation (8) gives the critical value Y'_i as an implicit function of the average payoff Π_i in task i . From equation (7) we see that $\Psi_i \geq 0$ for $Y \leq Y'_i$ and $\Psi_i < 0$ for $Y > Y'_i$. This implies that playing the strategy S_i^A with the critical value Y'_i constitutes a best reply for individual A given the same strategy for individual B , and vice versa.

The strategy pair $S_i = \{S_i^A, S_i^B\}$ where $S_i^j = \{S_i^{P,j}, S_i^{R,j}\}$ for $j = A, B$ with the critical value Y'_i in condition $(i)^R$ of S_i^R must have two characteristics in order to constitute a Nash equilibrium. Neither of the players will achieve a higher payoff by using an alternative strategy given the strategy of the other. The strategy S_i with Y'_i must further be a Nash equilibrium in all subgames of the game. As this is a repeated game, it is sufficient to test for alternative strategies in the initial episode when Y is drawn by *Nature*. It follows from the standard analysis of trigger strategy equilibrium that the strategy S_i with $Y'_i \in [0, Y^M]$ in task i is a subgame-perfect Nash equilibrium if $\Psi_i \geq 0$ for $Y \leq Y'_i$ (better to accept cooperation than end the game with zero payoff), and if $\Psi_i < 0$ for $Y > Y'_i$ (better to end the game with zero payoff than accept cooperation and proceed the game).

We can see from equation (7) that the critical value Y' satisfies condition $(i)^R$. Then $Y = Y'_i$ give $\Psi_i = 0$ in the task i where $\Pi_i = (1 - \delta Y'_i) Y'_i$. If $Y < Y'$, then $\Psi_i > 0$. If $Y > Y'_i$, then $\Psi_i < 0$. This shows that S_i with Y'_i given in the implicit function of equation (8) are subgame-perfect Nash equilibria for the discount factor δ .

¹²I assume the same constant time between the episodes in all tasks i in order to use the same discount factor.

The condition $(ii)^R$ also holds. A change in strategy to accept "profitable" cooperation even if such proposals have been refuted in the past, will still give zero in payoff since the *proposer* will not propose anyway.

The conditions in the *proposer* strategies will also be satisfied. I will split the tasks in two types in order to discuss condition $(i)^P$. When $\Pi_i + Y \geq 0$ and $\Pi_i \geq 0$ the immediate payoff for the *proposer* is non-negative and he can do no better by not proposing since bypassing this episode will give zero in immediate payoff and the same expected payoffs in future episodes. When $\Pi_i + Y \geq 0$ and $\Pi_i < 0$ the *proposer* receives zero in immediate and future payoff since the *responder* will refuse and end the game, i.e. same payoff whether he proposes or not. It is superfluous to discuss condition $(ii)^P$ since this is a convention reflecting that the player with most to gain should be the most eager to initiate cooperation. Furthermore, the *proposer* have nothing to gain by deviating from condition $(iii)^P$ since the *responder* will refuse any proposals anyhow¹³.

This proves that the pair of strategies S_i where the critical values Y'_i are given in equation (8) represents subgame-perfect Nash equilibria.

2.2.5 A numerical example

If $\delta = 0.9$ and $Y^M = 1$ in equation (8) Y'_i will be the following implicit function of Π_i :

$$\Pi_i = (1 - 0.9Y'_i) Y'_i \tag{9}$$

The curve in figure (1) below gives the combinations of Π_i on the vertical axis and Y'_i on the horizontal axis from equation (9).

¹³A coordinated deviation by both the *proposer* from $(iii)^P$ and the *responder* from $(ii)^R$ can increase their expected payoff, e.g. the *proposer* will "try again" when the realized Y is smaller, which will then be acceptable for the *responder*. This implies that the given Nash solution is not renegotiation proof, but this problem is not considered since I assume a non-cooperative game.

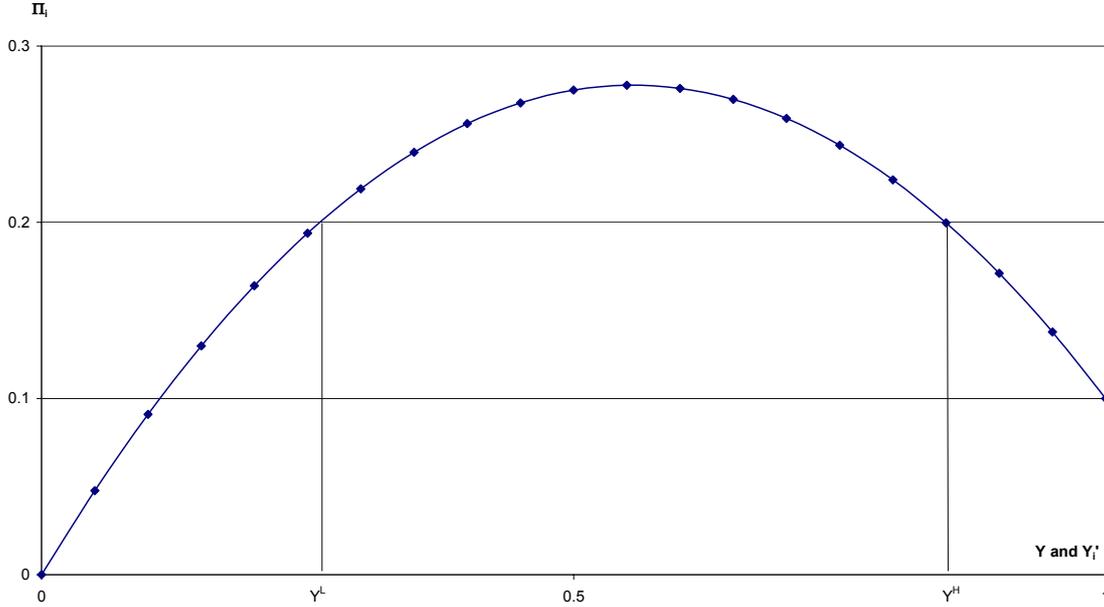


Figure (1): The curve $\Pi_i = (1 - 0.9Y_i')Y_i'$ in this figure represents the critical values Y_i' in the strategies S_i on the horizontal axis in tasks i with different Π_i values measured on the vertical axis when $\delta = 0.9$. In the specific example of task i with $\Pi_i = 0.2$ discussed in the text, $Y_i' = Y^L$ is the low cooperation equilibrium and $Y_i' = Y^H$ the high cooperation equilibrium.

The curve in figure (1) gives the critical values Y_i' in S_i that represent subgame-perfect Nash equilibria for a various tasks i with payoff Π_i measured on the vertical axis. The figure should be read in the following manner. In a task i with Π_i , the associated critical value(s) Y_i' are given on the horizontal axis. I will take task i with $\Pi_i = 0.2Y^M = 0.2$ when $Y^M = 1$ as an example. Then three different strategies S_i sustain subgame-perfect Nash equilibria. The first is S_i with $Y_i' = Y^L$. A realized stochastic value Y lower than the critical value Y_i' will induce the *responder* to accept cooperation proposals since equation (7) demonstrates that $\Psi_i \geq 0$ for $Y \leq Y^L$. The *responder* will on the other hand refuse cooperation if $Y > Y^L$ since $\Psi_i < 0$ according to equation (7). The second is S_i with $Y_i' = Y^H$ which is proven to be a Nash equilibrium in the same manner. The third is for S_i with $Y_i' = Y^M = 1$. Then $Y \leq Y^M$ give $\Psi_i \geq 0$ in equation (7).

Intuitively, in the equilibrium with higher cooperation, the *responder* will accept more adverse proposals (greater absolute value of Y), because he correctly perceives the value of continued cooperation as greater, due to the higher critical value Y_i' . The curve in Figure (1) is hump-shaped for $\delta = 0.9$. There are hence three different categories of task i depending on the

average payoff Π_i . When:

- $\Pi_i < 0.1Y^M$ only a low interior subgame-perfect Nash equilibrium will exist.
- $\Pi_i \in [0.1Y^M, 0.2776Y^M]$ there will be one low and one high interior subgame-perfect Nash equilibrium strategy in addition to the full cooperation strategy as described for task i with $\Pi_i = 0.2Y^M$ above.
- $\Pi_i > 0.2776Y^M$ give S_i with $Y'_i = Y^M$ as the only subgame-perfect Nash equilibrium. Then any strategy S_i with $Y'_i < Y^M$ implies $\Psi_i > 0$ for $Y > Y'_i$ and the *responder* would hence accept cooperation proposals when he is not supposed to according to the proposed strategy.

How stable will the subgame-perfect Nash equilibria strategies be? The low interior equilibrium when $Y'_i = Y^L$ is stable in the sense that if there is a slight stochastic change in the critical value $Y'_i = Y^L - \varepsilon$, then the *responder* will say yes to all $Y \leq Y'_i$. If $Y'_i = Y^L + \varepsilon$, the *responder* will say no to all $Y > Y'_i$. Thus a small stochastic noise to the expected Y'_i will not change the attitude of the *responder*. The high interior equilibrium $Y'_i = Y^H$ is on the other hand unstable because if the *responder* expects stochastic element $Y'_i = Y^H - \varepsilon$, then he will say no to $Y = Y'_i$. This may cause a successive reduction in the critical value Y'_i in the strategies and end in Y^L . If the *responder* expects $Y'_i = Y^H + \varepsilon$, he will say yes to $Y = Y'_i$, which may cause successive increases in critical values Y'_i in the strategies. This process will end with full cooperation, i.e. $Y'_i = Y^M$.

However, another type of dynamic process shows that the interior solutions, Y^L or Y^H , are only applicable in the short and medium term. For a given critical value $Y'_i < Y^M$, sooner or later there will be a work exchange episode where the stochastic $Y > Y'_i$. Then the *responder* says no and cooperation breaks down. Thus, over time only work exchange in tasks i is sustainable if the players have the critical value $Y'_i = Y^M$ in the strategy S_i . Only peasants in communities that were able to coordinate their expectations at full cooperation will cooperate in the longer run in this second category.

We see in figure (1) that S_i with $Y'_i = Y^M = 1$ is not a subgame-perfect Nash equilibrium in tasks i with low average payoff, i.e. category one in the numerical example. The marginal task i where full cooperation is a subgame-perfect Nash equilibrium can be calculated by setting

$Y'_i = 1$ and $\Psi_i = 0$ in equation (7), i.e.

$$\begin{aligned} \frac{1}{1-\delta}\Pi_i - 1 &= 0 \\ \Downarrow \\ \Pi_i &= 1 - \delta \end{aligned} \tag{10}$$

The subgame-perfect Nash equilibrium strategy of full cooperation hence exist in tasks i with $\Pi_i \geq 1 - \delta$. In the long run there will hence be no cooperation in all tasks i with $\Pi_i < 1 - \delta$. The latter hence represents an efficiency loss in the economy due to lack of cooperation.

2.2.6 Necessary punishment level

As shown above there is an efficiency loss because cooperation is not sustainable for tasks i where $\Pi_i < 1 - \delta$. In this section I show that if there is a norm involving a punishment of a *responder* who refuses to cooperate, then cooperation can be sustained in all tasks i with $\Pi_i \geq 0$. Such punishment is denoted $Z < 0$. The punishment level must be strong enough to make full cooperation strategy S_i with $Y'_i = Y^M = 1$ give $\Psi_i^Z = Z$ for a realized $Y = Y^M = 1$ in order to be sustainable in the marginal task i when $\Pi_i = 0$. From equation (7) I hence deduct the necessary punishment level, i.e.

$$\begin{aligned} \frac{1}{1-\delta}\Pi_i - Y &= Z \\ \Downarrow \\ Z &= -1 \end{aligned} \tag{11}$$

With $Z = -Y^M = -1$ S_i with $Y'_i = 1$ will sustain subgame-perfect Nash equilibrium in task i with $\Pi_i = 0$ since $\Psi_i^Z > 0$ for $Y < 1$ and $\Psi_i^Z = 0$ for $Y = 1$. This punishment level is a necessary condition to secure full cooperation as a sustainable strategy. However, S_i with critical value $Y'_i < 1$ can still be subgame-perfect Nash equilibria for some task i with $\Pi_i > 0$ when $Z = -1$, but I do not consider these cases at this stage as they do not represent long term equilibria¹⁴.

¹⁴A punishment $Z \leq -1.19Y^M$ is necessary avoid such solutions, but I will keep $Z = -1$ to simplify the presentation in the rest of the analysis. However, the starting point in this discussion is the assumption that collectively rational norms will develop over time. Some social scientists argue that norms changes slowly. Norms should hence be considered as exogenously given constants, e.g. Elster's vision of "brut norms". However, the sudden entry of women in the labor market is an example of how fast the norms of the society might change. This has happened not only in western countries, but there are also examples of how women in some Palestinian villages were suddenly expected to work outside the house when the men were prevented to enter the labor market

2.2.7 Negative payoff shock

The punishment Z will actually never be implemented if both players uses the critical value $Y'_i = Y^M = 1$ in task i with $\Pi_i \geq 0$, since cooperation will be proposed and accepted in each episode in this subgame-perfect Nash equilibrium. Such communities might be perceived as rich in social capital as they choose to cooperate without any realized threat of punishment. However, if the payoff from cooperation is reduced of some reason, the *responder* will prefer not to accept cooperation and a potentially existing punishment mechanism will be activated.

For simplicity, I assume there is a negative constant shift in the average payoff for all traditional tasks¹⁵ to $\Pi_i - k$ where $k > 0$. I will initially give a solution where the players are slow to adjust strategies and stick to the only long term sustainable strategy of full cooperation, i.e. S_i with critical value $Y'_i = Y^M = 1$. The punishment $Z = -1$ is one motivation for this assumption. Keeping the old strategy before the stochastic Y value is known for the given episode is reasonable if the players do not understand there has been a shift in the payoff. Then a shift to $\Pi_i - k$ might be interpreted as unexpectedly high $Y > Y^M$ value and the *responder* will refuse to cooperate according to the strategy S_i with $Y'_i = Y^M = 1$

The discounted stream of payoff, now denoted $\Psi_i^{Z,k}$ with punishment and change in payoff, that corresponds to equation (7) will be as follows:

$$\Psi_i^{Z,k} = \frac{1}{1-\delta} (\Pi_i - k) - Y \quad (12)$$

However, if the stochastic element Y takes the maximum value 1 in tasks i with negative payoff, i.e. $\Pi_i - k < 0$, then $\Psi_i^{Z,k} < Z = -1$ according to equation (12) and the *responder* will refuse to accept. Thus, cooperation breaks down.

If the stochastic element Y takes a lower value than 1, accepting the proposition may be profitable for the responder. Thus, this implies the players can keep on cooperating in tasks i where $\Pi_i - k < 0$ as long as $Y < Y^M = 1$. The limit value, denoted \bar{Y} , that will be accepted

in Israel during the first Intifada. As an economist who believe most institutions and norms have an economically rational motivation, I hence find it necessary to demonstrate the origin of my results.

¹⁵I will not consider other or new tasks where cooperation might have become more profitable. It will in practice often take long time before the players are able to coordinate cooperation after a transition in tasks where there is no such tradition.

will depend on the payoff $\Pi_i - k$ in a given task i . To find \bar{Y}_i we set $\Psi_i^Z = Z$ in equation (12):

$$\begin{aligned} \frac{1}{1-\delta} (\Pi_i - k) - \bar{Y}_i &= -1 \\ \Downarrow \\ \Pi_i - k &= (\bar{Y}_i - 1)(1 - \delta) \end{aligned} \quad (13)$$

Equation (13) hence gives the implicit function $\bar{Y}_i = g(\Pi_i - k)$. The "worst" task i to ever be accepted will have the payoff $\Pi_i - k = -(1 - \delta)$ since cooperation proposals will be accepted when $Y = 0$. The full cooperation strategy is not really contested as long as $Y < \bar{Y}_i$ and cooperation can hence take place even if the average payoff is negative¹⁶. When $Y > \bar{Y}_i$, the responder will refuse to cooperate and the game ends. Inefficient cooperation, i.e. cooperation in task i with $\Pi_i - k < 0$, is hence not sustainable in the long run but might persist in the short and medium term.

I will now show that inefficient cooperation might persist even if the players realize that the change in payoff will affect their strategies both as a *proposer* and a *responder*. I will only discuss task i with $\Pi_i - k < 0$ since tasks with negative payoff is the main interest of my analysis. I will deduct the solution by changing the strategies in three subsequent steps.

First, I observe that the critical value for the *responder* will be lower, i.e. a new critical value $Y'_i < Y^M = 1$ for the tasks i with $\Pi_i - k$. Both individuals understand that the opponent will change the strategy accordingly. The expected payoff in each episode, denoted $\Phi_i^{Z,k}$ when there is a punishment $Z < 0$ and negative shift in payoff $-k$, corresponds to equation (5) in the following way:

$$\Phi_i^{Z,k} = \int_{-Y^M}^{-Y'_i} 0f(Y)dY + \int_{-Y'_i}^{Y'_i} (\Pi_i - k - Y) f(Y)dY + \int_{Y'_i}^{Y^M} Zf(Y)dY \quad (14)$$

In the first term in equation (14) is $Y \in [-Y^M, -Y'_i]$ and individual A will get zero since individual B refuses to cooperate. In the second term when $Y \in [-Y'_i, Y'_i]$ there is cooperation with payoff $\Pi_i - k - Y$. In the third term when $Y \in \langle Y'_i, Y^M \rangle$ individual A will get the punishment Z since he refuses to accept cooperation. Given the same explicit Y distribution as before where

¹⁶The proposer might now prefer not to propose, but this will first be discussed when I later assume a change in strategies.

a normalization of $Y^M = 1$ implies $\int_{Y_i'}^{Y^M} f(Y)dY = \frac{1-Y_i'}{2}$, equation (14) will be as follows:

$$\Phi_i^{Z,k} = Y_i' (\Pi_i - k) + Z \left(\frac{1 - Y_i'}{2} \right) \quad (15)$$

The second term equation (15) reflects the punishment given if $Y > Y_i'$. With $Z = -1$, the discounted expected stream of payoff of accepting for a *responder* faced with an episode with stochastic element Y , corresponding to equation (7), will then be

$$\Psi_i^{Z,k} = \frac{1}{1 - \delta Y_i'} (\Pi_i - k) - Y - \frac{\delta}{1 - \delta Y_i'} \left(\frac{1 - Y_i'}{2} \right) \quad (16)$$

The only difference from a pre-transition solution is hence that the average payoff element that is reduced by a constant k . I find the new critical value Y_i' by imposing $\Psi_i^{Z,k} = Z = -1$ and $Y = Y_i'$ in equation (16), which gives the following result:

$$\begin{aligned} \frac{1}{1 - \delta Y_i'} (\Pi_i - k) - Y_i' - \frac{\delta}{1 - \delta Y_i'} \left(\frac{1 - Y_i'}{2} \right) &= -1 \\ \Downarrow \\ \Pi_i - k &= (1 - \delta Y_i') (Y_i' - 1) + \delta \left(\frac{1 - Y_i'}{2} \right) \end{aligned} \quad (17)$$

Equation (17) implicitly defines the critical value Y_i' as a function of the payoff $\Pi_i - k$ in task i . This is illustrated by the curve denoted $\delta - 0.9$ in figure (2) below for the explicit case when $\delta = 0.9$. Then $\Psi_i^{Z,k} \geq -1$ for $Y \leq Y_i'$ and $\Psi_i^{Z,k} < -1$ for $Y > Y_i'$. It corresponds to the curve of critical values Y_i' in figure (1) and the description of the solutions is identical. Given a proposal of cooperation, the *responder* will accept in tasks i with negative average payoff $\Pi_i - k < 0$ as long as Y is equal to or smaller than the value given on the horizontal axis indicated by the $\delta - 0.9$ curve.

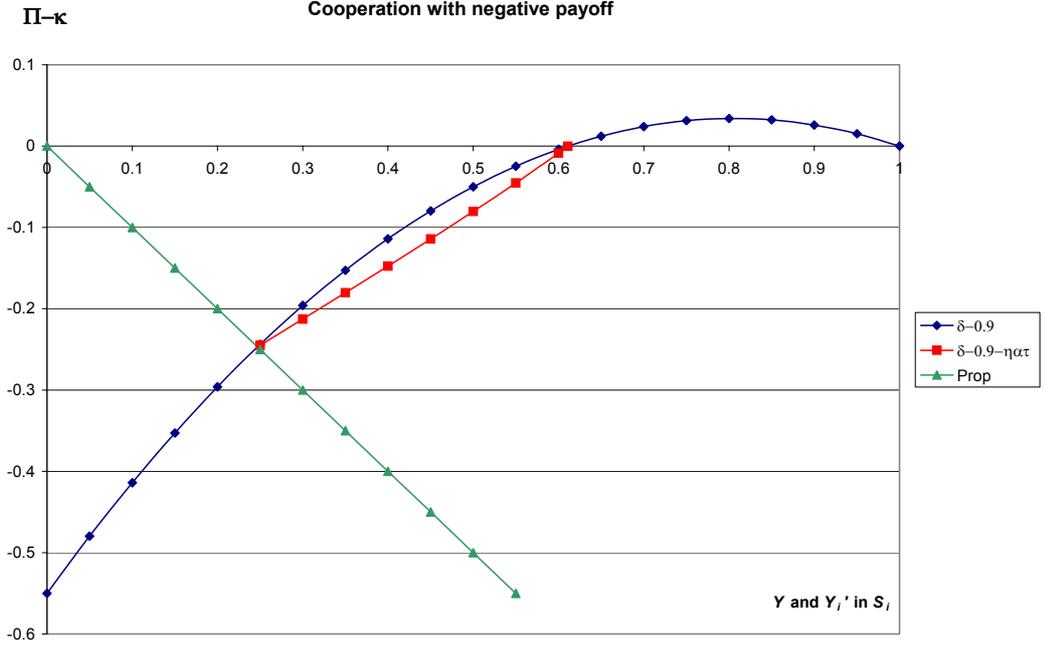


Figure (2): The three curves indicate the three stages of change in strategies after a negative shift in payoff. The first is the $\delta - 0.9$ curve, which gives the critical values Y_i' for the *responder* on the horizontal axis for the task i with payoff $\Pi_i - k$ on the vertical axis. The second is the *prop* line, where a realized Y equal or higher than the according point on the line for task i will induce a proposition. If Y is lower, there is no proposition because $\Pi_i - k + Y < 0$. The third is the $\delta - 0.9 - \hat{h}$ curve, which is similar to the $\delta - 0.9$ when the *responder* incorporates the fact that there will be less propositions. The "inefficiency triangle", i.e. combinations of task i with average payoffs $\Pi_i - k < 0$ and realized Y that induces cooperation, is hence given by the area between the X-axis, the $\delta - 0.9 - \hat{h}$ and the *prop* line.

Second, I assume the *proposer* will not propose if his immediate payoff is negative¹⁷. Since I discuss the situations when $Y \geq 0$ individual B will be the *proposer* and his immediate payoff of the given episode is $\Pi_i - k + Y$. The *proposer* condition $(i)^{P,B}$ for individual B is then:

$$(iv)^{P,B} \quad \Pi_i - k + Y \geq 0 \quad (18)$$

This gives the critical value for the *proposer* $Y_i'' = -(\Pi_i - k)$ as illustrated by the *Prop* line in Figure (2). In a given task i with $\Pi_i - k < 0$, the *proposer* will initiate cooperation if $Y \geq Y_i''$. There are no proposition when $Y < Y_i''$ and the current episode is bypassed in silence.

Third, a *responder* will take into consideration this expected reduction in realized episodes of work exchange in the task i with $\Pi_i - k < 0$ when he decides whether to accept a proposal.

¹⁷I will disregard the possibility that the *proposer* will strategic proposals with the intention to make the *responder* refuse.

Since the average payoff is negative, this reduction in episodes will reduce the future loss of accepting the proposal today. He will hence be willing to accept a worse stochastic outcome Y in the present episode, *ceteris paribus*.

To derive the critical value for the *responder* facing a stochastic element Y we must first find the expected payoff in each episode of the game before *nature* has drawn Y , now denoted $\widehat{\Phi}_i^{Z,k}$, which is equivalent to equation (15):

$$\widehat{\Phi}_i^{Z,k} = \int_{-Y^M}^{-\widehat{Y}'_i} 0f(Y)dY + \int_{-\widehat{Y}'_i}^{-Y_i^S} (\Pi_i - k - Y) f(Y)dY + \int_{-Y_i^S}^{Y_i^S} 0f(Y)dY \quad (19)$$

$$+ \int_{Y_i^S}^{\widehat{Y}'_i} (\Pi_i - k - Y) f(Y)dY + \int_{\widehat{Y}'_i}^{Y^M} Zf(Y)dY$$

↓

$$\widehat{\Phi}_i^{Z,k} = P(Y_i'^S) (\Pi_i - k) + \int_{\widehat{Y}'_i}^{Y^M} Zf(Y)dY \quad (20)$$

↓

$$\widehat{\Phi}_i^{Z,k} = \left[\widehat{Y}'_i + (\Pi_i - k) \right] (\Pi_i - k) - \frac{1 - \widehat{Y}'_i}{2} \quad (21)$$

The first term of equation (19) gives zero payoff for individual A when $Y \in [-Y^M, \widehat{Y}'_i]$ since individual B will refuse cooperation proposals and hence end the game. In the second term individual A obtains the payoff $\Pi_i - k - Y$ when $Y \in [-\widehat{Y}'_i, -Y_i^S]$ since individual B will accept his proposals. In the third term none of them will find it profitable to propose since $Y \in \langle -\widehat{Y}'_i, \widehat{Y}'_i \rangle$ and the payoff is zero. In the fourth, individual A will accept proposals when $Y \in [Y_i^S, \widehat{Y}'_i]$ and receive the payoff $\Pi_i - k - Y$. In the fifth, individual A will refuse cooperation when $Y \in \langle \widehat{Y}'_i, Y^M \rangle$ and hence prefer to take the punishment that give the payoff Z . Equation (20) follows since the probability that a game will be proposed and then accepted is $P(\widehat{Y}'_i'^S) = \int_{-\widehat{Y}'_i}^{-Y_i^S} f(Y)dY + \int_{Y_i^S}^{\widehat{Y}'_i} f(Y)dY$. Then equation (21) follows due to the normalized $Y^M = 1$ and a redefined probability function $P(\widehat{Y}'_i'^S) = \int_{-\widehat{Y}'_i}^{\widehat{Y}'_i} f(Y)dY - \int_{-Y_i^S}^{Y_i^S} f(Y)dY = P(\widehat{Y}'_i) - P(Y_i^S) = \widehat{Y}'_i - Y_i^S$. The last step is valid because Y is uniformly distributed. The *proposer* strategy gives $Y_i^S = -(\Pi_i - k)$ and then $P(Y_i'^S) = \widehat{Y}'_i + (\Pi_i - k)$ for our tasks i of interest where $(\Pi_i - k) < 0$ and $Y_i'^S > -(\Pi_i - k)$.

Thus, when the players incorporate the change in *proposer* strategy into the *responder* strategy, the discounted stream of future payoffs, now denoted $\widehat{\Psi}_i^{Z,k}$, is given by the following expres-

sion:

$$\widehat{\Psi}_i^{Z,k} = \frac{1 - \delta(\widehat{Y}_i' + (\Pi_i - k))}{1 - \delta\widehat{Y}_i'} (\Pi_i - k) - Y - \frac{\delta}{1 - \delta\widehat{Y}_i'} \left(\frac{1 - \widehat{Y}_i'}{2} \right) \quad (22)$$

The critical value of \widehat{Y}_i' is then deducted from equation (22) when $\widehat{\Psi}_i^{Z,k} = -1$ and $Y = \widehat{Y}_i'$, i.e.

$$\frac{1 - \delta(\widehat{Y}_i' + (\Pi_i - k))}{1 - \delta\widehat{Y}_i'} (\Pi_i - k) - \widehat{Y}_i' - \frac{\delta}{1 - \delta\widehat{Y}_i'} \left(\frac{1 - \widehat{Y}_i'}{2} \right) = -1 \quad (23)$$

Equation (23) gives the critical value \widehat{Y}_i' as a function of the $\Pi_i - k$ in the task i with negative payoff that are considered in this part of the analysis. This function is difficult to solve analytically, but a numerical simulation give the $\delta - 0.9 - hat$ curve in figure (2) in the numerical example when $\delta = 0.9$. For a given task i with payoff $\Pi_i - k$, the *responder* will accept cooperation proposals if Y is at or on the left side of the curve $\delta - 0.9 - hat$, i.e. $Y \leq \widehat{Y}_i'$. If Y is on the right side, i.e. $Y > \widehat{Y}_i'$, the *responder* will refuse, take the punishment $Z = -1$ and hence end the game.

When we compare equation (16) and equation (22) we immediately see that $\widehat{\Psi}_i^{Z,k} \geq \Psi_i^{Z,k}$ for a given task i with $\Pi_i - k \leq 0$ and $\widehat{Y}_i' = Y_i'$ since $1 - \delta(\widehat{Y}_i' + (\Pi_i - k)) \leq 1$ in the interval of Y where proposals actually will take place. A *responder* will hence put more emphasis on the immediate punishment Z of refusing to accept cooperation compared to the "indirect punishment" of a negative average payoff $\Pi_i - k$ in future interactions as cooperation will take place more seldom. This induces the downward shift in the subgame-perfect Nash equilibrium strategies to the $\delta = 0.9 hat$ curve line in Figure (2).

I have hence showed that the adjusted strategy S_i with the critical value \widehat{Y}_i' from equation (23) in condition $(ii)^R$ and the change in $(i)^P$ given in equation (18) for the *proposer* sustains a subgame-perfect Nash equilibrium.

Inefficiency "triangle". Whether cooperation will take place in the tasks i with negative average payoff, i.e. $\Pi_i - k < 0$, will hence depend on the realized Y value. When we assume the players understand there has been a shift in payoff for task i from Π_i to $\Pi_i - k$, it also seems reasonable to assume they adjust their strategies from long term Nash equilibria of full cooperation. Individual B as the *proposer* will not propose if the immediate payoff is negative, i.e. only propose if the Y value is on or at the right hand of the *prop* line in figure (2). Furthermore, the *responder* will know about the adjusted *proposer* strategy and hence take the reduced number of future work exchange episodes into consideration, i.e. he will accept proposals when Y is at or on the left side of the $\delta - 0.9 - hat$ curve for a given task i with

$\Pi_i - k < 0$. My focus of interest is combinations of task i with $\Pi_i - k$ and realized Y in the area restricted by the (i) X axis, (ii) *prop* line and (iii) $\delta - 0.9 - hat$ curve in figure (2). This "inefficiency triangle" gives the tasks i with negative average immediate payoff, i.e. $\Pi_i - k < 0$, that will be solved by work exchange as long as the stochastic payoff element Y is in as the indicated range¹⁸.

2.2.8 Summary and extensions

Cooperation with negative payoff is not viable in the long run¹⁹. As soon as the stochastic element is higher than what the *responder* will accept, cooperation proposals will be refused and the game ends. The longer time has passed since the shift in payoff, the less inefficient cooperation is hence expected to take place. The longer time between each episode, the longer time will the adjustment process take. As communities differ in both respects, we also expect them to have reached different stages in the adjustment process. If we assume all communities are able to cooperate when the payoff is non-negative, then more cooperation actually implies that the community cooperates in more tasks with a negative average payoff. The result is lower income. This game theory model hence gives a negative relationship between the level of cooperation and income.

The individual that refuses to cooperate are only punished once. An alternative would be that the game did not end if someone refused to cooperate, and the same individual could hence be punished again and again. If norms of cooperation are frequently broken, people will become more reserved against taking actions of punishment since sanctions often imply a real cost for the punisher too. Then cooperation in tasks with negative average payoff will cease over time. A less dispersed distribution will make high Y values less likely and inefficient cooperation hence more persistent. It might then take a long time before the immediate payoff is so bad that the *responder* prefers to take the punishment.

¹⁸Reasoning in figure (2) indicates that strategic proposals, which are ruled out in the formal model, do not constitute a problem. Such behavior implies that the *proposer* will propose on the left side of the *prop*-line. It does not make sense in tasks i with $\Pi_i - k$ above the intersection of the *prop*-line and the $\delta - 0.9 - hat$ curve since the *responder* will accept anyway. Neither in task i with $\Pi_i - k$ below the intersection level does strategic proposals make sense. If Y is on the left side of the $\delta - 0.9 - hat$ curve, proposals will be accepted with an immediate loss for both players as the result. If Y is on the right side, the responder will refuse and the game ends. But there is no point in ending the game since there will be no proposals in later potential episodes of the game anyway. The only possibility is that the *responder* of today is perceived to be "crazy" enough to propose in these tasks later. Then it is better for the *proposer* of today to propose first in order to end the game.

¹⁹I assumed in the preceding discussion that the players knew the punishment level Z . However, in practice there might be considerably insecurity attached to its level since was never enforced in the long term Nash equilibrium. If people perceives a strong punishment, e.g. $Z < -Y^M = -1$, then players might keep their full cooperation strategies also after a negative change in the immediate payoff from cooperation.

The examples in this chapter emphasize the theoretical possibility that people who cooperate more earn less. I will now proceed to estimate the effects of cooperation on income in a given rural area in the developing country Peru. The district of study consists of several small communities in the middle of the modernization process from being isolated traditional societies to modern market economies. The dispersion in cooperation level is surprisingly large taking the high degree of cultural and geographical similarities in this district into consideration.

3 Empirical study

3.1 Social capital and cooperation productivity measurement

Much of the empirical SC-literature focuses on norms and preferences and proxy this by some kind of perceived level of trust and trustworthiness in a given society. Putnam et al. (1993) argue that civic activity, i.e. being members of organizations, reading newspapers etc., make people more empathic and hence more willing to cooperate in "social dilemmas", which then constitutes an indirect measure of SC²⁰. Other authors have later preferred to measure the level of trust and trustworthiness directly. Either by experimental games, i.e. Glaeser et al. (2000), or by survey questionnaires, like Knack and Keefer (1997) using the World Value Survey where people were asked if "...most people can be trusted?" for cross-section analysis on country level. A similar approach can be used on all empirical levels, like Narayan and Princhett (1999) who carried out a household questionnaire survey for 1376 households in 87 rural Tanzanian villages mixing the two approaches. Each family was asked about membership in groups and its characteristics, and then about their subjective level of trust in others and perceptions of social cohesion in the village. Most studies hence actually try to measure the underlying variable for norms directly in order to apply these in econometric work, and *not* the efficiency of the actions resulting thereof as I have approached in my research.

Most of the empirical literature relates SC-proxies to some "social dilemma" and it is tacitly understood that the resulting cooperation has a positive effect on income. Preceding the SC-literature, Ostrom (1990) studied how local societies organize the exploitation of common pool resources (CPR) as a problem of "collective action". She finds different variables like homogeneity of the society to have a significant impact on the cooperation level. In Ostrom (2003) she argues that the effects work through cooperation inducing norms, "trust", "cultural

²⁰Putnam et al. (1993) found a positive effect on the efficiency of local governmental institution in their famous study of Italy.

identity" and the equilibrium combinations of reciprocal action rules chosen by the population, i.e. what I would call SC in this paper. The CPR-literature uses variables that are thought to work through the SC-effect in the econometric models, to explain the cooperation level. The negative impact of integration on cooperation in the set of Indian irrigation communities found in Bardhan (2000) is meant to be interpreted this way. Similarly, the Dayton-Johnson (2000) study of irrigation communities in Mexico finds homogeneity within the community to have a positive impact on cooperation²¹. None of these studies actually go beyond estimating the effect of trust on cooperation in exemplified "social dilemmas", nor do they measure the impact of cooperation on income.

Narayan and Princhett (1999) is one of the few studies that try to estimate the total income effect of SC. They find that income of the individual households increases with proxies for "trust" in reduced form regression models. The average number of organizational membership in the village had a significant positive impact on income level, while the households had no positive effect of belonging to more organizations themselves. SC is hence more a public than a private good²². But group membership can depend on the income level as some kind of consumption good, and the authors hence use "trust in strangers" and "trust in government" as instrument variables which renders significant results. These instruments are not valid in the opinion of Durlauf (2002), being incorrectly excluded from the original econometric model since he finds it rather non-controversial that societies with higher generalized trust also achieve more economic progress. Knack and Keefer (1997) do a similar exercise on a cross-country level and find the World Value Survey question of "...most people can be trusted" to be positively correlated with the average income level, but the endogeneity problem is expected to be just as important at this aggregation level. My paper follows the approach taken by Narayan and Princhett (1999) in using the income level as the left hand side variable, but differs by introducing cooperation resulting from SC as the explanatory variable rather than a proxy for SC itself.

²¹These resemble the communities of the Peruvian highland in this study both in natural conditions, infrastructure and culture.

²²Their estimated effect is surprisingly strong. Increasing average membership in groups by one standard deviation increases expected incomes by 20-50 percent. A similar increase in schooling entails just a 3 to 5 percent increase in income, while non-farm physical assets is associated with 19-22 percent more income.

3.2 Econometric analysis of work exchange in Tambo

3.2.1 Reciprocal traditions and community characteristics

Social anthropologists like Mayer (2002) often characterize the Peruvian highland as "the heartland of reciprocity". The forefathers of the inhabitants of the district Tambo in the Department of Ayacucho, where the survey of this author took place, were once part of the Incan empire. Quechua is the spoken language, even though people are now able to communicate in Spanish, and old traditions are still in place. The fundamental unit of social identification is the community. The communities differ considerably in size - from 12 to 180 households in this sample of 49 communities - but are organized in a rather similar manner (see summary statistics of main variables table A1 in the appendix). Community assemblies with compulsory attendance for (at least) all heads of households are held about four times a year. The assembly elects the president and other members of the community council, representatives for other offices like the defense committee, irrigation committees, etc. Even the official state representative is defacto elected by the community, since the government tends to appoint the candidate proposed by the community assembly.

The communities might have different juridical status. Some are Recognized peasant communities with registered common property rights to land. Others are non-registered communities where people have individual property rights even though few have legally registered entitlement papers²³. The difference is rather superficial. Most land has been handed out to households for individual use as well as the fact that family based inheritance rights are practiced in all communities. Most communities were forced to choose between the two property right systems when they were handed over land from the large estates during the land reforms of the 1970s. The result is a rather even distribution of land independent of the property rights system in place²⁴. Both common property rights to land and missing official property documents impede reconcentration of land without the acceptance of the community assembly. An important explanation for the existence of communities as units of organization is the need to protect individual property rights from outsiders according to Gonzales de Olarte (1994). A family alone would not

²³A large-scale entitlement program financed by the Inter-American Development Bank is now registering all plots and houses in both rural and urban areas in Peru. The official explanation is that a public property register makes it possible for the owners to use property as collateral in order to loan money for productive investments in line with the thoughts of de Soto (2001). Formal entitlement is furthermore necessary in order to introduce property tax in the future, something that is assumed by many as the government's hidden agenda.

²⁴Fairly equal land distribution is probably a necessary condition for reciprocal work exchange not being replaced by a market oriented labor market.

have the power to stop encroachments, either from other poor farmers or large capital owners, if they stand outside a mutual defense organization. The state apparatus is nearly absent in this poor part of the countryside and documents of formal property rights have played a minor role until today.

With this fundamental basis of institutional power, the community assembly and council are able to organize different forms of collective action like building and maintenance of infrastructure on irrigation systems, schools, roads, etc.; make attendance to assemblies compulsory; put pressure on people to take part in defense committees and Mothers' Clubs²⁵, or purely voluntary organizations like dance and music groups. Different forms of sanctions are imposed on people who do not comply with their obligations, starting with oral warnings and monetary fines and ending in the most extreme cases with confiscation of property, imprisonment and eviction from the community. Well functioning communities have hence institutional power to carry through collective action projects.

The line between institutional power and truly individual based voluntary cooperation is hence blurred. The aim of this paper is to measure the productivity of SC induced types of cooperation and it is hence important to select the variants that are less influenced by institutional aspects of power²⁶. The community authorities do not interfere or influence the implicit contracts of work exchange between individuals. At most they mediate between the partners if a conflict erupts. *Work exchange* is then a variable that is based on trust that originates in social capital rather than institutional factors and is hence chosen for this analysis.

3.2.2 Productivity effects

The agricultural production function is normally assumed to be homogenous of degree one in the basic inputs land, water, labor, capital, fertilizers and other chemicals for agricultural production, i.e. a general increase in all inputs entail an identical increase in income. The technical efficiency in the use of these inputs and the prices obtained from the products might however depend on cooperation, knowledge and transport facilities through higher production volumes, better prices and easier access to profitable markets.

²⁵The voluntary aspect of the defense committees is low since the military in practice made it compulsory. Membership in Mother Clubs is considered a necessity in order to receive governmental food aid.

²⁶Incumbent leaders can impede real democracy within the community by making the life of opponents difficult, for example by refusing to sign individual petitions for public documents, make false reports to central authorities and abuse their power in other ways. People hence often feel forced to participate in communal works that are initiated by the community elite, often in combination with central authorities.

Work exchange might lead to more efficient use of resources in the Peruvian highlands in several ways. The fundamental characteristic is to increase the number of people working on a given project at the same time, which opens for economies of scale effects. In the poor district of Tambo this is related to the lack of production capital. Tractors and other modern machinery are hardly existent and even plough oxen are scarce. The solution is to apply the traditional hand plow (*Chaquitaccla*). Three people working together - two trampling the hand plough into the ground and one taking a grip on the tuft of grass in order to till it over - are supposed to be able to turn the land faster than when each is working alone equipped with a separate hand plow. This system also gives rise to specialization gains since the labour power of youngsters is best exploited as tilling assistants.

A concentrated effort is often necessary in order to exploit short windows of opportunities given by nature or human organization in traditional agriculture. The land is for example humid and soft just after rainfalls. One man-hour of work with the hand plough will then till a lot more land than later when the land dries up and hardens. The same applies to irrigated land, since water is distributed in turns. Working for each other is hence technically efficient in the sense that land is tilled while soft and the others have also something to do while they are waiting for their turn of the water. Geographical distribution of land, soil types, etc. makes people have different needs at different times and work exchange can hence induce the optimal use of labour over time for the whole community as such. The freed resources can be used to increase the use of the other inputs, for example to till more land (if such is available), improve irrigation systems or engage in other fertility improving activities, ranging from collecting cow dung to engage in wage labour in order to buy commercial fertilizers and pesticides. Work exchange is not restricted to purely manual work since two and three teams of plough oxen working together is common in most places and were also observed in Tambo.

The farmers themselves tend to mention competition between participants in work exchange schemes as the most important production-enhancing factor. Working faster, doing more and better than the others becomes a more important element the larger the group. "Working alone, you fall asleep" is the standard comment²⁷. If this is an inherent characteristic of self-motivation and hence the people's ability to work hard, it stands in direct contrast to the assumed shirking effect when people work for others in modern societies.

²⁷I experienced variants of this phenomenon when I unexpectedly showed up in the fields to make interviews. People were more than willing to talk when they were working alone. A small group would sooner or later become impatient even though just some of them were asked to respond while the others kept on working. In large groups people could refuse to take time off at all.

On the other hand there are several aspects of work exchange that might reduce income. Large distances in this highland area force people to walk up to several hours to a given plot. If one person stayed for a longer time in order to work the land alone, or actually construct the house close to the field instead of clustering in groups, a lot of travel time would be spared. Even though the speed of work is high, the quality of work potentially is lower since people might be more careless and hurt the plants while working in the field. This becomes more important with market integration as quality has a large impact on the sales prices.

Other goals than maximization of expected income can be important to explain behavior that does not necessarily seem rational. Working together is often regarded as a social happening and hence juxtaposed to a consumption good, and Mayer (2002) hence doubts this custom will ever disappear. The expected standard of decent treatment is high, since good food, alcohol and coca leaves are served several times during the day²⁸. This should only represent an expense and not influence gross income. Meanwhile, this reduces physical working capabilities in some degree and people might turn too sociable, taking too many pauses. Since people also derive utility from the social interaction in itself, technical efficiency and optimal time allocation might be considered to be of secondary importance. Income insurance is further an important feature of reciprocal work exchange. Not to repay your obligations is normally accepted in case of "force majeure". One example is to send your son - who is normally not as productive - as replacement in work exchange schemes if the farmer is not able to attend due to illness or injuries, for example with a broken leg. People who normally work together can further constitute an "insurance club" for goods in case some of the members do a very poor harvest. According to Gonzales de Olarte (1994) agricultural production is considered to be individual property in good times, but turns common property when hunger strikes. Finally, accidents and injuries unfortunately constitute an important part of physical labour. The farmers can hence prefer to work together as a precaution in case of accidents.

Few people depend purely on wage income in these rural highland communities, since most households have their own plots. It is hence a risky business even for well-situated farmers not to take part in work exchange schemes since there is no labour market as such. The anthropological and peasant theory literature is full of examples of how peasants punish non-cooperative minded

²⁸When good service is a cultural obligation in work exchange arrangements, the general result is that participants (mostly men) hence consume a larger stake of the available family resources than the people doing household tasks (mostly women). A parallel might be the obligation for business leaders to "wine and dine" in the business community, a social equilibrium where the stockholders and consumers pay the cost (the former through lower business profits and the latter in form of higher product prices).

people by refusing to give a hand when help is most needed, no matter how much money they are offered²⁹. The fear of being stamped as "non-cooperative" can hence force people to take part in a proposed work exchange scheme that actually does not lead to higher income in itself, since they do not want to risk being prevented from making similar propositions when it is actually productive. Indirect and often unrelated rewards from taking part in work exchange (and hence labeled cooperation minded) can be access to public funds, political power and positions in the community, could hence take the character of rent-seeking activity and represent a drag on the economy.

The rules of the game of reciprocity are culturally given and seldom open for negotiation. Tit-for-tat exchange measured in hours under similar circumstances is the basic rule. There might exist ratios of exchange between different kinds of work (and those might change over time as the composition of tasks in the community changes), but not between different levels of inherent working capabilities. According to Mayer (2002), disproportional exchange between people with different levels of working capacity will "infer poison in a relationship". Gonzales de Olarte (1994) finds work exchange groups (of either highly productive or low productive) individuals to seldom cross. Total production would probably increase if people with low and high capabilities work together - which is the implication of a wage labour system where the market decides how the "cake" should be split between the different partners - but this is in practice ruled out. The "cake" splitting problem of cooperation between unequals hence leads to a sub-optimal combination in the use of the community's total labour resource of the community in general. Asymmetrical relations within the community might further induce the less powerful to trade work for influence with the more powerful according to Mitchell (1991) and the marginal productivity of labour might hence be lower under such conditions than when the community members are on an equal footing. However, fieldwork observations indicate that such systems of "Patronage" do not constitute the major component of work exchange relationship in this area.

The specialization and economies of scale effect on technical efficiency implies that communities where people do more work exchange should have a higher average income. But other aims than the maximization of expected income might lead people to cooperate more than optimal to maximize income. As shown in the game theoretical model above, norms might entail coop-

²⁹Mayer (2002) mentions an example of pure revenge and Gonzales de Olarte (1994) stresses the lack of labor in peak seasons which imply a rather high shadow wage on labor. The latter point is emphasized by Blum (1995), who calculated the marginal productivity of work during peak seasons to be 10 times higher than the going wage rate, but this becomes irrelevant since no one would work for such low wages if there were no reciprocity attached.

eration even if it reduces income. The 49 communities in the district of Tambo in the Peruvian highland differ a lot in their use of work exchange, even though they are geographically and culturally quite similar. The mean number of days per worker spent in work exchange schemes is 90 days a year, but the standard deviation is 78 with maximum 300 days a year and a minimum of 0. This rather high spread between the communities makes it more likely to find significant estimation results in the econometric analysis.

3.2.3 Community cross-section regression model

I conducted the questionnaire survey during spring 2002. All rural communities in the district of Tambo in the Peruvian highland were included (leaving out the urban district capital). The division into communities in the statistical material follows the lines of the municipal authorities in COZODES, i.e. units which were made responsible for organizing the Defense Committees during the civil war initiated by the Shining Path guerrilla, see Municipality (2002).

The intention of this fieldwork survey was to register the level of different forms of cooperation within each community, how the community institutions worked and the degree of economic integration with the rest of society. The respondents were normally one or more elected representatives of the communities ("an authority") who would assess production, sales, other income sources, average days of work exchange and other cooperation variables and institutional aspects for the whole community as such. Household interviews (even a stratified sample) were beyond the reach with the given time frame of this project. I was willing to accept less accurate estimations of community averages in order to obtain a larger sample of communities, since the point of interest of this study is the effect of community level culture on the living standard in general. The positive effect of interviewing representatives of the community is probably a lower risk of intended misinformation, since households would be more scared about abuse of information, e.g. individual taxation³⁰.

However, the roughness of the survey made it difficult to assess some variables that are normally included in production functions. The exclusion of labour probably does not represent a major source of estimation bias since most people are occupied in different work related activities most of the day. Attempts to register the use of labour within the agricultural sector

³⁰This method does not guarantee truthful information, as community leaders might believe an impression of poverty would entail help from NGOs and state run agencies. However, the problem is less severe since there are no personal implications for the respondent. The hard work of the field researcher is to dig deeper for correct information when the answer does not seem correct. Too many interviewers take a short cut by making their own estimations in order to save time and appear more credible.

would have further been insecure as people would have had problems in separating from the other sources of income such as animal husbandry, other sales and wage labour³¹. Capital is further left out since most people just use simple traditional technology. The use of plough oxen is not very extensive and hence the exclusion probably does not give rise to serious estimation biases. Some aspects of soil fertility like the use of chemical fertilizers and pesticides are neither included. These basic production factors are hence part of the residual of the econometric model.

All basic production variables are measured in units per person, i.e. the estimated total for community as such, divided by the number of people living there. Income is restricted to agricultural income, defined as *Agri income* and measured in New Soles per year per household, since work exchange is supposed to be more common within this field. This income source constitutes about 50 percent of all income in the survey. The income from agriculture is calculated by aggregating production by crops using a market price as weight, i.e. this figure is the total production value and not only the profit element. Animal husbandry also constitutes a large part, but the calculation is probably more inaccurate. The same applies to salary work outside the community, and production for sale that is mostly transformed agricultural products, for example the traditional freeze-dried potato. *Agri income* is measured in average New Soles per year per household.

The following explanatory variables will be included in the regression model explaining *Agri income*. *Land*; measured in units of valley bottom equivalents since land in valley sides and highlands are less useful for agricultural production. *Water*; the units of water supplied through irrigation system is calculated by multiplying different areas with assessed supply of water within the given system (area of well irrigated land is hence an alternative interpretation). *Ecology*; an indicator for natural soil fertility, which has a higher value the larger share of the land is in the valley bottoms compared to valley sides and highlands. *Road*; a dummy for being connected with a road or not. *Work exchange*; the average number of days adult men work together with others in work exchange schemes that directly or indirectly imply a duty to reciprocate (including some where money is given in return as discussed in the theoretical model).

The simple correlation coefficient of *Work exchange* and *Agri income* is small and even negative (-0.0433). The discussion of several potential negative income effects of *Work exchange*

³¹There is no real monetary labor market in the district. Exchange of work or non-monetary rewards are common within the communities, and there is little contact between members of different communities. The type of wage labor in this study is hence mostly farm work in the distant jungle or in the district capital.

given in the preceding chapter opens for a negative relation in general. On the other hand, it does seem reasonable that some types of work exchange have a positive income effect. The most obvious is economies-of-scale situations like ploughing after rainfalls and after given turns in the irrigation system. A quadratic function that allows for a non-monotonous relationship seems proper and is applied in the econometric model below. Few variables are included in the econometric model in order to not lose degrees of freedom since only 49 observations are included in the sample. The results of the OLS model estimations are given in table 1 below.

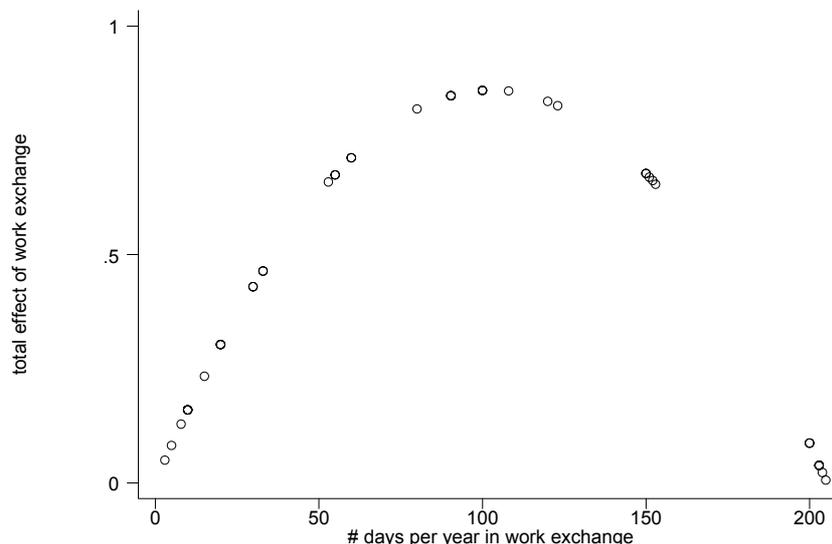
Variables	Full sample		No outliers	
	Coef.	St.dev.	Coef.	St.dev.
ln(Agri Income)				
Constant	5.14***	(0.68)	4.64***	(0.66)
ln(Land)	0.1526	(0.12)	0.1894	(0.11)
ln(Water+0.5)	1.7128**	(0.84)	1.2051	(0.79)
ln(Ecology)	0.6198	(0.52)	1.0172*	(0.51)
Road	0.6166**	(0.27)	0.6659**	(0.27)
<i>Work exchange</i>	0.0105*	(0.0057)	0.0167**	(0.0075)
<i>Work exchange</i> ²	-0.000044*	(0.000023)	-0.000081**	(0.000034)
<i>N</i>	49		45	
<i>R</i> ²	33%		46%	
<i>Adjusted R</i> ²	23%		38%	

Table 1: Results of OLS regression on a log-linear model explaining average agricultural income per person (*Agri income*) in the highland district of Tambo in Peru. *Land* is hectares of good land per person, *Water* is the water equivalents of hectares good irrigated land, *Ecology* is an indicator of natural soil fertility, *Road* is a dummy for road connection, *Work exchange* is days under such arrangement during the year, *Organization* is a dummy for private land. Significance levels * 10 percent, ** 5 percent and ***1 percent. *R*² is the overall explanatory power, *N* is number of observations .

The explanation power with *R*² equal to 32.5 percent in this model using all observations is rather high compared to similar regression models using cross-section data sets with few observations by other authors. *Water*, *Ecology*, *Road* and *Work exchange* are significant at 10 percent level, while *Land* and *Ecology* turn out to be insignificant. In order to check for model robustness, four outliers are taken out of the sample, reducing the numbers of observations to 45 communities³². The coefficient estimations are still rather robust to the model specifications.

³²One observation of 300 days a year, which seems excessive, and three communities reporting no work exchange at all.

All signs are as expected. All variables are nearly significant at 10 percent level when outliers are taken out of the sample. The positive coefficient for *Work exchange* and negative coefficient for *Work exchange* squared give rise to a hump-shaped effect of *Work exchange* on income and the estimated total effect is given in graph 1.



Graph (1): Aggregated effect using estimated coefficients for both level and squared *Work exchange* effect on income, when outliers are taken out of the sample.

The positive effect of *Work exchange* reaches its maximum at 103 days a year. The result is that 18 out of the 45 communities included in this sample actually choose to work more together than income maximizing behavior should imply³³. The significance of the estimated coefficients giving rise to this hump-shaped effect of *Work exchange* is robust to different estimation strategies³⁴. A sensitivity analysis using constant values from 0.25 to 2 in the logarithmic transformation of irrigation area (which is necessary since about 1/3 of the communities have no irrigation at all), reveals that the coefficient value for *Work exchange* is just altered in a minor way. Since the separation of land and irrigated land might seem artificial, I also tried

³³A contagion effect between different tasks can prevent changes. The communities might prefer to keep the unnecessary high level of cooperation rather than risk that all cooperation falls apart if they try to adjust the norms.

³⁴A quadratic model is sensitive to multicollinearity if the variable and the variable squared is too correlated. This problem is reduced transforming the variable to the departure from the mean value. This approach gives an insignificant value of the first coefficient for the mean adjusted *Work exchange*, but a highly significant negative coefficient value for the adjusted *Work exchange*². This result hence further supports the estimation result of negative payoff from *Work exchange* given in the text.

an alternative specification using a weighted sum of dry and irrigated land. The applied relative productivity relation of 1.48 for irrigated land compared to rain fed land is estimated from household level data in the same area, see discussion below. In this alternative model specification all coefficients are still significant at 10 percent level both in the full sample and when the outliers are taken out of the sample, and hence support the findings in the original setup given in table (1). There is also a distinctive inverse pattern when I use dummies for different intervals of *Work exchange* rather than the quadratic form. Communities with between 50 and 150 days of *Work exchange* have a significant higher income than the reference group between 0 and 50, while the estimated coefficient for communities with more than 150 days is positive but insignificant.

Latent variables might bias the estimated coefficients if *Work exchange* is correlated with the residual. One class is variables that affect both income and the productivity of *Work exchange*. Draught oxen is a striking example since they both raise the production per person and further reduce the productivity of *Work exchange* since it is possible to plough the field alone (or assisted by close family members) within an acceptable time frame. If this is the case, the effect of both capital and the interaction of capital and *Work exchange* will spill over on *Work exchange*. However, the effect is not so clear-cut as cooperation is normal also in more advanced technologies. I observed for example several teams of plough oxen work together in work exchange arrangements. More important is the lack of draught animals in general to minimize this potential source of bias, as most were slaughtered during the war. The other latent variables, labour and fertilizers with similar effects, will probably not be important sources of bias due to expected low variation between communities.

Other variables might be correlated with *Work exchange*, but have no direct effect on production. Then there is no interlinkage element, but the direct income effect spills over on *Work exchange*. An interesting example is norms of conformity, which both leads to work exchange through lower coordination costs but at the same time may lower levels of human capital since standing from the crowd by trying out new ideas is punished socially³⁵. The last variant are variables that only affect the productivity of work exchange but has no independent effect on the income level. Tests of such models are discussed in the end of this chapter.

³⁵Norms of conformity and "knowing your place" might lead to even more inefficient solutions if challenging people within the community is considered to be wrong, e.g. "we already got one shop, why make another one", or this family has always been the leaders of the community. The lack of competition might hence lead to low productivity and income levels.

Income simultaneity is also a possible source of estimation bias. The development literature in economics and social sciences and practitioners in the field often uses arguments for cooperation like "rings of survival", "being so poor that you have to cooperate" or "poor people do not have the money to hire labour and hence have to exchange between themselves". These phrases do not give any direct explanations why cooperation should be more productive for the poor than the rich³⁶. However, the poor might have stronger preferences for non-monetary results of *Work exchange* as discussed in previous sections of this paper. This applies to the sociability effect since poor people often need to work all day in order to feed the family. If they want to spend time with their friends and family they will have to do this during working hours. People with more resources can afford to spend time just interacting with their friends, for example doing sports, drinking beer at the canteen, etc. Casual observations in the field also indicate that especially youngsters (who still have little income) prefer not to organize work exchange schemes in order to prevent the accompanying consumption cost. This would hence give rise to opposing income simultaneity effect, since richer people can hence afford to work together.

Risk aversion is another potentially important source of income simultaneity as the utility increases with expected income and decreases with the variability of income. The closer to the limit of survival, the more emphasis they put on minimizing risk (see Fafchamps (1999) for a survey on risk in development agriculture). The "demand" for work exchange as an income insurance mechanism will then depend on the interaction of a risk parameter and *Income*³⁷.

However, observations in the field indicate that the insurance mechanism does not constitute a major part of the work exchange relationship. Neither does the data set indicate any serious income simultaneity bias since the correlation between *Total income* and *Work exchange* is only -0.15 and insignificant. An instrument variable that is uncorrelated with the residual (i.e. uncorrelated with all latent variables and does not have an impact on income in itself) and correlated with *Work exchange* will correct for both the latent variable and income simul-

³⁶Poverty should not in itself prevent functioning monetary labour markets, just imply lower equilibrium wages. The real explanation can be some kind of moral hazard problem in renting labour that is harder to overcome by poor/traditional than by the richer/modern farmers and communities. Fluctuating monetary income in combination with scarcity of saving opportunities for the poor will further lead to a fluctuating "shadow-price" on money. Other means of exchange then reduce this insecurity. Lack of contract enforcement is the classical explanation for social capital. Durlauf and Fafchamps (2004) show how perfect markets give first best resource allocation, while trust based exchanges constitutes the second best solution. No exchange is of course the worst possible solution. The third party contract enforcement in the labour market and first best is hence not possible in any of the communities in Tambo.

³⁷The agricultural development literature has increasingly started to use local variance in rainfall as a risk indicator, e.g. Nugent and Sanchez (1999). The level and variability of rains do also differ between the communities in the rather small district of Peru, but I do not have any rainfall data at such detail levels.

taneity problem. The IV model discussed below indicates that these effects do not give rise to considerable bias in the estimated coefficients of the OLS model.

Whether the community is juridically a "registered peasant community" with common property rights to the land or a more loose organization where the farmers have private property right to their own land, is a potential instrument variable. The correlation between the dummy for individual property rights to land (*Organization*) and *Work exchange* is -0.37 . One possible explanation might be that close-knit communities chose common property rights in the 1970's and the underlying norms and culture behind this decision prevail.

Even though farmers in the two systems experience no difference in their practical lives, the very possibility that the community council can question their property rights might induce people to be friendlier towards cooperation³⁸. *Organization* is not thought to have a direct impact on agricultural productivity nor income since people behave, as their land is their private land independently of their juridical status. It is hence no reason to expect it to be correlated with the capital level, (e.g. plough oxen) or other forms of excluded production-enhancing investments (e.g. soil erosion prevention) since the security of investment is more or less the same. However, a problem using *Organization* as instrument for *Work exchange* is the possible link from the underlying norm system working through the latent variable of individual human capital as earlier described. This effect is not thought to be very strong and I will hence ignore this possible source of estimation bias for now. In neither type of community do the leadership introduce any form of taxation directly on the production volume since the indirect taxation through compulsory work on community infrastructure is related to the number of household members and total plot area. The communities in practice chose the form of organization in the early 1970's and it has been impossible to change until today. Casual evidence from the fieldwork indicates that there is no direct underlying productivity effect of *Organization* due to reasons behind choice of organizations. The communities that chose common property rights historically do not seem to be more traditional today when it comes to other aspects of life. They have the same level of education, speak equally well Spanish and are not more isolated geographically. This indicates that *Organization* is a valid instrument variable for *Work exchange*.

However, one instrument variable of dummy nature is not enough to estimate a quadratic function. Yet, other good instrument variables are difficult to find. A way of testing whether

³⁸Tossing people out of the community if they for example do not comply with their obligations to work on communal infrastructure is mentioned as a possibility in some communities with common property rights to land. However, no concrete examples were given and such statements do probably just reflect the theoretical possibility.

the simultaneity problem is a major concern in this analysis is to first run a regression model with linear effect of *Work exchange* in OLS, and then use 2SLS model with *Organization* as instrument for *Work exchange*. The former gives a positive but insignificant coefficient. The latter increases the estimated coefficient value slightly as expected from the discussion of possible estimation bias, but the coefficient is still not significant (see table A2 in the appendix). This supports the hypothesis that income and latent variables do not constitute the major source for the estimated humpshaped effect of *Work exchange* on *Agri income*.

As mentioned above, cooperation might be productive under some circumstances while not in others. Different interaction variables for *Work exchange* and other variables are included one at the time in quadratic *Work exchange* effect regression models. None of the "suspects" from the discussion in the section 3.2.2 above turns out to be significant. Neither irrigation water (economies of scale due to time pressure), land³⁹ (similar reason), better functioning community organization represented by the ability to impose monetary fines, nor the organization of commonly or privately owned land, give a significant interlinkage effect with *Work exchange*⁴⁰. Further, the coefficient for *Work exchange* is again significant at less than 10 percent and is hence robust to the inclusion of these interlinkage variables. Interlinkage with the share of maize or potato of agricultural income on the other hand, gives significant effects. But choice of crop is endogenously set by the natural conditions and the availability of inputs, and would hence just steal explanation power from the basic inputs already included in the regression model. The introduction of maize-share or potato-share as separate effects does not yield significant coefficients.

If work exchange were more efficient than working alone, there would be more production for the same amount of basic input factors. This liberates resources that can actually be used to produce more inputs in order to increase production. Regression models explaining alternatively *Land* and *Water* give no significant effect of *Work exchange*. It hence seems like *Work exchange* does indeed have a direct effect on income rather than an indirect effect through other explanatory variables in the regression model.

³⁹Blum (1995) finds small amounts of work exchange to be a sign of poverty rather than modernity, since farmers with small plots are able to work their land alone in a rather short time. This is probably of minor importance for the analysis since average land holdings are controlled for in the regression models even though we do not know the average number and hence size of the plots.

⁴⁰Significant interlinkage effects would have implied that the optimal level of work exchange differs between the communities. Then the estimated curve in figure 1 would have been constant with income maximization behavior. Such differences can still not be ruled in spite of insignificant interlinkage coefficient due to stochastic elements in the residual.

3.2.4 Household cross-section and community panel data

I have demonstrated that average agricultural income of the community first is increasing in the average number of days spent in work exchange schemes and then decreases when work exchange is more common. The choice of work exchange probably reflects general norms and perceptions in the actual community, and this differs substantially within the same geographical district of Tambo. Average community values of control variables like land and irrigation hide variations at the individual level. The Central Bureau of Statistics in Peru (INEI) has given access to individual observations from the Agricultural census covering all households in the area in 1994. The same hump-shaped quadratic effect of *Work exchange* also appears in this data set as reflected in the estimated coefficients given in table 2 below.

Tambo was severely affected by the war between the Shining Path guerrilla and the Peruvian military in the 1980's and 1990's. Many communities were hence deserted when the survey took place. I have been able to cross information for 26 of the communities in my own survey with 1300 households in the same communities from the INEI survey. The underlying causal factors for *Work exchange* like norms, natural conditions, etc. is not expected to change radically over the rather short time span of 8 years between the INEI survey and my own. By comparison, Williamson (2000) assesses that it takes 100 years to change the fundamental characteristics of norms in a society. Institutions and norms are further path dependent as for example Acemoglu et al. (2004) demonstrate in their work on long run economic growth. *Work exchange* in 2002 hence seems like a valid proxy for the same type of cooperation in 1994 in this context. Each household in the model below is given their community level average in the model described below.

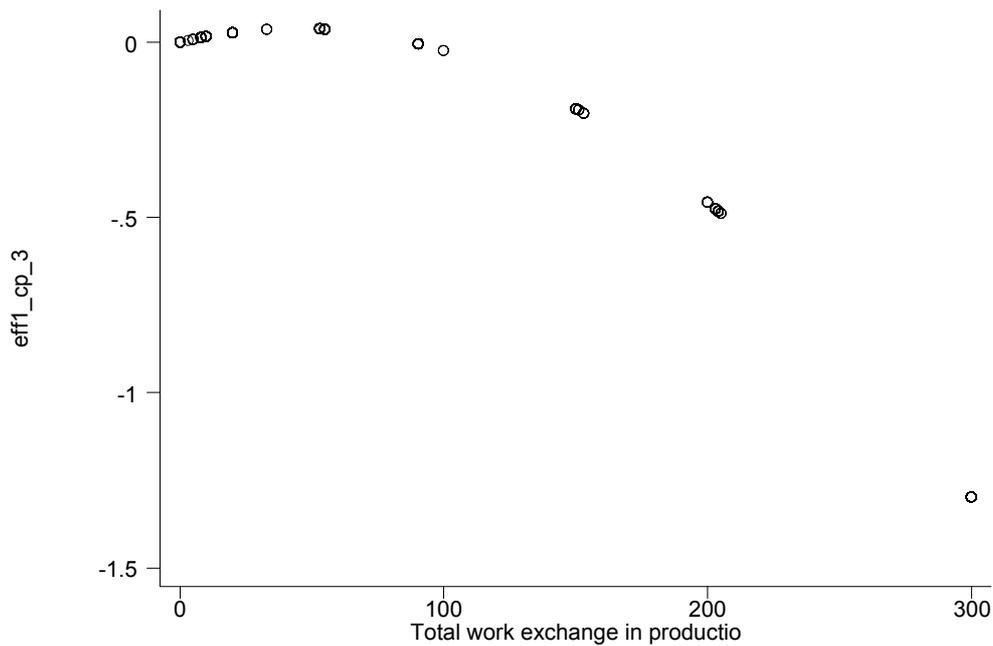
The INEI household level data set includes other potential explanatory variables and the higher number of observations improves the accuracy. A non-linear model is estimated using maximum likelihood. The data set gives information on hectares of irrigated and rain-fed land, but no details on the amount of water available. I hence denominate the former variables as *Irrigated* and the latter as *Dry*, and their relative productivity β is estimated in the non-linear estimation procedure and then simultaneously estimating the effect of $(Dry + \beta \cdot Irrigated)$. *Fertilizer* is dummy for the use of (chemical) fertilizers in any of the plots of the household. *Plough-oxen* is a dummy for ownership of draught animals in the household. *Age* is years of age of the household head. *Sex* is a dummy for a male household head and *Literacy* is a dummy for the ability to read and write by the household head. There is a potential endogeneity problem

for many of the included variables. For example income is correlated over time and hence leads to better schooling of the present household head, but I will not adjust for this potential bias in the following analysis.

Variables/Models	Full sample		No outliers	
	Coef.	t-value	Coef.	t-value
Constant	7.23***	32.03	7.48***	34.43
Irrigated (i.e. β)	1.45***	22.61	1.19***	22.75
$\ln(\text{Dry} + \beta \cdot \text{Irrigated})$	0.98***	43.69	0.98***	45.38
Fertilizer	0.0059	0.14	-0.0217	-0.54
Plough-oxen	0.0166	0.35	0.1311***	2.84
$\ln(\text{Age})$	-0.1468***	-2.68	-0.1251**	-2.37
Sex	0.0048	0.12	-0.0635	-1.59
Literacy	-0.0151	-0.49	0.0051	0.18
<i>Work exchange</i>	0.0017**	2.21	-0.0034***	-3.32
<i>Work exchange</i> ²	-0.00002***	-6.62	-0.000003	-0.66
<i>N</i>	1300		1173	
<i>R</i> ²	67%		69%	
<i>Adjusted R</i> ²	67%		69%	

Table 2: Non-linear model estimated by maximum likelihood procedure on INEI household cross-section data set from 1994. The estimated coefficient for *Irrigation* is the relative productivity of irrigated land compared to rain fed lands (β) which constitutes a part of the next variable $\ln(\text{Dry} + \beta \cdot \text{Irrigation})$ which is the weighted aggregation of dry and irrigated land. The full sample includes all observations, outliers with 0 or 300 days a year of *Work exchange* are taken out in the reduced sample. *Fertilizer* is a positive dummy if the household applies chemical fertilizers, *Plough-oxen* is similar for ploughing technique, "Age" is the age of the household head, the dummy *Sex* is positive for male household heads, *Literacy* is positive if the household head knows how to read and write and *Work exchange* is the number of days in work exchange schemes recorded in the community survey of 2002. Significance levels * 10 percent, ** 5 percent and ***1 percent. R^2 is the overall explanatory power and adj- R^2 is the adjusted explanatory power. The significance level, t-values and R^2 are asymptotic approximations in non-linear model estimation, but this is probably a minor problem due to the large number of observations.

The coefficients in the quadratic model of *Work exchange* are significant and the result is a hump-shaped effect on income also in the household sample. The negative effects of *Work exchange* seems to overshadow the positive (see Graph 2 below) and the estimated total effect on *Agri income* reaches the peak at 88 days when the contribution is hardly positive. The negative contribution to the income level is substantial for households that live in communities where work exchange is more frequent.



Graph 2: The total effect of days under work exchange schemes on the logarithmic transformation of agricultural income, full household sample.

The negative effect becomes even more pronounced when the outliers are taken out of the sample. These results at the household level support the hypothesis that social capital induced work exchange might have a negative effect on income, but the results should be used with caution due to following weaknesses of this sample; (i) Several communities were not included in the sample in 1994 since they had not yet returned after the guerrilla war. (ii) The variable *Work exchange* from 2002 is an imperfect representation of the same variable eight years earlier and (iii) *Work exchange* is the only community level variable in the model, and hence incorporates other community level effects that might be correlated with this variable. Anyhow, the results show a similar pattern as in the community sample and hence support the conclusions given in the preceding analysis⁴¹.

⁴¹In theory it would be possible to calculate the average for income and other variables in the communities for 1994, which in combination with the 2002 figures would give a panel data set. However, this is a futile exercise since the measurement differs between the two years and the less number of communities makes reduces the precision of econometric considerably.

4 Conclusions

In the regression model analysis, based on a sample of 49 peasant communities in the Peruvian highland, I find a significant hump-shaped effect of reciprocal work exchange on agricultural income. The marginal effect of more work exchange is positive at low levels of cooperation, but negative at medium and high levels. This represents a break with much of the existing social capital literature, where it is generally concluded that "the more cooperation, the better" at given levels of institutions and third party contract enforcement. Trust and trust inducing phenomena can actually make traditional societies cooperate more than what is economically optimal. Norms and institutions in traditional societies often do not keep up with rapid transformation from isolated enclaves to integrated parts of the market economies and modern society. They might induce collective solutions when working individually has become more efficient, and pressures of conformity can further represent obstacles for individual development. This notion of cooperation friendly but economically harmful traditional norms and institutions is more in line with the early development economists of the 1950's. The so-called Modernization theory, represented for example by Rostow (1990), then regarded resistance to modernization to be based on superstition, low levels of knowledge and irrational beliefs. Traditions hence represent roadblocks on the path to modernity and development that had to be surpassed or overrun. The analysis in this paper shows that cooperation might be individually rational even though it is collectively irrational. The truth probably lies somewhere in between the now-a-days politically correct positive view of traditional cooperation in the social capital literature and the old-fashioned negative view on traditional ways of organizing the society.

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5 Appendix

5.1 Variable summary

Variable	Mean	St.dev	Min	Max
ln(Agri income)	4.9	1.03	1.9	6.86
Agri income	210	206	7.2	955
Animal income	161	124	0	719
Other sales	32	60	0	366
Wage income	31	48	0	259
Total income	436	279	41	1468
Households	60	37	12	180
Population	277	224	50	1200
Work exchange	90	78	0	300
Ecology	1.74	0.57	1	3
Land	0.52	0.62	0.008	2.665
Road	0.48	0.50	0	1
Irrigation*	0.08	0.13	0	0.76

Table A1: Summary of variables used in the regression models. *Mean* is the average value in the sample, and *St.d.* is the standard deviation. *Min* is minimum value in the sample and *Max* the maximum.

5.2 Comparing OLS and IV models

	OLS - ln(Agri income)		IV - Ln(Agri income)		OLS - Work exchange	
	Coeff	St.dev.	Coeff	St.dev.	Coeff.	St.dev.
Constant	5.45***	0.58	4.80***	1.49	128***	17
ln(land)	0.19*	0.12	0.18	0.12		
Ln(water+0.5)	1.51*	0.86	1.33	0.97		
ln(Ecology)	0.52	0.53	1.01	1.11		
Road	0.58**	0.28	0.49	0.35		
Work exchange	0.0001	0.002				
Organization as IV			0.0039	0.0078		
Organization					-59***	21
Pseudo R ²		0.26		0.20		0.13
N		49		49		49

Table A2: The first regression is a OLS on agricultural income. The second is an 2SLS where *Organization* is used as instrument for *Work exchange*. The third is the first stage of the 2SLS where *Work exchange* is explained by *Organization* in an OLS model. *Land* is hectares of good land per person, *Water* is the water equivalents of hectares good irrigated land, *Ecology* is an indicator of natural soil fertility, *Road* is a dummy for road connection, Work exchange is days under such arrangement during the year, *Organization* is a dummy for private land. Significance levels * 10 percent, ** 5 percent and ***1 percent. R² is the overall explanatory power, N is number of observations and Rho is the fraction of variance due to the unobserved individual effects. A Hausman test comparing the OLS and 2SLS models give Chi²=-025, which imply we got strong evidence that we can not reject the H₀ hypothesis of no difference between them.

Social capital in war-thorn Peruvian communities

By Henrik Wiig

Abstract: Entire communities were abandoned in the Peruvian highlands during the guerrilla war of the 1980-90's. People later returned in spite of the lack of resources in their original communities. An econometric analysis on data from 49 rural communities - a questionnaire survey conducted by the author - discloses a significant positive income effect in such return communities compared to communities that were never abandoned when controlling for land and other basic production inputs. Both data and fieldwork observations indicate that social capital effects, through the "push" of discrimination and mistrust in host residences, the "pull" of homogeneity in the original communities and improved organization skills through the return process, are important causal explanations for this return. Furthermore, this estimated social capital effect is not biased due to the simultaneity problems apparent in most migration studies as displacement and return represents a "natural experiment" in this district.

Code-words: Social capital, Human capital, Emigration, Return, War, Peru

JEL-code: C21, D7, O15, Z13

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1 Introduction

Most people in developing countries now live in urban centers and the share continues to grow¹. The underlying migration pattern is still complex. People do not only move from the countryside to the cities. There is also a considerable rural-rural and even urban-rural emigration flows that has attracted little attention by practitioners and academics within development economics². These countercurrent migration patterns are often thought to be poverty driven as people move to the frontier of civilization in search for agricultural lands and other natural resources. Some simple facts indicate that the process is more complex. Emigrants have often quite a lot of resources available (which is needed in order to settle down somewhere else) and those could alternatively be invested in economic activity in the cities. Furthermore, people with rather similar economic and professional background emigrate in both directions. This indicates that other income related and social phenomena than the basic production factors play an important role.

It is important to understand the underlying explanatory factors as the emerging population structure might be unsustainable even though there is a seductive aura of "back-to-the-roots adventure" over the rural-rural and urban-rural emigration movements. Such movements might improve life for a short while, but still represent a detour to development³ since a more concentrated population is probably the characteristic of a modern and economically efficient society⁴. Economies of scale are considerable both in public services and production, and the transformation to a highly efficient modern agriculture will probably make most of the population in the

¹The rural population in Latin America decreased from 43 percent in 1970, to 35 percent in 1980 and 29 percent in 1990. Similar figures for Peru is 43 percent, 35 percent and 30 percent according to United Nations calculations reproduced in Roberts (1995).

²The few cases of public interest most often carry a negative connotation, for example deforestation and conflicts with the indigenous population as colonists move further into the Amazon.

³Development is in this paper interpreted as economic growth and increased consumption opportunities. This is a highly contested assumption in the development research community. First of all can other aspects like culture, influence, freedom, etc. be important elements of human happiness that are not necessarily correlated with the income level as discussed by Sen (2000) in his capability concept. Secondly, the correlation between income and consumption related states like malnutrition is surprisingly low. Meanwhile, it is not possible to measure human happiness and I will in this paper satisfy with the lesser aim of explaining differences in income level.

⁴The Modernization literature as presented by its main advocate Rostow (1990) emphasizes a dynamic development from rural agriculture to urban industry. A main fallacy in the interpretation of his work is to assume increased population concentration is a sufficient condition for economic growth rather than a necessary condition. Just moving people to urban areas does not necessarily raise income in itself. Another aspect of urbanization is the composition of production sectors. Manufactures as share of GDP is reduced considerably in most developed (and developing) countries. This is due to technological growth and the entry of some highly efficient and populous countries (e.g. China) in the world economy. This raises the question whether it is possible to pass the industrial stage, leaping directly from agriculture to a service based society.

countryside redundant within this sector. It is difficult to create other forms of employment in sparsely populated areas⁵.

Empirical studies of emigration patterns are often troubled by an expected interdependence of income and emigration. Emigrants might be better educated or have other inherent characteristics that entail higher income than the people who stays behind in general, but they still choose to go because the payoff from these characteristics are higher in other places. This self-selection bias distorts the estimated coefficients in econometric analysis and we need to control for this mechanism one way or another if we want to understand how emigration in itself affects income. This article studies a very special emigration experience in Peru where the self-selection problem is thought to be minimal due to historical reasons. It hence represents a "natural experiment" where the estimated effects can be interpreted to come directly from the emigration process itself.

The armed conflict between the communist Shining Path guerrilla and the Army in the 1980 and 1990s led entire communities in the highlands to abandon their homes and lands temporarily. This displacement (i.e. forced emigration) of entire communities depended more on location than the income level of the population. Furthermore, nearly all communities are now repopulated again. The selection of communities in the sample does hence not depend on the income level itself. The tautology "all individuals left as the communities were completely abandoned" underlines the important fact that there was no self-selection problem at an individual level in the decision to leave or not. The history of return in this specific situation led individuals of most income categories to go back. The institutions further strongly advised returnees to also bring elderly, disabled and other less work capable individuals with them. It was further often

⁵Perception of future possibilities are unfortunately often based on historical experiences, and this might explain the emphasis on land as an important element to escape poverty. This influences for example the Landless Workers Movement (MST) organization in Brazil, which helps the landless people obtain land and take part in cooperative solutions. Another example is the purchase of large estates by the government and NGOs in Guatemala in order to resettle war refugees that are already established in Mexico. Ironically, this old idea of fairness and equality through redistribution of land is now actually possible because there is hardly any money left in traditional agriculture. The land-rent is approaching zero as coffee prices are slumping in Guatemala and gene-manipulation increases productivity in modern large-scale farms manifolds in Brazil. This process is also driven from the consumption side as people start to buy their food products in the supermarkets. Their share of the food market has risen from 10-20 percent to 50-75 percent for the Latin American countries in just 20 years according to Reardon et al. (2003). Small-scale farmers are seldom capable of producing the standardized quality for this market. Even though peasants are finally "working for themselves" instead of serving in serfdom for the hacienda owner, the small scale and technically less advanced agriculture might soon end up to represent just another poverty trap for the poor, while state subsidies to buy overpriced land fuels the pockets of the wealthy. Even the World Bank takes part in this process by subsidizing the calculated difference between the land-rent, i.e. the productivity of land itself, and the actual sales price. This overprice due to several types of imperfections in the economy constitute 70 percent of the sales price of land in Colombia, according to Deininger (2003).

an indirect prerequisite for governmental financial support. This implies that the self-selection problem is neither present at the individual level.

I conducted a questionnaire survey in the 49 communities that constitute the district of Tambo in the department of Ayacucho in the Peruvian highlands, where I collected statistics on production, sales, institutions, cooperation and war experience. Of these, 31 communities were completely abandoned during the violent conflict and later repopulated by returnees. These communities hence constitute examples of rural-rural and urban-rural emigration. The remaining 18 communities were never abandoned and also served as the residence of the refugees from the surrounding communities for an average of 10 years. Any fixed costs in connection to the uprooting process should be regarded as a sunk cost, and it was possible to stay in the more populous clusters since the travel distance to farm their original lands was reasonable. Still, nearly all Internally Displaced People (IDP) have preferred to return to their home communities and this puzzle of "urban"-rural emigration is the main motivation for this study.

An additional motivation is to study the process of rebuilding war thorn societies. The number of IDPs in the 1990's in Peru was 600,000 individuals from 114,000 households, according to figures calculated by the non-governmental organization (NGO) CEPRODEP, as quoted in Kirk (1993). The official authorities now consider that there is no IDP problem because they have either returned to their original communities or chosen to resettle permanently somewhere else. Official figures at the world level today is 25 million in developing countries due to armed conflicts, Project (2004). In addition come considerably more cross-border refugees. How should governments and the international society use their limited resources to help these vulnerable people rebuild their future when the violence is over? The return of abandoned communities is only one of several options. We hence need to understand why people leave their refuges even though it would probably take several years of hardship in order to reach the same level of both private and communal infrastructure in their places of origin. We also need to understand how the experience of forced migration affects people's behaviour. The traditional approach in the literature is to stress unfortunate sides like increased violence, social breakdown, economic hardship, etc. This makes it all the more important to search for positive effects, being it the IDP's increased knowledge of how a modern society works, extended social networks, improved language knowledge and the knitting of a common destiny between the returnees.

The claim of this paper is actually that forced migration experience involves positive income effects. The returnees have become better adapted and more capable to exploit the new possibil-

ities that come with the market integration, i.e. human capital. It is further possible to trace a positive social capital effect since the war experience facilitates cooperation in order to organize the return and reconstruction and apply for government and NGO sponsorship. Barr (2003) finds a similar positive effect in game experiments in resettlement communities in Zimbabwe. The people were more willing to trust others in order to "build the community", i.e. the example of being trustworthy oneself influences others to act in a similar pattern later.

Econometric analysis of the 49 communities in the Tambo district supports the claim of positive human capital and social capital effects. The OLS regression model gives a positive and significant dummy for being a return community compared to a resistant community⁶. Finding total income to be higher when controlling for the most important production inputs in this mainly agricultural economy is a counter intuitive result that contrasts the negative effects often stressed in both the emigration and the conflict literature. Anecdotal evidence from the area further supports both the human capital and social capital interpretation. The return communities have more experience in how the society works and are able "rent-seekers" since they are more experienced in lobbying the larger society for help in their reconstruction effort.

Social capital hence seems to be both a "push" and a "pull" effect. The trust between members of different communities was originally low. So when the resistant communities became a mixture of original community members and people who had fled from several surrounding communities, the level of mistrust increased considerably and collective action efforts broke down. This influenced also the level of trust between the original community members as a subgroup, and this has unfortunately not improved very much after the IDPs returned home. The return communities are on the other hand more homogenous since all share the same displacement experience. The need for common efforts to "community build" is an additional element of trust and cooperation.

The main contribution of this study is to test empirically the effect of a displacement and return experience on income in an environment where emigration and return is probably independent of income since the civil war experience is a natural experiment. The estimated positive effect of being a return community compared to resistant communities further represents a novel finding as most of the literature stresses the drawbacks of war related experiences.

⁶People who stayed in their original communities during the whole conflict define their communities as "resistant" communities. It does not necessarily mean they fought the guerrilla, but rather sought a balance between both sides in the armed conflict in order to stay put. This applied term for the non-displacement communities bears no connotation to resistance to top-down state enforcement as often discussed in the anthropological literature.

2 Economic aspect of return

2.1 IDP policy in general

The first impression of Tambo is a vibrant and living society. You will find people anywhere, even on the most remote mountain slope. The men are strong and well-built from manual labour in the fields, children walk in groups on the paths crossing the steep valleys sides on their way to the school, women herd sheep and goats on the pastures close to the mountain peaks at nearly 5,000 meters above sea level. The joy of finding a living traditional society is mixed with the impression of no economic progress. The scene looks like any rural society in the western world in the 18th century. Today it is hard to find people in such places at all. The previous wheat fields in the hills of New Hampshire are now covered by forests, agricultural machinery sweep the enormous fields in the Mid-West, the heavily subsidized agriculture in Norway is done by single individuals as a part-time profession, while people in isolated areas of Sweden were actually paid by the government to move to urban centers in the 1950's. The picture of Tambo today is simply not the future if the poor countries are to follow in the footsteps of the western world.

Ironically, 10 years ago the situation was completely different and more in line with a modern society. The population was concentrated in the valley bottoms after the exodus from the highland communities. Why did they return to their original communities? Institutional aspects are part of the answer. Foreign donors, NGOs and government tend to see return as the solution to the "problem of displacement", rather than displacement as a "golden opportunity" to speed up the modernization process through centralizing the population. The term Internally Displaced People (IDP) was introduced in Peru as late as the 1990 even though the majority actually left their communities in mid 1980's, with the aim to increase the attention to the refugee problem. The definition of IDP given by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) uses the words "...forced or obliged to flee their home..", so bringing them back home actually reduces the numbers of IDP. Voilà, problem solved! Ironically again, this was achieved using a milder form of pressure in form of economic incentives.

There was a large presence of different NGOs, state agencies and foreign donors doing a number of small and large projects in the district according to García-Godos (2003) who did fieldwork in Tambo in 1999. The governmental organization Program in Support of the Repopulation (PAR), which financed most of the reconstruction process in the area, would at first only give financial and in-kind support to war affected people who returned to their original com-

munities. Neither people who had remained in their communities, nor the IDPs who intended to stay in their host communities, would receive any help. This changed as late as 1997 when the discrimination that caused jealousy and conflicts between the groups became too obvious. But there were still no special initiatives to make life easier for the IDPs wherever they ended up, for example by buying land in the valleys, improving irrigation, constructing houses with a purpose to improve the connection between communities, etc. The aim of the practitioners in the field was quite simple: get the displaced people back to the communities of origin⁷.

This often created a conflict between organizations and the displaced people themselves. A study by Stepputat and Nyberg Sørensen (2001) followed a group of people who fled collectively to the urban slums⁸ of the city Huancayo in Central Peru. They applied but did not receive any help. However, they were offered support if they organized a return to their original community. The organizations in this case indicated (incorrectly) that no help would be given to the returnees if not all chose to return and this way turning group pressure on the individuals. The authors further stress that temporal migration is a part of the Andean culture. It was hence a viable option to let the family stay in town, while the men went back to work in the field in the main agricultural seasons. However, PAR put the return of the whole family as necessary condition to obtain support. The evaluation of PAR in PROMUDEH (2001) also underlines how people tend to "live on two feet", one in the countryside and one in urban areas. During my own fieldwork, I often came across people who had houses in different places. One in the community where the family lived and farmed the land, one in district capital where they send their elder offspring for (not obligatory) secondary education, to sell products in the market and meet friends to drink a bottle of beer in the weekends, and one in the department capital Ayacucho for alternatively higher education and business trips. The houses in urban areas further represent escape possibilities in event that the political violence erupts again.

⁷The present director of PAR (and former director of CEPRODEP, which pioneered the work on IDPs in Peru) Elisabeth Coral confirms return and not centralization in more efficient units to be the main aim in the reconstruction work. Besides the bureaucratic need for "simple solutions" other aspects play an important underlying role. (i) President Fujimori reduced coordination between state agencies in order to obtain direct power, for example by dissolving the Planning Ministry, which earlier had the coordinating responsibility. This made any connection between development in general and reconstruction less obvious. (ii) The Army emptied the countryside in the 1980's in order to remove potential guerrilla support bases. Later they gained control of the peasants who were organized in self-defense groups against SL. Their return would hence reduce the free movement of the guerrilla fighters in the highland. (iii) The return became the symbol of winning the war, the main card in the President election campaign of Fujimori in 1995 and 2000.

⁸"Young villages" is a common term for slums in Peru and it brings a positive connotation of optimism towards the future. With hard work and investments at both individual and community level, the neighborhood will become a lower middleclass area in due time.

It is hence not given that returning to the original communities is the optimal development strategy. Besides the effort by the community members themselves there is considerable public resources put into community infrastructure: schools, medical centers, public houses, churches, roads, water and sanitary systems, etc. Alternatively, this money could have been invested other places and in other projects. Reasoning and simple cost-benefit analysis of the different alternatives of which return is only one of many is conspicuously missing, not only in Peru but also at the international level.

To my knowledge, there is no economic literature on the phenomenon of returning communities after forced migration. There are few examples within other social scientific disciplines even though the refugee problem receives a lot of attention. The related term resettlement is in the literature given a different significance than return. It is used to describe the (forced) movement of people from the place of origin to a new and distant area (from A to B, and not going back to A again which would be the content of the term return). The reason for such movement is either violent conflicts or development projects like building hydroelectric dams. The latter is especially given consideration, probably as academic spin-offs from consultancies that are done in connection to the specific development project.

The resettlement communities in Zimbabwe described in the study of Barr (2003) are anyway close to the return community concept since the movement is a deliberate choice by the individuals. 18 out of 24 small communities in the study were created in the early 1980's on state confiscated land and the inhabitants are a mixture of former employees on the commercial farms and newcomers. The author conducted economic experiments and found that the trusting behaviour in the resettled communities was less responsive to variations in revealed trustworthiness. Her interpretation is that people in this situation are "community building", i.e. they are willing to involve in trust based projects even though they do not expect others to do their share since their intention is to teach their companions to trust others by making a good example themselves.

Hammond (1999) is an anthropological study of Tigrean refugees that underlines the significance of basic economic conditions. Original community members had not only stuck together in the refugee camps of Sudan, but also when they were forced to return to Ethiopia. They willingly accepted to be resettled in sparsely populated lowlands, rather than in their original highland district where the competition for agricultural land was strong. This way they could keep the community as a social and productive unit, while achieving access to more production

inputs. The author's impression was that the Tigrerian refugees were not very attached to the geographical spot of their original community as such, but rather considered the economic and social opportunities of the different alternatives at hand. She also stresses that the refugee experience made people more entrepreneurial as they had to search for new opportunities of survival. Being more open to new solutions, they would rather choose the unknown with a higher expected income potential than the original that would imply a tolerable but more secure income⁹.

2.2 Return and social capital in Tambo

Members of the Maoist communist guerilla Shining Path (SL) bypassed all communities and attacked the police station in the district capital Tambo throwing dynamite and firing automat rifles early in the morning October 11th, 1981. This incursion marked the initiation of the civil war in the district of Tambo, about one year after the first violent SL attack in Peru. Two policemen and one peasant that happened to be in the police station were dead when the guerilla members left some hours later, the first of 498 war related deaths in the district estimated by CVR (2003)¹⁰. All 15,000 inhabitants of today were affected by the conflict one way or another. Houses were burned down, animals slaughtered, people forced to abandon their house, land was lost, etc. The idyllic highland area with 49 communities spread over a highland area of 335 km^2 - from the fertile valley bottoms at about 2,800 meter above sea levels to the naked pastures reaching the often snow-covered peaks at about 4,500 - was the very heartland of the conflict that lasted for nearly two decades in Peru. People still have problems freeing themselves from the grip of fear¹¹.

⁹Hammond (1999) however emphasizes how the refugees tended to look at the insecurity in the settlement process as a negative stress factor rather than a positive experience of creating a new society. She describes how people longed for fixed norms and rules that would make human behavior more predictable. This further supports that the return in my sample of communities in the Andes might have been driven by the same longing for known rules as perceived to have functioned in the past in their original communities.

¹⁰The appointment of the Truth and Reconciliation Commission (CVR) was one of the first initiative of the post-Fujimori government. It carried out a large-scale interview program in war-affected areas and concluded that about 70,000 people were killed in war related actions (with the guerilla as the major culprit). This number is well above the 28,000 that had been the official figure until then. In the district of Tambo Antesana and García-Godos (1999) cooperated with the local Committee of Self-Defense (CAD) to make a similar registration four years earlier. Their result of 349 deaths and 65 disabled is in line with the CVR investigation since they did not include deaths caused by the Army because their motive was to apply for governmental compensations for guerilla harassment.

¹¹Technically, the conflict is still going on, as a few hundred guerillas are still active in some remote jungle areas. The capture of the main guerilla leader Abimaél Guzman in 1992 was an important turnaround, but the guerilla war still affected Tambo for several years to come. As late as 1996 confrontations with SL groups lead to casualties and death of local peasants, and other sporadic episodes kept the population alert. The state of emergency was first lifted in 2000 and the military replaced by police (although special war-fare units) in the local garrison in 2003. The same year, a SL group made a spectacular attack on a construction site of the national

The saying "History is written by the victors" is probably a valid description of the post-war discussions in Peru. The successful quelling of the guerrilla uprising was the main trump card in the elections of 1995 and 2000 for president Fujimori. Shining Path is considered to have been exceptionally cruel, only comparable with the Khmer Rouge in Cambodia, even by traditionally left-wing revolutionary romantics in other parts of the world. The army on the other hand hit extremely hard during the first years of insurrection. Drafted soldiers from other parts of country - who often did not speak the Indian language Quechua nor understood the local costumes - were allowed to kill indiscriminately and punish whole communities collectively. The CVR (2003) indicates that both factions were about equally violent and cruel. However, the question of "guilt" is not relevant for the analysis in this paper. It is sufficient to note that the lawlessness and reign of terror in the area probably implied that there was only one possible strategy in order to survive: to play both sides at the same time in order to fall down on the victorious side in the end¹². This fundamental insecurity breeds mistrust, as people could not be sure of their fellow community members anymore. Even family members could be informants for one of the sides. This was the reality in all parts of the district¹³.

However, there is one major difference between the 49 communities that were part of the questionnaire survey conducted by the author in spring of 2002. Two thirds are return communities, i.e. abandoned completely during the war and where the population has returned afterwards, and one third are defined as resistant communities, i.e. its population has lived there throughout the conflict. Anecdotal evidence from Tambo and analysis by other social scientists in Peru indicate a fundamental difference in the process of both the breakdown and then the reconstruction of social capital for the two types of communities. People in the return communities tend to be more closely knit than the inhabitants in the resistant communities. This facilitates cooperation in various ways. People in return communities have a stronger sense of sharing the same destiny for better and worse. Highland communities were often the first

gas pipeline taking nearly 100 hostages in a neighboring district. The guerilla fighters were said to have passed undetected through Tambo and to have been given shelter for the night in one of the communities.

¹²There are accounts of several important CAD members who actually started out fighting for the Shining Path. Pretending to be neutral is nearly impossible during civil war. Loughna (1998) describes how a rural community in Colombia that officially announced neutrality in the ongoing conflict between the army, the left guerrillas and the right wing paramilitary forces ended up being badly treated by all sides. 37 community members were killed within three months. In Tambo were all defense groups inactive in 1989-1991 and the whole area declared a "red zone". Then CAD representative from neighboring districts infiltrated secretly to reorganize the groups again, see Fumerton (2002).

¹³As late as 1989-1991 all defense groups were inactive and the whole area declared a "red zone". Then secrete infiltration by CAD representative from neighboring districts were able to reorganize the groups again, see Fumerton (2002).

to be abandoned. This could happen because the peasants found the situation too insecure. More often they were forced to leave by the army who wanted to concentrate the population in places that were easier to control. This "scorched earth tactic" would leave no houses intact. The displaced were met by a deep mistrust by the residents in the resistant communities that were normally in the more fertile valley bottoms. Not only did they carry with them original prejudices against the more traditional highland peasants, but also considered them to be the root cause of the ongoing violence. IDP's were either suspected to be members of the SL, or at least to have sympathized with them earlier on. They were often isolated in their communities of refuge, had no land, little resources and were hence open for exploitation by the original residents. "We had access to an enormous amount of cheap workers in those days, and we made a lot of money by starting the more labour intensive onion production" as an original member of a resistant community told me. Incursions by SL, killing people or forcefully recruiting teenagers, could lead to serious conflicts between the groups after the guerilla fighters had left the scene.

The traditional system of communal work disintegrated under these conditions of mistrust. Working together with suspected SL sympathizers, for example by repairing irrigation systems or maintaining schools, would create suspicion and could hence be dangerous. Keeping to oneself was one way of minimizing the risk since the notion of collective guilt was strong especially in the earlier days of the conflict. Monje (2000) describes how on third of the population in a community suspected to be a SL stronghold in Tambo was killed indiscriminately - men, women and children alike - by the military in helicopters from the air. The survivors fled to the nearest community, but experienced complete isolation as the original inhabitants did not want to be associated with them in fear of being assaulted in a similar indiscriminately manner as well. Cooperation and common work in larger groups hence became the exception rather than the rule as it had been in the past.

The main wave of return took place in the mid 1990's, even though SL incursions still occurred sporadically. It would have been possible for the returnees to live in the resistant communities and keep on farming their original land by walking to the field for the day or staying overnight in improvised houses during the most intensive periods if they chose, since the maximum walking distance is about two hours¹⁴. The isolation and bad treatment of the IDPs constituted a strong

¹⁴Anthropologists often claims that the family members are spread on the different plots in order to protect the crop from theft in the Andes region. I seldom experienced such need for protection in this district, probably due low tension between communities today and all belong to the same ethnic group. Furthermore, such strategies do not actually prevent the choice of permanent housing in the valley bottom, the effect is rather the contrary.

"push" SC factor explaining their eagerness to break up from their "new" communities. This experience had further knitted people of the same origin together and this hence constitutes a strong "pull" SC factor. The combined effect was to make it easier to cooperate in order to improve their livelihood returning home rather than staying put. The very process of organizing the return further knitted people together since this was seldom an individual decision. People who had emigrated to the most distant places in the jungle or the cities were contacted through informal networks as radio and newspapers, and many then joined the movement. The resistant communities had little access governmental funds even though they too had more or less to start all over again, and they had hence less motivations to coordinate their actions¹⁵.

There were also considerable numbers of people who had fled from the resistant communities during the conflict, but their return had a fundamentally different impact than in the return communities. These IDP had come home mainly from urban areas where they had become more educated and obtained more contacts. The people who had stayed resented giving up privileges - land and power - to people who "cowardly" had escaped not fighting for their rights as they had done, see Fumerton (2002) and Monje (2000) who made anthropological studies in some communities in Tambo. The process of integrating returnees from distant places ended in conflicts in the resistant communities, while knitted people together in the return communities. This creates a fundamental difference in how their social and economic activities are handled in their daily lives.

Other aspects are knowledge and external networks. Most people in the abandoned communities just moved down to the resistant communities, but a lot also went further to the jungle, to the district capital, department capital and Lima itself. More people living in the return communities hence have a history in distant places. These people have better knowledge of Spanish and have learned how the markets work. Furthermore, they have more contacts in the cities that might inform them market developments, prices, opportunities to obtain assistance from governmental and NGO sources and represent them in long distance trading operations, etc. The external networks of the community as such are simply larger. Furthermore, the attained knowledge and improved understanding of how a modern society works by the returnees from distant places is also more important. They constitute a larger share of the population and are more respected due to less power contests between groups within the community as discussed

¹⁵PAR changed strategy when this unfair treatment of different groups of war victims became too obvious and started to hand out food supplies, building materials, etc. to all communities that applied for it.

above. This should hence give more spillover effect by the returnees from distant places in the return compared to the resistant communities.

3 Empirical analysis in Tambo

3.1 Effects on income

Only the district capital were excluded when I made the questionnaire survey in the 49 communities of Tambo¹⁶. One or more authorities, either president and/or members of the community council, CAD, irrigation committee etc. was interviewed with a standard questionnaire about income potential, resources, institutions and cooperation within the community. The use of representatives made it possible for me to visit all 49 communities and make the interviews myself (just supported by a local research assistant in the few cases when translation from Quechua were needed). This statistical collection method makes the data more coherent and thus easier to discover inconsistencies by the respondents. Household information is further not necessary when the aim is to study how the community functions as a unit¹⁷. All figures in this analysis are hence average numbers per person living in the community.

Agriculture is the main economic activity in this highland region. Of total income for the whole estimated rural population (13,500 inhabitants) 48 percent is due to land cultivation, 36 percent animal herding, 7 percent other sales (often processed agricultural products) and 7 percent paid labour income outside the community. Paid labour constitutes a surprisingly low share of total income, as commuting to the jungle (cash crops, mainly coca) and urban areas (construction) is thought to constitute a pillar in their cash-economy¹⁸. Sales of agricultural products in fact seem to be more import for their integration to the market economy since on average nearly half of the crop was actually sold. The rather high level of market integration, between 25 percent and 87 percent sold of total agricultural production value, is surprising as the farmers on average only have 0.5 hectare of good land equivalents per person available. This

¹⁶In follow-up fieldwork, spring 2004, there were about 8 more on the official list of communities made by the Municipal authorities. Some were genuine returns, while others were probably a formal split between sectors of a given community as for example illustrated in ACRAVIMP (2003). This was done to appear as a union of communities rather than a single community, since the government and NGOs have in the latter years become more willing to support a group of communities rather than a single community (even if it is larger).

¹⁷Household surveys might actually give rise to serious multicollinearity problems if social capital is actually a characteristic of the society rather than the individual.

¹⁸One explanation is the minimal amount of wage labour within the communities. Work exchange is supposed to take place through often traditional and often complex transactions not applying money as the mean of exchange, see discussion of work exchange in the companion paper Wiig (2005).

indicates that pure subsistence farming is something of the past as the peasants have become more integrated to the markets¹⁹.

Due to the overwhelming importance of the three agricultural related sectors, it is reasonable to use the normal production inputs for agriculture as explanatory variables in a regression model explaining total income. The results from a standard OLS regression that explains total income and its components is hence as follows in table (1) below:

Variables	Ln(*-income)		Total		Agri		Animal		Other sales		Work	
	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.
Constant	6.10***	0.42	4.99***	0.70	5.09***	0.44	4.34***	1.19	2.64*	1.39		
ln(Land)	0.22***	0.07	0.16	0.12	0.20**	0.07	0.03	0.19	0.21	0.17		
ln(Water+0.5)	0.92*	0.51	1.51*	0.84	0.76	0.53	2.87**	1.21	-1.57	1.86		
ln(Ecology)	0.37	0.29	0.70	0.48	0.02	0.31	-0.16	0.87	0.01	0.67		
Road	0.34*	0.18	0.72**	0.30	0.10	0.19	0.71	0.55	0.41	0.38		
Return	0.35*	0.21	0.41	0.34	0.63***	0.22	0.62	0.65	-0.09	0.46		
<i>N</i>	49		49		49		49		49		49	
<i>R</i> ²	40%		29%		43%		26%		12%			
<i>Adj R</i> ²	33%		21%		36%		12%		-6%			

Table (1): Results of a OLS regression on log-linear models. The logarithmic transformation of the *Total income* and the four subcategories *Agri*, *Animal*, *Other sales* and *Wage* income per person is explained by the logarithmic transformation of *Land*, *Water* and *Ecology* where the latter is an indicator of soil fertility. *Road* is a dummy for road connection, while *Return* is a dummy variable equal to unity if it is a return and not resistant community (see variable description in table A.1 in the appendix). *** indicate significant at 1 percent level, ** at 5 percent level and * at 10 percent level. *St.d.* is the stand deviation of the estimated coefficient.

Each model has a separate type of income. *Income*; average total income per person which is calculated by dividing the calculated total income for the community by the number of inhabitants (all average figures are calculated the same way). It is an aggregation of the following different sources of income. *Agri income* is the cultivation of crops for both sales and home validated at farm gate prices. *Animal income* is animal husbandry. *Other-sales* is the production of goods for sales (mainly processing of farm products like cheese and freeze dried potatoes and some handicrafts). *Wage income* is wage labour outside the community, which normally implies outside the district of Tambo (as discussed above).

¹⁹Sales varies a lot depending on the harvest. A good harvest in 2002 made people sell a lot to the market (and similarly low prices), while there were for example hardly any potatoes to be bought in spring 2004 due to a disastrous harvest. The farmers sold minimal even though the prices increased more than five times.

The model is log-linear due to an assumed homogeneity of degree one in the main production inputs. *Land*; denominated in units of cultivated land equivalents per person. The shares of productive lands are supposed to be different in the three types of land (valley bottoms, valley slopes and highlands). *Water*; the calculated amount of irrigation water available per person. About one third of the communities do not have any irrigation system at all. A constant is hence added to the variable in order to make a log-linear transformation and this transformation implies that the model differs slightly from the homogeneity assumption. *Ecology*; indicator of soil fertility calculated on the weighted average of crop lands in valley bottoms, i.e. lowlands are supposed to be more fertile than highlands.

There are no figures of labour and capital in the data set due to problems in collecting reliable information on these inputs. However, this omitted variable bias is probably of minor importance. People tend to work all day anyway (with different productivity) and farmers who are rather poor in this district only use traditional tools like the hand plow (Chaquitaclla). There are more draught oxen in the valley bottoms and this bias implies that the estimated effect of *Return* is actually lower than it should have been. A more extensive discussion of the omitted variable problems in this data set is given in Wiig (2005).

The productivity of the basic production inputs will however depend on several aspects of human capital, social capital and public infrastructure. These are added as scale variables in the income function that is log-linear in the main production inputs. *Road*; a positive dummy for community that is connected with roads in contrast to footpaths and animal tracks. The road connection does not only imply cheaper transport of products to and from the community, but also easier access to information. *Return* is defined above.

The results of the OLS model estimating total income is given in the first column in Table (1). All coefficients have the expected sign and *Land*, *Road* and *Return* are significant at better than 10 percent level. The results are considered to be reasonably close to the expectations as the degrees of freedom is rather small in this sample of 49 communities. The coefficients then represent elasticities in this log-linear model. The sum of the coefficients for the basic inputs is 1.5. The literal interpretation of increasing return to scale is not realistic, but the sum is not very far apart from the more reasonable assumption of homogeneity of degree one. The relative size between coefficients is however realistic with the major emphasis on irrigation water, which constitutes an important production input in this rather dry district. The coefficient value for *Return* is surprisingly high. It implies that people in a return community earn 35 percent more

than people in a resistant community given the same amount of basic production inputs.

The econometric models do not distinguish between the social capital and human capital effects of *Return*, and there are no variables in the data set that might reveal their relative importance. However, it is possible to run the regression model on the separate income components. The results reveal that it is especially income from animal herding (*Animal income*) that is higher in the return communities (see table 1). The natural conditions for animal husbandry are probably better in the return communities since most are in the highlands where the pastures are better and more plentiful. However, the pasture area is already controlled for with the inclusion of the variable *Land*. The effect should hence be due to something else, e.g. social capital and human capital. The estimated coefficient for *Return* has a positive sign for the other agricultural related income components *Agri income* and *Other sales* but the significance is rather low. It is hardly possible to trace any difference between the two types of communities for migrant labour income (*Wage income*). This implies that migrant work income is equally important in all communities. On the other hand the rather low average share of monetary income from wage labour of 7 percent (see table A.2) indicates that off-farm work is less important than what is commonly assumed in the literature on Andean peasants. The different income sources are expected to be negatively correlated due to a substitution effect. If natural conditions for farming are missing, people will tend to put their efforts on animal herding instead, try to make a living producing handicrafts or use their labour as migrant workers.

It might further be argued within the Malthusian tradition that population size depends endogenously on productive resources like land, water, etc. The family will multiply until the carrying capacity is reached and then some will be forced to leave. In this case the intended analysis would be less interesting as the average income per person would be just above the survival level in the long run in all communities. The large spread in income in this data set indicates the opposite. Modern migration theory finds migration to depend positively on income. The extended family invests by sending some of their members to the cities in order to diversify income. Migration will then deepen the difference between poor and the not so poor, since the Malthusian argument is valid for the former and there will be more production resources in the latter. Since my econometric analysis controls for production inputs will this argument not matter much in one or the other direction. Other sources of bias in the estimated coefficient for *Return* are more important. I will in the following argue that they probably do not represent a serious problem in this data set.

The first objection is a simultaneity problem between income and being a return community in the decision of abandoning the community in the first place. Since a left wing guerrilla nearly by definition would harass "rich" communities more than poor and more often force them to leave, it becomes natural to assume return communities to have higher income potential. Even though rich individuals fled more easily, the same does not apply at the community level. The communities were most often abandoned voluntarily and collectively due to the general insecurity created by incursions of both the Army and SL. Compulsive abandonment was actually most often induced by the army. Their "scorched earth tactic" was applied in the certain geographical areas they found especially important to prevent guerrilla support.

The second objection is a similar simultaneity in the selection of communities choosing to return. Refugees are often assumed to go back if the economic basis is sound, but stay if they do not expect a better living back home. The three main reasons why this potential positive simultaneity is not a problem are as follows: (i) Nearly all communities are actually resettled. The 49 communities included in my sample constitute nearly all the communities included in list of pre-war existent communities given in Vílchez Amésquita (1961). (ii) People from the few communities that are not resettled are incorporated in other communities, both resistant and return communities. This "merger" hence implies that most land is utilized and that the population (as well as land) has increased in some communities. (iii) Most return communities are anyhow situated in less favorable ecological zones than the resistant communities. The regression model further controls for production inputs and market connection. There is no reason to believe that income should be higher in the return communities than in the resistant communities, even though it should be higher than in the few communities that are not resettled at all.

The third objection is that people who return represent the more workable share of the population. Since labour is not included in the regression model, a positive correlation between the latent variable and *Return* will give a positive estimation bias for the coefficient of the latter. This might have been true very early in the return process as the men started the reconstruction process by building provisional housing. Woman, children and elderly soon followed. Their return was actually a prerequisite to obtain further governmental and NGO assistance in the reconstruction process according to Stepputat and Nyberg Sørensen (2001) and my own personal interviews with PAR representatives. Still, war widows and disabled have probably been less able to return and have chosen to carve out a living in the resistant communities or more distant places. However, a negative selection mechanism is also present. The most able did probably

prefer to stay on wherever they settled down. Anecdotal evidence shows that most returnees did not acquire major production assets neither in the resistant communities, the jungle nor the cities.

The fourth objection is a potential difference in soil productivity since the land was supposedly laid idle during the war. This latent variable problem implies a positive estimation bias in the *Return* coefficient. However, many people seeking refuge in the resistant communities kept on farming the land in their original communities. Many were willing to walk for hours in order to reach the plot and then work during the day until returning in the evening. This way it was possible to escape if either the Army or SL appeared. The animal herds were on the other hand decimated as the warring factions slaughtered animals to feed themselves. Furthermore, there were many accusations of plain theft by SL, the Army and peasants both from neighboring communities as well as fellow community members, in order to sell the animals to the market in this age of lawlessness. The peasants were further forced to take the animals home for the night and this way prevented them from using the more distant pastures. But the fallow effect is probably less important since the pastures even close to the resistant communities are not severely degraded by overgrazing anyway. Differences in governmental financial support would also bias the result if the money were used to purchase production inputs not included in the econometric model. However, the return communities needed to spend more money in the reconstruction and the total effects should hence be less use of such production inputs like fertilizers.

There is hence no reason to suspect any estimation bias in the simple log-linear regression models given in table 1 above. The models could be expanded by other variables that might affect income - for example work exchange and other social capital effects as shown in Wiig (2005) - but this approach will lead to a unnecessary reduction in degrees of freedom in this small sample data set.

3.2 Effects on cooperation

The discussion above emphasizes social capital and human capital as the link between *Return* and the different sources of income. There are unfortunately no indicators of human capital in the data set. On the other hand, community institutions and traditional cooperation constituted the core of the questionnaire survey. The results from separate regression models explaining cooperation indicators and simple correlations with *Return* are given in the table 2 below.

Cooperation	Work exchange		Assembly		Infrastruct		Voluntary		Water	
Variables	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.	Coef.	St.d.
Constant	262***	56	1.07	0.15	25*	13	0.26	0.18	-0.09	0.13
Ecology	-67***	19	-0.03	0.05					0.04	0.05
Ass-sanc	12	25	-0.11	0.07	11	8				
Inequality	-44	58	-0.02	0.15	-2	18	-0.63*	0.33	0.17	0.16
Road	2	23		0.06	-10	7	0.23*	0.13	-0.05	0.06
Organization	-38*	22	-0.07	0.06	-16**	7	0.24*	0.12	-0.01	0.07
Return	-39	25	-0.05	0.15	10	7	-0.13	0.13	0.07	0.06
Irr-sanc									0.07	0.08
<i>N</i>	49		49		49		49		33	
R^2	35%		10%		28%		21%		19%	
<i>Adjusted R</i> ²	26%		0%		20%		14%		0%	
Corr(Return,*)	-0.04		0.00		0.30		-0.30		0.24	

Table 2: Indicators of traditional cooperation in OLS regression models (see variable definitions in table A.1). The given results are the coefficient value and the significance of their t-value as the probability of wrongly rejecting the zero-hypothesis that the coefficient value is zero. *N* is number of observations, R^2 and *Adjusted R*² are measures of the models explanatory power, while Corr(Return,*) is the simple correlation between Return and the different traditional cooperation indicators. *** indicate significant at 1 percent level, ** at 5 percent level and * at 10 percent level. *St.d.* is the stand deviation of the estimated coefficient.

Return communities hardly cooperate more than the resistant communities when I control for characteristics that are common in the literature to explain traditional cooperation, such as ability to sanction, inequality, market connection, institutional organization and natural conditions. The dummy coefficient for return is actually significantly negative in the regression model explaining reciprocal work exchange (*Work exchange*) between individual community members. This might actually have a positive income effect, as the cooperation level is often higher than what is economically optimal. The regression analysis in the companion paper Wiig (2005) gives a hump-shaped effect of work exchange on income and the marginal effect is negative for 40 percent of the communities. The effect is significantly positive on a 10 percent level for the days of participation in public works (*Infrastruct*) like construction of roads, schools, public houses, etc.

Both the coefficient for assembly turn-up (*Assembly*) and irrigation system (*Water*), the latter which is supposed to have a direct effect on income, are on the other hand insignificant. Assembly turn-up is often used in the literature as an indicator of social capital, but the estimated

effect is insignificant in this data set. It turns out that it is probably not a good social capital indicator in Tambo. One reason might be that absence due to work outside the community is accepted as long as the individual pays a working day's wage in fine. This implies that more economic activity actually reduces the assembly turn-up rate and hence constitutes a simultaneity problem to be solved in the econometric analysis. Irrigation water is an important input factor as shown in table 1 which is set by natural conditions and the quality itself. Only land inequality has a significant impact on this variable and *Return* has no real impact.

The significant effect of return on total income hence does not seem to be channeled through the variables of traditional cooperation included in the questionnaire. However, other social capital aspects that unfortunately were not included in the survey might matter more. Peasants in the Tambo communities are very poor and exposed to rather large income swings due to changing natural conditions. Even though they are living in the same community, the idiosyncratic individual element is quite large due to different plots, plants and access to production inputs like irrigation water, etc. The closer to the survival line, the more important are insurance arrangements between the individuals²⁰. Such arrangements are in the social capital literature often supposed to emerge endogenously. Lending and monetary support is also more common when social capital is high. A more efficient use of this "resource", for example through the purchase of commercial fertilizers to be applied on the plots where it yields the most, will hence entail higher average income. Rent seeking and lobbying for support from government and NGOs was important during the reconstruction period. The very process of organizing a collective return gave a better insight to how these help organizations work and how to lobby for their support, for example by collecting contributions for the costs of sending a representative to influence the decision makers in governmental and NGO offices in town.

These indirect social capital effects are in some cases difficult to distinguish from human capital. It seems reasonable to assume the return communities have a relatively larger share of the population living outside the community. The correlation between the number of people who have left to a distant place like the jungle or the cities and stayed is high. There is both a social capital and human capital side to this. Contacts outside the community are important to get information and this hence increases knowledge and represents networks to do things on the community members' behalf, either as counterparts in long distance trade arrangements or as

²⁰ People who have had their crops destroyed, for example by local frosts, can often take part in the harvest of others and get a disproportionate large share of the products, compared to the work contribution, according to Blum (1995).

a business exchange in itself. Monetary remittances are often thought of as gifts. They might actually be considered as parts of exchange operations, for example a monetary contribution as brothers and sisters take the daily responsibility of the family's elders. Or they function as a part of a common agricultural production operation, where they put in the money of the purchased inputs and then took care of the marketing later. A separate regression model using general emigration and not return gives some evidence of this effect, see table A.3 in the appendix. The coefficient for *Emigration* (the number of community members who have emigrated to distant places and not returned compared to the population today) is positive for both agricultural income and total income, but only the former is significant at more than 10 percent.

An interlinkage variable between *Emigration* and the dummy for private land ownership in the community denominated *Emig-Org* is negative in both regression models, see table A.3 in the appendix. However, only the effect on agricultural income is significant at an acceptable level. This result indicates that communities with common property rights to land, i.e. Legally Registered Peasant Communities, benefit more from their emigrants than people in communities with private property rights to land. The bonds to the emigrants are for some reason tighter. At the surface both systems are similar. Even with private property to land, the individual will still depend on the acceptance of the community at large since coercive means by the state are missing. Each plot is individually controlled under common property rights to land to such degree that it is even passed on within the family in bequest.

However, anecdotal evidence indicates that the two legal property systems influence the contact with emigrants differently. (i) The community with common property rights to land is obliged to give returning emigrants a possibility to support themselves, for example a piece of land. The emigrants are hence more willing to support their community fellows as an insurance mechanism in case they have to return at a later stage. (ii) An advanced land entitlement program financed by the Inter-American Development Bank (IDB) has just started. Anyone who can prove they have farmed a plot of land for more than five years is given the land title. Emigrants, who either lent their plots to family, or rented it to neighbors, might suddenly discover that someone else claims their property and thereby might actually end up losing it. Heavy quarrels and broken ties with family and fellows in their original community have often been the result. No such entitlement program has taken place in the Legally Registered Peasant Communities since land is already entitled to the whole community as a legal subject. There is hence no increase in conflicts between emigrants and inhabitants of their old communities due to external interference in matters of the community. Mutual help relationships are thus lest

likely to be broken.

4 Conclusions

Civil war and armed conflicts still ravage many regions in the developing world. People living in the countryside are especially exposed and seek refuge in more central areas. This could actually speed up the process of development as people are concentrated to a smaller area, something that is thought to be consistent with a modern society based on free market economy. When sunk cost of breaking up from the old traditional life is paid, a new life is possible. It is hence puzzling to find people actually going back to the most remote areas when peace returns. From the development perspective it is a "golden opportunity" to speed up the modernization process lost. On the contrary, the process is probably further delayed compared to a normal evolution since people tend to invest more in the reconstruction of their communities than they would have done under normal circumstances. Without conditions for a livelihood present, they will sooner or later end up leaving the communities individually. However, rather than moving to the neighboring communities they will then go to the big cities where overpopulation is a real problem.

The major contribution of the econometric analysis in this article is to show that the choice of return probably depends on something else than the access to basic production inputs like land, water, etc. The significant positive coefficient for the dummy representing return communities compared to resistant communities shows they are actually able to earn more with a given amount of resources. Furthermore, this econometric result is probably not contaminated by the self-selection bias that normally appears in migration studies. The displacement in the Peruvian highlands represents a "natural experiment", as the decision of both fleeing and afterward returning is probably exogenous and independent of the income level. Harassment by the guerrilla movement Sendero Luminoso (SL) and the Army took place independent of income level in the community, and nearly all abandoned communities have later been populated with returnees.

However, we should not necessarily interpret this result as evidence that it is good to send people back to their places of origin. The main problem of the centralization during the war was that different communities were forced to live too close to each other. The result was a deep mistrust between them and the inability to cooperate representing a "push-SC" factor making people return to their original communities even though it was possible to actually farm their old

land from their new residences. The "pull-SC" factor was the expected population homogeneity in return communities. A contrary process took place in the resistant communities leading to less trust. The return of IDPs from distant places did in contrast then create conflicts in the resistant communities since their war experience was so different from the people who had stayed behind.

This experience illustrates the importance of segregating the population into sub-groups of people who trust each other and are able to cooperate. The resulting positive social capital and human capital effects could have been achieved in a more efficient way than encouraging people to go back to their original communities. The geographical site itself can be compared to a "meeting point" sign. People returned because they knew they will find fellow community members to trust in this place. An intervening government could try to create this "meeting point" effect in a place that is more in line with economic development, for example by constructing roads only to given places, purchasing land and construct irrigation channels in the right spots instead of supporting return by paying for building materials. Then, soft persuasion might convince the community to resettle not too far from the other communities²¹. This way they would be segregated enough to achieve cooperation, but still enjoy the economies of scale for example by a sharing larger and better functioning schools with the others communities. New generations would then probably learn to trust people from other communities too in due time.

²¹Heavy-handed top-down planning experiments, for example the creating of the Ujamaa villages of Tanzania, have discredited governmental intervention and social engineering in rural areas. It is hence important to remember there are different degrees of interventions. Even if people are free to move where they want, the construction of infrastructure will actually influence their choices. Communication between the government and the people, even when they are left with no actual choice and the meetings only serves as "window dressing", might facilitate the process and reduce the degree of resistance to such changes in the population. The reconstruction of the northern part of Norway where everything was burned down during the last phase of the World War II is an illustrative example of how enforced changes might backfire. The government at first meant to centralize this population of fishermen in just a few large cities and then introduce large trawlers as the main fishing technology. This proposition only fueled the locals' determination to rebuild their houses on the tofts of the old ones, just as scattered as before. When economic realities hit a few years later, many people emigrated from their new built houses according to Brox (2005).

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5 Appendix

5.1 Variable definitions

Variable	Definition
Total Income	Income from all sources, #soles/year/person
Agriculture	Income from agriculture crop production, #soles/year/person
Animals	Income from animal husbandry, #soles/year/person
Other sales	Income from sales of products, #soles/year/person
Wage	Income from wage labour outside community, #soles/year/person
Households	Households in the community, #households
Population	Persons including children in the community, #individuals
Work exchange	Reciprocal work arrangements per male adult, # days/year
Assembly	Household turn up at community assembly, %
Infrastruct	Work on public infrastructure, #days/adult/10 years
Voluntary	Existence of music or dance group, dummy
Road	Community with road connection, dummy
Ecology	Weighed share of land in valley bottoms, indicator between 1 and 3
Land	Estimated sum of valley bottom crop land equivalents, #hectares
Water	Water, amount needed to irrigate well # hectares of land
Return	Communities first abandoned and then repopulated, dummy
Emigration	Number of emigrated people compared to population today, share
Organization	Registered peasant com. with common land property rights, dummy
Ass-sanc	Communities fining households not present at assemblies, dummy
Inequality	Land inequality in community measured with gini coefficient, %
Irr-sanc	Communities fining households not participating in irrigation work, dummy

Table A.1: Variable definitions

5.2 Variable summary

Variable	Mean	St. dev.	Min	Max
Total Income	436	279	41	1468
Agriculture	210	206	7	955
Animals	161	124	0	719
Other sales	32	60	0	366
Wage labour	32	48	0	259
Households	60	37	12	180
Population	277	224	50	1200
Work exchange	90	79	0	300
Assembly	0.83	0.18	0.2	1
Infrastruct	25	23	0	75
Voluntary	0.22	0.42	0	1
Road	0.48	0.50	0	1
Ecology	1.74	0.57	1	3
Land	0.52	0.62	0.01	2.67
Water	0.11	0.15	0	0.76
Return	0.63	0.48	0	1
Emigration	0.28	0.39	0	2
Organization	0.63	0.48	0	1
Ass-sanc	0.79	0.42	0	1
Inequality	0.35	0.18	0.03	0.67
Irr-sanc	0.84	0.36	0	1

Table A.2: Summarizing information on main variable values. Data set consists of 49 communities in Tambo with the exception of *Water* and *Irr-sanc* where the number of observation is 33.

5.3 OLS with Emigration

Variables	ln(Income)		ln(Agri-income)	
	Coef.	St.d.	Coef.	St.d.
Constant	6.52***	0.36	5.44	0.57
ln(Land)	0.24***	0.08	0.11	0.12
ln(Water+0.5)	1.00*	0.54	1.94**	0.85
ln(Ecology)	0.18	0.28	0.46	0.45
Road	0.22	0.17	0.65**	0.27
Emigration	0.26	0.28	0.97**	0.44
Emig-Org	-0.34	0.34	-0.76	0.54
<i>N</i>	49		49	
<i>R</i> ²	37%		34%	
<i>Adjusted R</i> ²	29%		25%	

Table A.3: OLS regression models on *Income* and *Agri* (see definition of variables in table 1), where *Return* is exchanged for emigration related variables, i.e. *Emigration* is the number of community members who have emigrated to distant places and not returned compared to the population today and *Emig-Org* is the interlinkage variable between *Emigration* and a positive dummy for private land ownership in the community.

Catching up in distant trade - The effects of trust and telephone for Peruvian peasants

By Henrik Wiig

Abstract: Liberalized agricultural markets and more roads in remote areas of the developing world have led to a transition from self-subsistence agriculture to specialization and trade. However, seemingly similar peasants often choose different marketing strategies. This puzzle is investigated by using a panel household level survey of small-scale potato farmers in combination with a community level survey on social capital conducted by the author in a Peruvian highland district. Access to public telephone service seems to facilitate sales in distant markets, while households in communities with high internal trust levels are more disposed to sell in markets close by. However, both effects have become weaker over time, while total production volume has become more important. This indicates that fundamental production conditions matter more as markets mature and that peasants will learn how to surpass initial information and cultural drawbacks.

Code-words: Social capital, Information, Transaction costs, Market integration, Potato trade, Peru

JEL-code: C21, D7, O15, Z13

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1 Introduction

There is a common view that peasant-trader relationship in developing countries is based on exploitation. Urban intermediaries arrive in the fields, pay miserably in order to enrich themselves and then leave the farmers behind hungry. This simple stereotype is complicated by the fact that peasants often have different options, e.g. trading or relying on self-subsistence production. Furthermore, peasants from the same geographical area, who are seemingly of equal background, often choose rather different marketing strategies. Some sell their products to traders who appear in the field, and some bring their products to the local market, while others prefer distant markets and might even end up in the capital itself. This paper investigates the choice of trading options empirically in a rural district of Peru.

The argument is that the price is higher in more central areas, and the peasants will hence earn more by bringing their products themselves. This view conceals travel and marketing cost and ignores the risks involved in trading in distant markets. State agencies, local and international non-governmental organizations (NGO) and development agencies intervene in the market-based solutions with good intentions of "helping" the peasants; examples, unfortunately mostly unsuccessful ones, are easy to find in Peru where the empirical data for this article was collected. FONCODES (2002)¹ describes a project of coordinating potato sales for peasants in the highland district of Tambo. The participating peasants were told to plant a given area with potatoes. Then they were supposed to harvest at a given time and a truck were supposed to collect sacks of potatoes in order to bring the product to Lima for sale. In the end, people harvested at separate days, the truck did not show up as agreed, each peasant mixed products of good and bad quality. This led the intended industrial purchaser to refuse to accept the goods and the representatives wasted by gas driving around for several days trying to find a buyer, in the end achieving only the minimum price at the major spot market in Lima. The peasants involved later told me they had lost faith in market cooperation of any sorts, and would only trust themselves from now on. This illustrates how the failures of initiatives from above might choke peasant initiatives of collective action to achieve economies of scale in marketing and sales².

¹The Fund for National Compensation and Social Development (FONCODES) is the main rural government development agency. The motive behind the project is stated in the given report: "The common problem in these communities is the presence of the intermediaries, who limit the marginal utility of the peasants using their well known methodology". No further description of a "well known methodology" is given.

²I conducted a questionnaire survey in this district, which consists of 49 traditional communities where people sell a surprisingly high share of their production. The results given in Wiig (2005b) show high levels of trust and

What will happen if the peasants are left for themselves without well-intentioned interventions? The possibility of actually bringing the products themselves to the large markets in regional centers and the capital, hereafter denoted distant markets, is of rather recent date. We hence expect that the peasants are still in the middle of a learning process. The first peasants who first started selling to distant markets might have done so out of pure coincidence, e.g. they happened to know someone in the regional center or they live in a community that is more outward oriented for some historical reason. Such "coincidental" circumstances might be decisive for the choice of market in the beginning. Meanwhile, we would expect that fundamental economic conditions will determine the individual choices by each peasant in the longer run as markets mature and the knowledge of how it works becomes common knowledge.

The empirical analysis in this paper indicates a considerable change in marketing behaviour over a four-year period in the Peruvian highland district of Pazos³. The data set contains information on household sales volumes and the price the peasants received for their product in different places: in the field, in the local, district and regional markets, as well as in the capital. The information was gathered in two household surveys from 1997 and 2001 respectively. This was combined with a data set of community characteristics from a community level survey I carried out in Pazos myself in 2003, which makes it possible to estimate the effects of community institutions and infrastructure on the households' integration with distant markets.

The main hypothesis is that fundamental economic conditions should become more important and "coincidental" conditions less important over time; this is confirmed in the analysis. The access to public telephone service is taken as an indicator of the ease to obtain market information. It had a significantly strong positive effect on the decision to enter distant markets in 1997, but the effect is gone by 2001. This may indicate that potential distant markets participants, living in communities without telephone service, have learned how to surpass the disadvantage of not having direct access to this source of information. They might now use the telephone in their neighbouring communities or they might have found other ways to get market information and communicate with potential buyers. Since public transport has become

coordinated actions when it comes to traditional tasks like work exchange, infrastructure construction, irrigation system maintenance, etc. On the other hand, there is hardly any cooperation when it comes to modern tasks with potential gains from cooperation. Only two of the 49 communities reported any self-initiated marketing cooperation and then only for a minor share of about 10 percent of the total sales volume. The cooperation was further restricted to only include common contracting of transport vehicle. All proprietaries went along with the truck to the regional market four hour drive away. Then they separated their individual cargo and each had to find a purchaser on their own.

³I do not know of any top-down marketing cooperation projects in Pazos. The dynamic changes in this district should hence reflect the natural process of market integration.

cheaper, the peasants can either travel themselves or use friends and relatives who intended to go anyway as middlemen. The vanishing effect of direct access to public telephone service for participation in distant markets is an example of how all farmers are put at the same level over time.

Social capital, measured as trust between members of a given community, is interpreted as another coincidental variable. Ideally, the ability to cooperate increases with trust. The peasants who trust each other should be more able to coordinate sales and marketing operations, share information, etc., which should entail a higher degree of integration with distant markets. High trust on the other hand, signals that the community is more traditional and less integrated with the modern world. Social ostracizing, as a form of punishment for breaking common norms of behaviour, is more powerful in isolated communities. The estimated reduced form coefficient for trust is significantly negative, as well as at the same level, in both years. However, the peasants that sold to distant markets actually traded a larger share of their total sales figures there. Taking advantage of the possibility of analyzing the panel structure for a sub-sample of the households, I find support that households living in high trust communities had a positive shift in sales to distant markets. This indicates that being traditional and coming from a close-knit community has become less of a disadvantage for the peasants that have surpassed the barriers of entry to distant markets.

A possible policy conclusion is that well-intentioned organizations should hence be more patient and not necessarily interfere if they observe that small-scale peasants are not able to reap the potential profits from sales to distant markets. The "slow-starters" will gradually learn how to surpass initial drawbacks and be equally able to sell their products to distant markets in the same way as "early-starters" do. In the long run, production volume and other fundamental economic conditions determine the profitability of bringing the products to distant markets and hence which households will settle for this marketing option.

2 Literature

A separation between traditional and modern tasks can explain why high levels of trust will not necessarily be an advantage in the marketing and sales process. The anthropological literature stresses the deep roots of reciprocity in the Indian communities of the Andes, see Mayer (2002), but the peasants tend to separate between tasks and apply different norms. Mayer (2002) and Blum (1995), amongst others, describe a sharp distinction between traditional and modern tasks

in the Peruvian highland as well as between production for self-consumption and for sales in the markets, etc. This would indicate that high trust levels within traditional tasks does not necessarily imply that they will trust each other to bring products to the markets. Stealing directly in the potato field is harshly punished in the communities in the Peruvian highland, while the community at large normally turns a blind eye to the fact that someone for example cheated a fellow community member on the price in a trading operation. The study of Duflo and Udry (2004) is an example within the development economics literature that finds different sources of income to constitute different budgets in the households in an empirical study of households in Ghana.

If there is monopoly or collusive behaviour between intermediaries who trade in the rural areas, then the gains from bringing the products to more central markets is potentially high. However, there are surprisingly few large-scale empirical studies trying to explore whether there is competition between the traders in the rural areas of developing countries. Most practitioners, as in the projects described above, have to rely on anecdotal evidence or subjective opinions of the involved peasants themselves. The classical study of Scott (1985) on the potato marketing chain in Peru finds no decisive evidence of excessive market power in any parts of the marketing chain from the most distant plot to the central market of Lima.

In theory, economies of scale can open for unreasonable high trader profits. With a high entry barrier for small-scale traders, few large-scale traders might be tempted to collude. Fafchamps et al. (2005) use data from agricultural traders in Africa to estimate potential economies of scale in volume, distance and personal travel, in addition to the potential economy of scope across marketing tasks. They only find increasing returns in personal travel cost but conclude that these "nevertheless remain too small to generate noticeable increasing returns to scale". On the other side, there is probably an economies of scale effect in networks. Fafchamps and Minten (2001) show that agricultural traders in Africa who know more and have closer contact with other traders have a higher output. This is due to reduced transaction cost since rural agricultural markets in developing countries are normally thin with incomplete information. Knowing more peasants, the trader is able to buy products in the cheapest way, for example by turning to those who, by luck, had a bumper harvest and have a pressing need to sell. The trader who knows more purchasers will have a higher probability of reaching a potential client who is short of goods and hence willing to pay a high price. Thin markets also widen the spectrum of expected prices, increasing the importance of negotiations and hence leading to more wasted time, by lacking institutional protection in each sales operation, most exchanges are, for example, based on oral

deals making repeated interaction important to achieve trust between the partners. Otherwise, none of them would have anything to loose by cheating.

The same need for networks also applies for the peasants. Information through networks is important to find traders who are willing to pay a good price. The household datasets used in the empirical analysis of this paper were collected to estimate the different components of the transaction costs in Escobal (2000). Using a novel econometric approach in the 1997 survey, he estimates that transaction costs constitute 50-60 percent of the sales price. This paper will instead concentrate on the dynamic aspects of change in trading behaviour by using a more easily interpretable measure of market integration, i.e. the share sold to distant markets of total sales by the households is estimated in econometric models using both household and community level explanatory variables.

3 Empirical study

3.1 Highland region

The location of this study is the district of Pazos in the department Huancavelica in Peru. This is a typical highland mountain area where most of the agricultural activity takes place in the rather steep valley sides between the altitudes of 2,500 and 3,500 meter above sea level. The soil is well suited for potato production. The connections to other parts of the country are rather good. Huancayo - the main city of the central highland region with about 800,000 inhabitants - is about a four-hour drive away and the capital Lima about another six-hour drive crossing the central Andes mountain range on asphalt paved road.

The good connection routes have led to a high degree of specialization in potato production in the district of this study compared to other geographically and agriculturally comparable regions in the country. However, nearly all farmers are small-scale peasants using traditional technology. The hillsides are too steep for mechanized agriculture and even draught oxen are seldom useful. The traditional hand plow, the "Chaquitaccla", a stock with a small spade in the end, is then the only suitable equipment. One man, or several men simultaneously, use it to loosen a piece of soil, while one man at the same time pulls the soil around by hand. However, the use of fertilizers and other agrochemicals has become common among most peasants and some are now able to harvest up to three times a year. There are some rustic irrigation systems, but most plots are purely rain fed.

3.2 Data sets

A random stratified sample of households are drawn for each of the surveys that constitute the data sets for 1997 and 2001 respectively⁴. The aim of the surveys was to estimate transaction costs in potato trade. They hence used the Agricultural Census conducted by the Statistical Office of Peru (INEI) in 1994 to identify households who said market sales were an important activity. Among these, 1396 households farm in comparable agro-ecological zones. A representative sample of 190 households in 1997 was drawn, and then a new and independent drawing of 244 households was conducted four years later. The researchers never intended to use this material as a panel data set, but rather wanted to extend the survey by including new questions to cover new needs. However, both surveys include volume and price by markets, hence a dynamic analysis makes sense. I was able to identify 74 households that appeared in both surveys by comparing the name and age of all household members. For these households it is possible to calculate both changes in sales volume and obtained prices.

The household surveys mainly covered characteristics of the given trading operations. I hence extended the data set by including aspects of community level institutions, infrastructure or social functioning. The district is the lowest level of state organization, but each community in fact represents both a social and an institutional unit. The state for example uses the community as the natural unit for primary school, food distribution, organizing self defense groups, etc. There is further a prevailing notion of "fair" distribution of infrastructure projects between communities over time, which has become an official part of the new state fund distribution system⁵. The community further elects an assembly that is given power to represent them in interactions with state authorities and further exercises important power to make people behave according to the existing norms of the community. This is especially important when it comes to collective action and cooperation, see Wiig (2005a) and Wiig (2005b) for analysis of norms and cooperation in a similar highland district of Peru. Some communities work well, while other does not. Such differences between communities also apply to marketing and trade.

I hence conducted a community level questionnaire in the spring of 2003 to cover community characteristics missing in the household surveys. One or more "authorities", i.e. council mem-

⁴The questionnaire surveys were conducted by a team from the independent research institute Group for Analysis of Development (GRADE) in Lima led by Ph. D. Javier Escobal, who most kindly gave me access to their data sets. Their data collection was sponsored by the International Development Research Center in Canada and the Canadian International Development Agency.

⁵People vote between explicit projects, but there are complicated rules for assigning weights to secure distrib-
utional justice over time.

bers, teachers, defense group leaders, etc., were interviewed in a questionnaire survey on various aspects of community life. This survey covered 12 communities out of the 14 included in the 1997 survey, as well as the 18 included in the slightly larger 2001 survey. The excluded communities belong to the neighbour district of Huaribamba. These communities use a different road access route, which makes it difficult to compare the market choices made by the households in the two different districts. The final datasets used in the analysis consists of 158 observations in cross section for 1997, 226 observations in cross section for 2001 and 74 households in the balanced panel analysis.

3.3 Potato trade pattern

Most farmers are small-scale peasants in the district of Pazos and hence representative for most of the rural areas in Peru. They are independent and control their own plots of land, but there are defacto restrictions on the sale of land. This "land owner" pattern is partly due to the land reform of the 1970's. Land belonging to large land owners was confiscated by the state and redistributed to the employees working on the farm, returning emigrants tempted by the promise of access to land, or independent small-scale peasants living in nearby communities⁶. The community assembly has rather strong institutional power in land use matters and can in the end decide how and who should use it⁷. The initial egalitarian distribution and the defacto restrictions on land sales have led to further land fragmentation. So most agricultural production is now made by small-scale traditional farmers. Each household has on average 4.1 hectares of cultivable land distributed on 6.4 different plots in the 1997 survey. The plots are often spread geographically over different agro-ecological zones to reduce risk. However, the peasants of this district were highly integrated to the markets in 1994 since the production on 49.3 percent of the plots with potato were mainly destined for market sales according to INEI (1994). To compare, the national average for all plots (independent of crop) was 23 percent.

Most peasants sell some of their potato production, but the degree of market involvement differs a lot between the households in Pazos. The mean sales volume was 23 tons in 1997 and 27 tons in 2001, while the standard deviation was 29 tons in both years. There is also a considerable difference between the households when it comes to choice of market place. The

⁶Deininger (2003) estimates that 28 percent of all agricultural land was redistributed during the Peruvian land reform in the benefit of about 31 percent of all rural households.

⁷The juridical status is either common property rights in registered peasant communities or individual property rights. However, entitlement papers seldom exist and the isolation implies that people depend on being included and accepted by the other community members.

difference between the peasants becomes even more striking when it comes to choice of market place. The five possible markets are:

- Field: The peasants sell to intermediaries directly in the field (who on their side hence have to pay for the transport). The sale between the intermediary and the peasant might have been agreed upon on beforehand. This is facilitated by good contacts based on stable relationships. Another possibility is that the purchasers more or less show up in the field around harvest time and then negotiate a spot transaction.
- Local: There is a market once a week in nearly all communities of a certain size, especially those with road access. The peasants bring the products on horseback or llama to the market, where most are sold to intermediaries who transport the products to more central markets. The maximum transport distance is about four hours ride by animal to such local markets.
- District: The largest market within a relatively short distance is the district capital Pazos. Then peasants either bring the products on horseback or they pay for motorized transport. The maximum driving distance is about two hours from the most distant local market.
- Region: The regional center in central Peru is the city of Huancayo. It takes about three hours drive to get there from Pazos and to pay for motorized transport is the only real alternative for the peasants.
- Capital: Lima is another five hours drive further by crossing the mountain range. Motorized transport is the only viable option here.

There is a categorical difference between the near markets consisting of field, local and district on the one hand, and distant markets, consisting of region and capital, on the other hand. In 1997, 60 percent of the farmers only operated in the near markets, while 40 percent sold in both types of markets. Four years later, less than 50 percent sold only in the near markets, 40 percent operated in both types while 10 percent now only sold in distant markets. Thus, more peasants now prefer to bring their products closer to the consumers themselves, bypassing one or more levels of intermediaries. Such change is supposed to increase profitability since the peasants receive a considerable higher price in distant markets. This data set is not suitable to estimate the degree of competition in any reasonable way, but anecdotal evidence indicates the price differential is due to the lack of competition between the intermediaries in the near

markets⁸.

Trade has to some degree always been a part of life in Pazos. In the days of the Incan empire, communities in different altitudes were integrated as one organizational unit and they exchanged goods from different agro-ecological zones. Potatoes and other highland products were brought to the lowlands and maize, fruits and other lowland products sent in return. However, the units existed in parallel with minimal interaction between them and the exchange hence could be compared to bilateral trade agreements between specific countries today. Moving to modern days, trade has to a large degree been controlled by the state through purchaser rights and fixed prices from the 1950's. All markets were suddenly liberalized in the early 1990's as president Fujimori came to power with a liberal agenda. Rural roads and footpath systems have also been considerably extended and improved due to large national and international infrastructure programs. A functioning integrated market is hence a rather new phenomenon. The peasants are probably in the middle a learning process and will only gradually adjust their behaviour.

3.4 Empirical evidence

A key question is whether the determinants of peasants' choice of sales have changed over time. To explore this question, we allow for time dependent effects of the explanatory variables in equation (1) below:

$$X_{it}^D = \alpha_{0t} + \alpha_{Xt}X_{it} + \alpha_{It}I_i + \alpha_{St}S_i + \alpha_{Rt}R_i + \alpha_{PDt}P_{it}^D + \epsilon_{it} \quad (1)$$

The explained variable X_{it}^D is the share of total sales that is traded in distant markets by household i in year t , i.e. kilos to distant markets divided by kilos sold totally.

The explanatory variable X is total sales volume, denoted in tons per year. A combination of several aspects suggests that the effects are positive. If prices vary in each market, risk averse peasants will prefer to divide the sales on different markets in order reduce the variance in sales price. If there is a fixed cost element in transportation and market information, this will imply that a peasant will prefer to enter more markets the higher total production volume. The origin of fixed entry costs can for example be that it takes time to find customers and therefore a higher risk of not being able to sell or having to sell at dumping prices at the start when the

⁸Especially peasants living close to the road said there had been a pronounced shift after the last households survey in my data set was conducted. "We have now learned that it pays off to sell to Huancayo and Lima ourselves rather than accept the prices offered by the intermediaries here" was the typical refrain indicating unfair price setting in near markets.

peasant does not know how the given market works. This implies that peasants will be willing to exchange reduced income security by entering fewer markets to save fixed costs when the total sales volume is low⁹. Since I expect the effect to change over time as markets mature, the coefficients α_{Xt} will also change over time.

There is a considerable risk associated with entering distant markets. First of all, you have to pay for the transport in advance since few peasants possess a motorized vehicle of their own. The few who do regard themselves as transporters and traders and demand payment for bringing products belonging to fellow community members. Furthermore, if the price is low, it might be better to sell in near markets or store the potatoes near home until the market price improves. Peasants who are better informed about the actual market prices in the distant market will therefore perceive a lower risk of entering this market. The telephone is a useful tool to achieve such information. Furthermore, it facilitates repeated interactions with traders. So even if the trade contracts are seldom concluded beforehand at a distance, both parts know more about what to expect of volume and prices hence reducing the cost of the trading operation. Thus, I include a dummy I_i for the existence of public telephone service in the community. The variable is constant over time since the existing telephone services in 2001 was also in place four years earlier¹⁰.

The social capital indicator S_i is a combination of several aspects of trust between people who live in a given community. The four questions in the community survey are in line with the standardized questions formulated in World Bank surveys given in WB (2002) on attitudes between members of a given community. (i) Is there confidence in general? (ii) Do you have to be alert in order not to be exploited? (iii) Are most people disposed to help in case you need it? (iv) Do you lend and borrow money? The scale is from 1 to 4, a higher number indicate more trust. The constructed applied indicator is the average value where each question is given an equal weight. The mean S_i value is 2.3 for all households and the standard deviation is 0.5.

The trust variable is expected to correlate with both norms and networks. We would expect that people who trust each other have better access to information and cheaper marketing costs

⁹Hence volume is first of all important for the decision to pay the sunk investment cost of entering distant market. Once there, total sales volume is probably less important to explain the share sold to distant markets, i.e. it seems reasonable to include volume in the participation decision of the Heckman model but leave it out of the actual OLS model for households that do participate in distant trade, as discussed later.

¹⁰The establishment of satellite phones in the connected communities was part of a privatization deal with the Peruvian government. These are heavily subsidized and hence represent a truly exogenous variable independent of income level.

as they can entrust representatives to take the products to the distant markets. The economies of scale in common transport and marketing is probably large compared to the situation where each has to bring small amounts of products to market themselves.

But why do people in some communities trust each other more than they do in other communities? One aspect is the ability of the community to punish defectors from common norms. Many communities have explicit punishments by giving fines or even putting people into local prisons. However, social ostracizing is the most normal form of punishment. The effect is stronger, the less outside opportunities people have. For example Bardhan (2000) finds irrigation systems in South India, where the maintenance is based on collective action, to be in worse conditions the closer they are to large towns and the higher share of production is actually traded on the market. The existence of access to road in a community is a plausible indicator of integration to the larger society since people then will depend less on their fellow community members. The simple correlation between road access and trust, -0.43 , is constant with this effect¹¹. Being more isolated both geographically and culturally implies lower market integration. The variable S_i is measured in 2003, but I assume it is a good proxy for the trust level in both earlier years. Norms are inflexible and are typically more persistent than both institutions and markets. As an example of this Williamson (2000) takes a hierarchical approach when he assumes it takes 100 years to change norms, 10 years to change institutions and 1 year to change the functioning of markets¹².

Even socially isolated people will sooner or later learn how markets work and integrate if there is a large premium of specialization and trade compared to self-subsistence agriculture. The same applies to bringing the products to more profitable distant markets rather than selling them for low prices in near markets. We would hence expect a positive shift in the coefficient for the social capital indicator over time as the negative effect is reduced. The reduced form coefficient might hence be negative, but expected to be less so in 2001 than 1997. I further expect a similar decrease in importance for the access to telephone. The more isolated people will also learn how to use the telephone over time in order to integrate to the distant markets, for example when they are visiting communities with telephone service and then possibly spreading the word on prices and sales opportunities at home.

¹¹However, the correlation is not too large in the sense of a serious multicollinearity problem when both variables are included in the regression models.

¹²However, the process can be quite speedy when norms do change, e.g. "women liberalization" in the 1960's and 70's. However, in the context of market integration in developing countries do I consider variables collected in 2003 to roughly reflect similar measurements six years earlier.

The final community characteristic to be included is a dummy R_i for having access to roads. Access to road facilitates transport and it makes it possible to do the whole marketing operation in distant markets in one day, leaving in the morning and coming back in the evening. The possibility of meeting transporters to negotiate and coordinate transport before any products are actually moved will normally lead to lower transport prices and facilitate the whole sales process. In contrast, the additional hours of taking the product from isolated communities to the road will imply that sales to distant markets will become a two day project which further implies extra costs like accommodation, meals, etc.

The variable reflecting the relative price level of potatoes sold to distant markets P_{it}^D will influence the market choice by the peasants. The interpretation of prices in the reduced form model of equation (1) is however ambiguous since price and quality reflect the equilibrium between supply and demand curves. *Ceteris paribus*, the peasants will be willing to sell a larger share to distant markets, the higher prices they achieve compared to the price in near markets. On their side, the purchasers will be willing to buy larger quantities the lower the prices, reflecting a downward sloping demand curve. A negative relation in reduced form might hence reflect a strong bulk discount effect¹³.

3.5 Results

3.5.1 Cross-section

The share of total sales volume that was traded in distant markets increased from 37 percent to 53 percent over the four-year period. The regional center Huancayo has especially become more important and is now the major trading market with 40 percent of total volume sold, see Table 1 below.

¹³Another possible explanation for the potential negative relationship between price and volume is quality differences. Native potatoes are produced and sold in small quantities at high prices, industrial potatoes are produced and sold in large quantities at low prices. Since specialization is plausible, the relationship between price and volume will be negative. The dataset contains quality information covering 92 percent of the total sales volume in 2001. Then native potatoes constitute only the minor share of 15 percent of total sales. The share further decreases the more advanced the markets become. It constitutes 12 percent in Huancayo and only 3 percent in Lima. Furthermore, the simple correlation between price and volume for each quality type is still negative and this indicates that the "bulk discount" effect exists even within each quality group.

		Field	Local	District	Region	Capital
Price	1997	0.41	0.38	0.49	0.66	0.94
	2001	0.19	0.23	0.26	0.34	0.42
Volume share all	1997	36%	10%	16%	22%	13%
	2001	18%	8%	19%	36%	17%
Volume share panel	1997	33%	12%	16%	21%	15%
	2001	20%	8%	19%	41%	11%

Table 1: *Price* is the weighted average price per kilo in the local currency Nuevo Soles achieved in the representative destinations. *Volume share all* is the sales to each destination divided by sales to all destinations for all households in each year, while *Volume share panel* is the same for only the 74 households who took part in both surveys.

The decision of selling to distant markets can be viewed in two parts, (i) whether to bring goods to distant markets and (ii) how much to bring. I hence use a Heckman two-step regression procedure and the results are given in Table 2 below¹⁴.

¹⁴This procedure first estimates the Probit function in the bottom part to find the inverse Mills ratio to be included in the OLS of the upper part. The estimation program STATA also allows for a simultaneous estimation of both parts by Maximum Likelihood. However, this method often fails to give a solution. Comparing the results in the specific markets where both methods do give a solution, there are only minor differences in the estimated models. These differences are actually insignificant in a Hausman test. I hence consequently stick to the two-step procedure.

<i>Share distant markets</i> (% of total sales)				
	1997		2001	
	Coeff	St. dev	Coeff	St.dev.
Constant	1.14***	(0.16)	1.73***	(0.15)
Trust	-0.03	(0.06)	0.06	(0.04)
Phone	-0.05	(0.06)	0.07*	(0.04)
Road	-0.07	(0.06)	0.04	(0.06)
Price	-0.50***	(0.11)	-1.05***	(0.08)
Constant	1.51*	(0.87)	1.29*	(0.71)
Volume	0.02*	(0.01)	0.06***	(0.01)
Phone	1.16***	(0.34)	-0.51*	(0.29)
Trust	-1.00***	(0.32)	-1.26***	(0.26)
Road	0.56*	(0.32)	0.86**	(0.34)
Wald Chi	75		327	
N/uncens	158/96		226/122	
<i>Rho</i>	-0.75		-0.88	

Table 2: Heckman cross-section models for each year using *Share Distant market* sales as left hand side variable, i.e. share of total sales going to distant markets. The lower section are the Probit results for participation in distant markets sales. The upper sections are the OLS for households that do participate including the estimated Mills ratio from the first stage to correct for self-selection bias. *Trust* is an indicator of trust within the community, *Phone* is a dummy for public phone in the community, *Road* is a dummy for road access to the community and *Price* is the relative price on sales to distant markets compared to all markets. Significance level: * 10%, ** 5% and ***1%. N is the number of observations and uncens gives the number of uncensored observations.

Share distant markets, i.e. share of total sales measured in monetary units traded in distant markets by the household, is the left hand side variable to be explained in the model. The explanatory variable *Price* is similarly the relative weighted price on products sold to distant markets compared to the weighted price of sales to all markets. I use relative and not absolute measures since my intention is to explain the degree of integration to distant markets as compared to near markets.

The Probit model in the first step calculates the probability of participating in distant markets. The inverse Mills ratio is deducted, and then included in the OLS including only the households who do sell to distant markets in the second step. *Volume* is the total sales volume denoted in tons, while *Trust*, *Phone* and *Road* are as earlier described.

The regression result for the first year, 1997, is given as the left part of table (2). In the Probit section, which reflects the participation decision, we find that the coefficient for *Volume* is positive only at a 10 percent significance level. The positive coefficient for *Phone* is highly significant and *Trust* is similarly significantly negative. This implies that the potentially positive effect of more trust is more than counterbalanced by the effect of being socially more isolated. The coefficient for *Road* is positive. The rather low significance level of 10 percent is a bit surprising, and indicates that the markets are not very developed.

There is a striking lack of significant coefficients in the second stage of the Heckman model of households in 1997, given in the upper part of the table (2). Neither *Trust*, *Phone* nor *Road* were significant. However, the coefficient for *Price* is negative and significant at 1 percent level. The explanation is probably that people who sell large volumes in distant markets normally trade with intermediaries, while peasants that just bring some sacks of potatoes will sell directly to the consumers in the market. This is hence a "volume rebate" effect. The variable *Price* is hence an indirect description of what type of farmer you are, either intermediary or market seller.

There has been a considerable change in the estimated coefficients between 1997 and 2001. The result of the latter is given in the right hand side of table (2). *Volume* has become more important for the decision of whether to enter distant markets or not. The coefficient for *Volume* is tripled from 1997 to 2001, and the according significance increases from 10 percent level to 1 percent level¹⁵. This implies that peasants who produce a considerable volume have started to specialize by taking more products to distant markets¹⁶.

The importance of access to telephone changes dramatically in the participation decision. *Phone* was significantly positive at 1 percent level in 1997. Four years later the effect has disappeared. In fact the coefficient is negative, but only at 10 percent significance level. People with access to telephone more easily entered distant markets in 1997, but their relative advantage compared to people living in communities has disappeared as markets mature. There are several possible explanations for this change. One is that peasants who live elsewhere have started to use

¹⁵The coefficients are not directly comparable between years since the Probit estimation method actually gives the coefficient divided by the variance of the residual. However, I do not find any pattern that indicates a considerable change in the residual variance, and I will therefore compare the absolute coefficient values given for the two years in Table 2.

¹⁶No households sold only to distant markets in 1997, while more than 10 percent chose this specialized marketing option in 2001. On average, the households selling to distant markets had 120 percent higher total sales than households who sold only to near markets in 2001.

the telephone when visiting communities with public telephone, and then possibly spreading the word on prices and sales opportunities when they go home to their own communities. Another possibility is that information through other channels has become more important. More people travel regularly as public transport has improved. They often share information and often do favors for fellow community members. This might have made the telephone less important since people tend to prefer face-to-face relationships even though they act through middlemen. The reduced importance of living in a community with access to telephone hence represents a catch-up phenomenon for the "slow-starters" who live in communities without such access¹⁷.

The coefficient for *Trust* is negative and highly significant in both years. The Probit analysis indicates that this effect is rather constant as the change in coefficient value is within the standard deviation of the coefficient in 1997. *Road* also has a significantly positive effect in both years as expected, with no radical change in effect.

The Probit results in the lower section of Table 2 are in line with the summary results indicating that some peasants specialize in sales to distant markets. A Mills ratio is calculated from the Probit analysis and included in the OLS on the households that do sell to distant markets to correct for self-selection. The estimated coefficients will then be unbiased. This two-step Heckman procedure presupposes, to secure identification, that at least one variable in the Probit analysis does not also appear in the OLS. I have chosen to exclude *Volume* in the OLS since this is probably most important for the decision to enter the market at all or not. Risk minimizing behaviour implies farmers will spread their sales in different markets. A fixed cost of entry then implies that there is a higher chance of selling to distant markets, the higher production. It then seems reasonable from the risk spreading motive to assume a given distribution of sales between markets that is not dependent on total sales volume¹⁸. I conducted a Hausman test to check for the effect of excluding *Volume*. A Heckman model including *Volume* is compared to the same model without *Volume*. The H_0 hypothesis of the Heckman test is no

¹⁷The decreasing importance of telephone service for participation is supported by the highly significant negative coefficient for the interaction variable between Phone and the dummy for year 2001 in the pooled regression model, see results in Table A2 in the appendix. The only common element for both years is then the residual, which does not seem to be an unreasonable assumption. A panel random effect model fails to give a similar significant effect, see Table A3 in appendix. However, the results from this approach is less reliable since the unobserved household characteristics must be uncorrelated with all explanatory variables including the observed household characteristics to give unbiased results, and this is probably not fulfilled in this data set.

¹⁸This "exclusion restriction" is due to possible endogeneity problems. Inclusion of the same explanatory variables at both stages is still possible under strong assumption of functional identification, i.e. the residual in the Probit is actually normal distributed. If this condition is not satisfied, the OLS coefficients will in the second step be biased.

systematic difference in (all) coefficients in the OLS part between the two model versions. In 1997, $\chi^2 = 5.46$ implies a probability of 0.25 for wrongly rejecting the H_0 hypothesis and in 2001, $\chi^2 = 0.24$ implies a probability of 0.99. We can hence not reject that there are no systematic difference between the model with and without *Volume*, and I hence stick to the approach of leaving out *Volume* from the OLS part. Especially the strong results in the last year indicate that *Volume* is not an important explanatory variable for *Share distant markets* among the peasants that do sell to distant markets.

Price is significantly negative at 1 percent level in both years in the OLS, and the absolute coefficient value nearly doubles over this period. One immediate interpretation is that it has become more necessary to give "volume rebates" in order to sell a higher share to distant markets. Another possibility is that an increased segregation of marketing strategies among households, i.e. they either sell a small share directly to consumers or they bring a lot of products and dump everything to intermediaries at low prices. A mixed solutions, some sale to consumers and some to intermediaries, become less common as markets mature and people are more specialized.

The effect of *Phone* is significantly positive at 10 percent level. This further supports the notion that trade with distant markets has become more specialized. Peasants that do sell potatoes to distant markets are now more dependent on telephone service in order to maintain contact with the purchasers. Although not significant in any of the years, the coefficient value of *Trust* changes from negative to a positive value¹⁹. The positive sides of information sharing and exchange of favours can as previously discussed now become more important when the peasants have surpassed cultural and geographical barriers and actually started to trade in distant markets.

¹⁹This result is supported in the Heckman model with pooled observations and the random effect model. The results of the former are given in table A2 in the appendix where the positive coefficient (even though not significant) for e_T , i.e. the interaction variable between *Trust* and year 2001. Table A3 gives the results of the latter and then the interaction variable e_T is highly significant at 1 percent level.

<i>Share distant markets</i> (% of total sales)				
	1997		2001	
	Coeff.	St.dev.	Coeff.	St.dev.
Constant	0.43***	(0.14)	0.16	(0.23)
Trust	-0.23***	(0.05)	-0.24***	(0.08)
Phone	0.20***	(0.06)	0.15*	(0.08)
Road	0.17**	(0.07)	0.24**	(0.11)
Volume	0.003***	(0.0007)	0.009***	(0.001)
Pseudo R ²	55%		28%	
N/uncens	158/96		226/122	

Table 3: Tobit estimation. The left hand side variable is *Share distant markets*, i.e. the share of total sales for each household that is sold to distant markets, The variable *Trust* is indicator of trust within the community, *Phone* is a dummy for public phone in the community, *Road* is a dummy for road access in the community and *Price* is the relative price on sales to distant markets compared to all markets. Significance level: * 10%, ** 5% and ***1%. The Pseudo R² is used as indicator for the explanatory power of the Tobit regression models, N is number of observations while uncens is the number of uncensored observations.

An alternative approach is to use cross-section Tobit regression, the results are given in Table 3. *Price* is not available for the households that do not sell. Thus, it is taken out of the regression model. *Volume* on the other hand turns out to be significant at 1 percent level in both years and the coefficient value triples over time. This also supports the notion of increased importance of *Volume* in the participation decision found in the Heckman model. *Trust*, *Phone* and *Road* are all significant with the expected signs, but the change from 1997 to 2001 does not seem to be important in this regression models.

3.5.2 Household specific change in trading behaviour

The summary variables in table (1) demonstrate a radical shift in trading behaviour. The share of total sales for all households that is sold in the field decreases by 13 percentage points, while the sale in the regional center Huancayo increases by 20 percentage points. The sale in field is often characterized by stable and long term contacts between seller and purchaser. Going into the field with a transport vehicle represent a sunk cost that weakens the bargaining position by the purchaser since the producers are geographically separated and harvest at different times. The purchaser hence have to trust that he will not be exploited when he turns up. This relationship between a peasant and a traders can continue to exist, but might now be a component of a different trading pattern. It is probably more efficient that the farmer brings the products to

the trader in the distant markets. The peasants then has to be reasonably sure they have a purchaser. With established contacts beforehand, the telephone becomes an important tool to actually coordinate timing and place of delivery. It was less important when the purchaser went out to the field, since the two parties normally agreed when and what to trade the next time.

I use household characteristics that are constant over time in this analysis. This makes it impossible to use fixed effects panel models since it is not possible to separate between the effect of the observed and unobserved individual characteristics²⁰. However, it is possible and even more fruitful to approach our main concern of catch-up in trade to distant markets in a rather direct manner. Do communities with high trust and without access to telephone service increase their share sold to distant markets more rapidly than their counterparts? The results are given in Table 3 below.

<i>ΔShare distant markets</i> (change share sold to distant markets)						
	Full sample		One year		Both years	
markets	Coeff.	St. dev.	Coeff.	St. dev.	Coeff	St. dev.
Constant	-0.37*	(0.21)	-0.53	(0.32)	-0.21	(0.27)
ΔVolume	0.06*	(0.03)	0.11**	(0.05)	0.11*	(0.06)
Trust	0.13*	(0.07)	0.21*	(0.11)	0.7	(0.11)
Phone	0.01	(0.01)	-0.04	(0.11)	0.18	(1.12)
Road	0.10	(0.09)	0.11	(0.17)		
R ²	0.09		0.18		0.21	
Adj R ²	0.04		0.11		0.13	
N	74		50		33	

Table 4: OLS model to explain *ΔShare distant markets*, i.e. the percentage points change in the share of total sales to distant markets. *ΔVolume* is the change in total sales volume, *Trust* is an indicator of trust with the community, *Phone* is a dummy for public phone in the community, *Road* is a dummy for road access in the community (excluded in the last model since all household are then connected) and *ΔPrice* is the percentage points change in the relative price on sales to distant markets compared to all markets. Significance level: * 10%, ** 5% and ***1%; N is number of observations, R² and Adj R² are explanatory powers. The "Full sample" model is run on the subset of all 74 households that are

²⁰Another possibility is pooling of observations. The whole data set consists of 384 household observations, i.e. 158 households from 1997 and 226 households from 2001. There are some radical changes in the estimated coefficients given in Table 2 and the χ^2 indicator value from the Hausman tests comparing the models for the two years is -62 for the Heckman model and -64 for the Tobit model. These tests indicate there has been a significant shift in the underlying relation explaining the share sold to *Distant markets*. One possibility is however to include interaction variables, i.e. a given variable interacted with a year dummy for 2001, which is interpreted as the shift in the coefficient value. The results from these exercises are given in table A2 and A3.

included in both years, the "One year" includes only the households that have sold in at least one year to Distant markets and the "Both years" model includes only households that sold to distant markets in both years. "Road" is excluded in the last as only these households only lived in communities with road connection.

The left hand side variable to be explained in an OLS model is $\Delta Share\ distant\ markets$, i.e. percentage point change in share of total sales that is traded in distant markets. There are three different sub-samples of households in Table 4. "Full sample" includes all households that take part in both surveys. "One year" includes households that sell to distant markets in at least one of the years²¹. "Two years" includes only households that sell to distant markets in both years.

The results given in Table 4 above support the interpretations given on the changes in coefficient values between years in the Heckman cross section models. In the two first sub-samples the significantly positive coefficient for $\Delta Volume$, i.e. the percent change in total sales volume, also indicates a difference between large and small traders in their marketing strategy since the former have increased their share sold to distant markets. The positive coefficient for *Trust* gives further evidence for the results found in the cross section analysis for the peasants that do sell to distant markets where a negative coefficient in 1997 turned positive in 2001. Being a member of a more traditional community is hence no longer a drawback for the peasants who sell to distant markets²². The coefficient for *Phone* and *Road* are insignificant. This implies that these variables have no effect on the shift in *Share distant markets*. The number of observations is reduced to 33 households in the "Both years" category, which further weakens the results. Now, only $\Delta Volume$ gives a significant result. The exclusion of households that enter and exit in either year also reduces the variance in the left side variable considerably²³.

²¹ Among the 50 households that entered distant markets in at least one of the years, 33 were active in both years, 8 households only sold in 1997 and 9 households only in 2001. There is hence a considerable entry and exit from sales to distant markets.

²² The numerical effect of *Trust* is rather strong. According to the point estimate, a community with one point higher trust indicator on the scale from 1 to 4 will have 21 percentage points higher change in share sold to distant markets, e.g. with same share in 1997 the share for more trusting community will be 21 percentage points higher in 2001.

²³ We can also include change in the relative price obtained in distant markets in this sub-sample of households. This variable would then be highly significant, but none of the others. However, the change in price is highly endogenously due to the bulk discount effect, i.e. farmers that sold little to high retail prices and shifted to intermediate sales will have to lower their price, and is hence left out of the analysis. The simultaneity between price and volume might be solved by using an instrument variable that is uncorrelated with the residual but correlated with prices. It has not been possible to find such variable that is truly independent in the data set. The models in this article that include *Price* must hence be interpreted in light of this simultaneity problem.

4 Conclusions

Peasants in Latin America are definitively poor. Herrera (2001) estimate that 70 percent of the people living in rural Peru are poor and about half of these are considered extremely poor. This implicates that peasants today do not necessarily enjoy a better life than their ancestors in pre-Hispanic times. Four years is a rather short period to measure rural development in this comparison. However, the marketing opportunities for the potato peasants in this area have changed radically in the last decade through the construction of new roads, improvement of rural footpaths and, not least, the complete liberalization of the agricultural markets. Some households are quick to exploit new opportunities, while others are latecomers who do not take the chance of entering distant markets before the gains are obvious for everyone.

Quite radical changes in household behaviour might hence come about in a rather short time. The econometric results in this study of small-scale peasants indicate that such dynamic change is actually taking place in the Peruvian highlands. The effect of access to telephone service on the decision to sell in distant markets was significantly positive in 1997 and insignificantly negative four years later. This implies that households living in communities with public telephone service has learned how to surpass this drawback, for example by using the telephone while visiting their neighbour communities or they substitute with other forms of communication.

Trust between members of a given community might have opposing effects on trading behaviour. On the one hand members in communities with a high trust level will probably be more able to help each other out in the trading process, for example through entrusting others to take the products to market or giving each other vital information on prices, contacts and sales opportunities. High trust can on the other hand signal that the community is rather isolated (in several dimensions), since the possible punishment of social ostracizing is more powerful in enforcing common norms, the less outside options exist. The total effect on the decision to sell to distant markets turns out to be significantly negative. This result is further consistent with the view that norms of cooperation are probably more prominent in traditional tasks than in modern tasks like marketing and sales. However, this negative effect seems to have become weaker from 1997 to 2001. Panel data show households in trusting communities have a higher increase in the share sold to distant markets. Moreover, there is a shift from negative to positive effect of trust on the share sold to distant markets for the households that do participate. This may illustrate how initial cultural and historical drawbacks are surpassed over time as markets mature.

Institutional restrictions to free trade of land is probably one of the reasons why we can observe this catch-up effect in trade with distant markets by the initially less integrated households. This dynamic development might have been quite different if this had not been the case. If "early-movers" earn more because the profits from sales to distant markets are indeed higher than sales to near markets, they could buy land from the others and the result would be an increased inequality in the land distribution. Being left without land and finally learning how markets work would then be of no use for "slow-starters".

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5 Appendix

5.1 Variable summary

	1997			2001		
	N	Mean	St. dev	N	Mean	St.dev
Trust	158	2.35	(0.49)	226	2.31	(0.50)
Phone	158	0.47	(0.50)	226	0.54	(0.49)
Road	158	0.72	(0.45)	226	0.78	(0.41)
Total sales	190	23.2	(29.1)	244	27.6	(29.1)
Share field	190	0.27	(0.24)	244	0.21	(0.28)
Share local	190	0.21	(0.27)	244	0.19	(0.31)
Share district	190	0.26	(0.21)	244	0.27	(0.29)
Share region	190	0.18	(0.18)	244	0.25	(0.32)
Share capital	190	0.63	(0.13)	244	0.06	(0.18)
Share distant markets	190	0.25	(0.24)	244	0.31	(0.37)
R Price region	109	1.19	(0.21)	120	1.18	(0.19)
R Price capital	42	1.46	(0.23)	38	1.29	(0.21)
R Price distant markets	113	1.27	(0.19)	126	1.20	(0.19)
Land				196	4.1	2.6
Plots				182	6.3	2.5

Table A1: Variable summary: *Trust* is indicator from 1 to 4, *Phone* and *Road* dummies, *Total sales* denoted in tons, The prefix *Share* indicate the share of total sales in percent that is sold to the indicated market, The prefix *R price* give the give relative price achieved in the given market compared to average price for all markets. *Land* is cultivated land per household denoted in hectares and *Plots* is the number of plots of land.

5.2 Heckman pooled with interaction

<i>Share distant markets</i> (% of total sales)				
	OLS		Probit	
	Coeff.	St. dev	Coeff.	St. dev
Constant	0.56	(0.37)	1.72	(1.88)
e_C	0.59***	(0.23)	-0.21	(1.12)
Trust	-0.03	(0.05)	-1.00***	(0.32)
e_T	0.09	(0.06)	-0.26	(0.41)
Phone	-0.05	(0.06)	1.16***	(0.34)
e_Ph	0.12*	(0.07)	-1.67***	(0.45)
Road	0.07	(0.07)	0.56*	(0.31)
e_R	-0.03	(0.09)	0.29	(0.46)
Price	-0.49***	(0.10)		
e_Pr	-0.56***	(0.14)		
Volume			0.02*	(0.01)
e_V			0.04***	(0.01)
Lambda	-0.12	(0.08)		
e_L	-0.03	(0.09)		
R ²	0.68		0.42	
N	218		384	

Table A2: Pooled Heckman with interaction variables with *Share distant markets*, i.e. share of total sales taken to distant markets, as right hand side variable. The left side of the table is the results for the Probit at first stage, the left side of the table is the OLS in the second step. Explanatory variables are: *Trust* is indicator of trust within the community, *Phone* is a dummy for access to public telephone service in the community, *Road* is a dummy for road access in the community and *Price* is the relative price on sales to distant markets compared to all markets and *Volume* is total sales. The prefix *e_* indicates interaction between the variable immediately above with a dummy for year 2001. *Lambda* is the inverse Mills ratio calculated from the Significance levels * 10%, ** 5% and ***1%.

5.3 Panel random effects

<i>Share distant markets</i> (% of total)		
	Coeff.	St. dev.
Constant	0.93***	(0.31)
r_C	-0.60***	(0.19)
Trust	-0.12**	(0.05)
e_T	0.21***	(0.67)
Phone	0.18***	(0.06)
e_Ph	0.03	(0.07)
Road	0.11	(0.07)
e_R	0.03	(0.72)
Volume	0.002**	(0.0009)
e_V	0.004***	(0.001)
R ²	0.54	
N/Groups	148/74	
Rho	0.33	

Table A3: Panel data set random effect model including household observed in both surveys with *Share distant markets* as right hand side variable. Explanatory variables are: *Trust* is indicator of trust within the community, *Phone* is a dummy for public phone in the community, *Road* is a dummy for road access in the community and *Volume* is total sales. Significance levels * 10%, ** 5% and ***1%. R² is the overall explanatory power, N is number of observations and Rho is the fraction of variance due to the unobserved individual effects.