

Changing the Risk at the Margin

Smallholder Farming and Public Policy in
Developing Countries

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To my father

Abstract

This thesis consists of a summary and four self-contained papers.

Paper [I] examines whether the implementation of a social safety net programme in Ethiopia has affected the value, risk and composition of farmers' crop portfolios. The empirical analysis suggests that the value and risk of the crop portfolio have not been altered due to the programme. However, the programme seems to have brought about some changes in the land allocated to different crops.

Paper [II] studies how a social safety net affects farmers' (dis)investments in productive assets. More specifically, it studies how the Productive Safety Net Programme in Ethiopia has changed livestock and tree holdings. The results indicate no significant effect on livestock holdings, but a significant increase in tree holdings.

Paper [III] investigates if there is a problem of adverse selection in formal microlending in rural Bangladesh. The results indicate that farmers who only borrow formally have a shadow price of capital that is substantially higher than the average informal interest rate. This suggests that farmers that only borrow formally are perceived as poor credit risks by informal lenders.

Paper [IV] explores the economic incentives surrounding the cultivation of opium poppy in Afghanistan. Specifically, it examines the impact of eradication policies when opium is used as a means of obtaining credit, and when the crops are produced in sharecropping arrangements. The results indicate that both these features are likely to affect the outcome of eradication policies.

Keywords: Smallholder farming, Public policy, Informal risk strategies, Microcredit, Opium eradication, Development economics, Food policy.

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Camilla

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This thesis consists of a summary and the following self-contained papers:

[I] Andersson, C. (2010) Can a Social Safety Net Affect Farmers' Crop Portfolios? A Study of the Productive Safety Net Programme in Ethiopia. *Umeå Economic Studies* No. 807

[II] Andersson, C., Mekonnen, A. and Stage, J. (2010) Impacts of the Productive Safety Net Program in Ethiopia on livestock and tree holdings of rural households. Forthcoming in *Journal of Development Economics*. Reprinted with kind permission from Elsevier B.V.

[III] Andersson, C., Holmberg, E., MacGregor, J. and Stage, J. (2010) Formal Microlending and Adverse (or Non-existent) Selection. A Case Study of Shrimp Farmers in Bangladesh. Forthcoming in *Applied Economics*. Reprinted with kind permission from the Taylor & Francis Group.

[IV] Andersson, C. (2010) Counterproductive counternarcotic strategies? A study of the effects of opium eradication in the presence of imperfect capital markets and sharecropping arrangements. *Umeå Economic Studies* No. 809.

Introduction and summary

1 Introduction

This thesis consists of four self-contained papers, all related to informal insurance- and credit strategies, public policy and smallholder farming in developing countries.

Agricultural production is an inherently risky business where farmers are exposed to a range of hazards such as droughts, floods, crop failures and price variations. Agricultural production is also a business that requires large investments in the beginning of the season and hence the needs to transfer means over time are substantial. However, in many developing countries formal credit and insurance markets that can be used to manage risk and transfer means over time, are lacking or are insufficient. The reason why the credit and insurance markets are more likely to fail in developing countries is that, in addition to the problems of information asymmetries and moral hazard that are usually associated with these markets, it is often difficult to enforce contracts due to unclear property rights and poorly functioning legal systems in these areas.

To cope in this environment, smallholder farmers in developing countries have developed a number of strategies to survive: they keep extra buffers that can be used when an adverse outcome occurs, they engage in activities where the risk is low, they make use of informal credit systems, they form contracts where the risk is shared between stakeholders and so forth.¹ These informal insurance and credit strategies are integral parts of the rural economy: they, at least partially, fill the farmers' need to insure

¹ For a literature review of risk strategies see e.g. Alderman and Paxson, (1992)

against risk and smooth consumption over time and they have survived in areas where other options have failed. However, at times these informal systems are not enough, and when they fail the consequences can be devastating. Even under normal circumstances, it is difficult to get an efficient allocation of resources and smooth consumption over time without use of well functioning credit and insurance markets. It is often argued that the low productivity in agriculture that can be seen in some parts of the world today is due to the difficulties to handle risk and transfer of income over time: income is traded for risk reduction at substantial cost and credit constraints prevent the farmers from making investments that are of importance for the future flow of income. In this environment, particular policies are carried out; some intended to reduce risk exposure, some to increase productivity, some to maintain law and order, and others for other purposes. The question is then, what happens when policy interventions take place in a context where informal credit and insurance strategies are already established? Do the formal institutions replace informal risk strategies (Paper [1] and Paper [2])? Are the new formal institutions as functionally viable as the informal institutions (Paper [3])? Also, how do the informal strategies affect the outcome of the policies (Paper [4])? These are the main questions that are reflected upon in this thesis.

The rest of the introduction is organized as follows. Section 2 discusses why formal insurance and credit strategies often fail in developing countries. Section 3 describes the different informal insurance and credit strategies that are the focus of this thesis. Section 4 describes the main policies that are of interest. Section 5 summarizes the papers, and this is where the strategies and policies are related.

2 Why the formal insurance and credit markets fail

In many developing countries, legal systems function poorly and it is difficult to enforce formal contracts. This makes it difficult for farmers to use land as collateral when borrowing money, even if property rights to land are clearly defined. In addition to this, land rights are frequently unclear, exacerbating the problems. In theory, formal lenders can reduce their risk by collecting information about potential borrowers; however, information gathering is costly and the costs need to be recouped through the interest charged on the loans, making these loans prohibitively costly for many farmers. Thus, access to formal credit is a problem in many rural areas.

For similar reasons, access to formal insurance is problematic for many farmers in developing countries. Insurance creates a moral hazard problem, where farmers who insure have less incentive to act so as to avoid the negative outcome. More importantly, however, the farmers who are most likely to insure are those who are most likely to need the insurance, either because their farm has poor characteristics that make the risk of a crop failure high or because they have personal characteristics that increase the risk that their crops will fail. This creates an adverse selection problem for insurers, where higher premia will drive out the best remaining customers (since they are the ones who are least likely to need the insurance) and make the remaining pool of customers even worse. In developed countries, insurance companies collect information about potential customers, in order to reduce the risk of insuring poor risks, and use this information to tailor insurance premia to the characteristics of the customer; however, such information gathering is costly, and in rural areas

in developing countries this makes the premia prohibitively high so that smallholder farmers cannot access formal insurance.

3 Informal insurance and credit strategies

In this thesis, five types of risk and/or credit strategies are of special interest: activity choices, asset buffers, informal lending, sales on futures markets and sharecropping arrangements.

In Paper [1], the focus is on the choice of income generating activities as a means of managing risk. In the absence of functioning insurance and credit markets, the optimal portfolio of income generating activities would consist of a number of different activities with the same mean income but whose risks are uncorrelated. Compared to a less diverse portfolio of activities, this would reduce the total income risk without affecting the mean income. However, in practice the scope for choosing activities with low correlation in terms of risk can be limited. For example, if there is a poor harvest, many different crops usually fail simultaneously, and the possibility of finding off-farm employment is reduced because of shallow labour markets. In order to avoid major shortfalls in consumption, farmers may therefore be forced to choose activities with low risk at the expense of lower income to avoid income fluctuations (Dercon, 1996). The choice of how much income to sacrifice in order to reduce the exposure to risk will not only depend on the degree of risk aversion but also the opportunities to smooth consumption *ex-post* in case something happens (Alderman and Paxson, 1992). A number of studies have found that if households have possibilities to smooth income fluctuations *ex-post* by having access to consumption credit or liquid assets, they are more

prone to take up high-risk high-yield activities, e.g. Eswaran and Kotwal (1990), Morduch (1990), Rosenzweig and Binswanger (1993), Dercon (1996) and Lamb (2002).

In Paper [2], the focus is on the asset strategy to cope with risks. This strategy is based on building up the stock of assets in good times in order to deplete them during bad times. Hence, the strategy can basically be seen as inter-temporal consumption smoothing through asset building. Two assets that are frequently mentioned in the literature, as potential buffers to income fluctuations, are livestock and trees (Rosenzweig and Wolpin, 1993; Udry, 1995; Fafchamps *et al.*, 1998; McPeak, 2004; Delacote, 2007). Although these assets may fill important roles as buffers against income shocks, there are shortcomings associated with using them as a store of value over time. For example, if the markets are shallow, the price of livestock is likely to be low when the need to sell them is the highest; furthermore, the long time horizon for growing trees makes them a rather illiquid asset. Hence, there is a scope for better allocation of resources through other types of insurance systems. The question is, however, not unproblematic. In the theoretical framework developed by Deaton (1989, 1991) and Rosenzweig and Binswanger (1993), it is shown that in the absence of functioning credit and insurance markets, risk averse households will save even though they have high discount rates. However, when the future income uncertainty is reduced, consumption will increase at the expense of investments in assets; these are assets that may in themselves be important for rural development and reduction of poverty. Thus, less exposure to risk can in this situation lead to fewer investments in productive assets since the motives for precautionary savings have been reduced. An important thing to note here, though, is

that liquidation of productive assets may not be the outcome of a planned strategy for risk management; it can also be a forced outcome due to lack of alternatives to manage a negative income shock and where the distressed sales seriously harm future income possibilities. In this situation, less exposure to risk will only protect the assets in times of negative income shocks and there is no reason for reducing the investments in these assets.

In Paper [3], the focus is on the use of informal credit markets as a means to reduce liquidity constraints to make investments in agriculture at the beginning of the season. An important question to reflect upon in this context is: how come the formal credit markets in many rural areas in developing countries are often lacking or insufficient whilst the informal credit markets continue to survive? In his famous article, “The Market for ‘Lemons’”, Akerlof (1970) makes an illustrative example of the inherent problem in credit markets. He describes the credit markets in India, where the interest rate is significantly higher in the rural areas than in the city, and thus poses the question: How can these differences in interest rate persist without someone using the possibility to make arbitrage? The answer, the author argues, lies in the information asymmetries: if an arbitrageur tries to profit from the price difference, he will suffer from the fact that he has no information on which borrowers are good credit risks, and which borrowers are not. He will therefore attract all the ‘lemons’, i.e. the poor credit risks. This problem is inherent in credit markets, but is worse in areas where contracts are difficult to enforce so that lenders cannot demand collateral (and where lenders cannot collect information on potential borrowers). Informal lenders, on the other hand, who are based in the community in question and pursue lending as a side activity,

have the advantage that they often know the individual borrowers and have prior information on their behavior; by using this information, they can operate in communities where formal credit is likely to fail.

In Paper [4], one of the focuses is on sales of crops on futures markets as an informal credit and insurance strategy. This strategy is simply based on selling crops prior to harvest at a fixed price on a futures market. After harvest, the crop is delivered to the lender who can resell it on the market at a higher price. By selling crops on futures markets the farmer can obtain credit and thereby reduce liquidity constraints to make investments or smooth consumption over the year. Depending on the type of contract, such an arrangement can also provide risk sharing if the lender takes on some or all of the loss in case of a crop failure. However, the efficiency of futures markets will depend on the structure of the market. Considering that many agricultural markets are shallow, which would make the risk for a local supplier of credit extremely high, it is not unreasonable to assume that lenders would prefer to give advances on crops that have a high value and that are easy to store and to transport, as this would spread the risk and the law of big number more easily can be applied. Unfortunately, in some areas this has stimulated cultivation of illegal crops such as opium, which happen to exhibit exactly these features.

Another risk strategy in focus in Paper [4] is sharecropping arrangements. In a sharecropping arrangement the landlord and tenant divide the agricultural output according to some predetermined rule. It can easily be shown that compared to the situation with perfect insurance markets, land rental markets and labour markets, sharecropping leads to under-provision of labour and therefore a lower overall profit (Ellis, 1993). This is because

the sharecropping tenant will have less incentive to work when he only keeps part of the marginal product of labour. It has also been found that sharecropping arrangements can lead to perverse outcome of public policies. For example, Braverman and Stiglitz (1986) show that under some circumstances, it is optimal for the landlord to resist technological innovations. The historical persistence of these, seemingly sub-optimal, sharecropping arrangements have long puzzled economists and therefore a number of theories for its existence have been developed (Singh, 2000). One important explanation that has been put forward is that sharecropping contracts allow for risk sharing between landlords and tenants. If the tenant were to rent the land, he would take the entire risk of crop failure and price variations. If the landowner were to hire farm labour, on the other hand, he would take the entire risk but would also need to hire managerial staff to oversee the farm workers, which can be prohibitively expensive in some regions. Thus, sharecropping creates better incentives for effort from the workers than a hired-labour setup would, but also permits better risk sharing than a hired-land setup would. Sharecropping cannot be explained by risk sharing and considerations of labour monitoring alone; there are combinations of fixed-rent and wage contracts that could spread the risk equally well. However, such contracts quickly become quite complicated to monitor and enforce, and in a situation where the transactions costs linked to monitoring and enforcement are high, a sharecropping arrangement may be more cost effective in practice (Ellis, 1993).

4 Policy interventions in the rural economy

4.1 The PSNP program in Ethiopia

One means for policymakers to reduce the impacts of a crop failure on farmers is to provide public work in rural areas, either limited to situations when a widespread crop failure occurs or on a more regular basis. Ideally, such food-for-work or cash-for-work programs can reduce the risk that farmers will have to sell off productive assets in times of poor harvests; if they are predictable enough, they may also affect the composition of farmers' crop portfolios in the direction of more risky but higher-yielding crops. Thus, such programs can potentially alleviate several of the problems discussed earlier that are linked to the lack of formal insurance. These types of programs have gained increasing popularity over the last decade, especially in Sub-Saharan Africa (Barrett *et al.*, 2004). The largest such program currently in operation is the Productive Safety Net Program (PSNP) in Ethiopia.

Food insecurity has been a recurrent problem in Ethiopia. Historically, this problem has been tackled with emergency relief on a more or less annual basis. In an attempt to get away from these temporary measures and to give the farmers a longer planning horizon, the Ethiopian government, together with a number of donors, launched the PSNP in 2005. The program operates with an annual budget of US\$500 million and reaches more than 7 million Ethiopians. This makes the program one of the largest ever in African history (Gilligan *et al.*, 2008). The general idea of the program is to provide the most food insecure households with public work during the agricultural slack season. The extra income or food

received from this public work is intended to enable participants to cover food shortages, and to protect productive assets that otherwise would have been sold in times of negative income shocks.

The public works that are conducted within the program is supposed to generate public goods and can for example be construction of roads, planting of trees or building of stone terraces for soil conservation. Besides the provision of public works, the program also has a minor component for food insecure people that are unable to work; these households are provided with unconditional direct support (MoARD, 2004, 2006). The PSNP is a part of a wider program for food security in Ethiopia, the rest of the activities in this program are basically called Other Food Security Programs (OFSP) where the main component is provision of credit (Slater *et al.*, 2006).

With the exception of its larger size and longer planning horizon, the main features of the PSNP are the same as those for other food-for-work and cash-for-work programs. The potential for these kinds of programs to reduce poverty are substantial; however, so are the potential pitfalls. The program creates a demand for labour that would otherwise have been unemployed, but it may also compete for labour used in on-farm activities. The program may reduce liquidity constraints that are likely to be substantial at the beginning of the farming season; leading to opportunities to invest inputs that otherwise would not have been possible. However, there is also a risk that the provision of food through the program reduces the demand for food on the local market, leading to lower prices and reduced incentives for investments in own production.

The list of potential benefits, but also potential problems, can be made even longer.

The main literature on food-for-work programs has focused on how well these programs target the poor, whether they stimulate investments in productive assets (such as soil conservation, improved inputs and production technology, livestock and so forth) and the quality of the public goods created in these programs (see Barrett *et al.*, 2004, for a review of the literature). Less attention has been given to the relationship between these programs and informal risk strategies. Dercon and Krishnan (2003) is an exception; they study the effects of food aid and food-for-work programs on informal-risk sharing between households and find some evidence that the programs actually weaken the informal risk sharing arrangements.

Paper [1] and Paper [2] studies the effects of food-for-work programs on the informal risk strategies of income skewing and asset buffers.

4.2 Formal micro-lending

It has long been recognized that credit is important for rural development. However, as described above, information asymmetries and difficulties to enforce contracts have made provision of this formal credit problematic. In the 1970s, many governments and foreign donors provided cheap formal credit to small-scale farmers in developing countries. However, for the reasons discussed above, these programs tended to attract poor credit risks and governments were reluctant to enforce contracts for fear of alienating the farmers, leading to poor repayment rates. Therefore, these

credit programs only survived thanks to government subsidies. When subsidies were removed as part of fiscal retrenchment programs in the 1980s, many of these credit institutions collapsed. Thus, attempts to provide cheap formal credit in rural areas have frequently failed in the past.

Lately, microcredit institutions have gained increasing popularity and in 2006, the micro-credit organization, Grameen Bank, together with its founder, Muhamud Yunus, was awarded the Nobel Peace Prize. The general idea behind these types of micro-credit institution is that participants form groups that are made jointly responsible for each other's loan. This way of organizing the loans is an attempt to make use of village knowledge and peer pressure to avoid the inherent information asymmetries between lenders and borrowers and to reduce the cost of contract enforcement. Considering the trouble encountered by formal small-scale credit schemes in the past, it is interesting to study whether the formal micro-lending institutions that are operating today are as functionally viable as the informal lenders.

Previous literature has focused on studying the functioning of the formal-micro lending systems by comparing the outcomes under different setups of these systems (Tedeschi, 2008). Less attention has been given to studying how effective they are in relation to the informal lenders; in the few cases where this has been done, studies have focused on aggregate indicators such as overall profitability and performance (Hartarska and Nadolnyak, 2008) rather than on studying suitability of individual borrowers. When studies have looked at characteristics of individual borrowers, the focus has been on identifying determinants of borrowers'

choice of credit source (Barslund and Tarp, 2008), rather than on whether lenders are equally successful in identifying low-risk borrowers.

Considering that many of the new micro-lending organizations have abandoned the group-lending setup, and that many of the established microlending organizations are doing the same (thus, for instance, Grameen Bank has shifted from group lending to individual lending), it is interesting to see if the formal micro-lending organizations are successful in their selection of borrowers, or if the adverse selection problems faced by previous small-scale formal credit schemes still remains. The success of formal micro lending is studied in Paper [3].

4.3 Opium Eradication in Afghanistan

As noted earlier, risk will affect the composition of farmers' crop portfolios. In the case of illegal crops such as coca or opium, governments may deliberately seek to increase the riskiness of these crops through eradication programs. The intention is, of course, that increased risk will cause farmers to shift to cultivation of legal crops instead. However, the illegal crops often play an important role in the rural economy; thus, eradication policies may interact with informal rural institutions in an unintended manner.

Today, Afghanistan accounts for the lion's share of the world's production of opium (UNODC, 2009). The high level of production is of international concern not only due to the health problems related to its usage, but also due to its contribution to insecurity, instability and corruption, both within and outside Afghanistan's borders (Clemens,

2007). To combat the opium production in Afghanistan, substantial resources have been spent on source country counter-narcotic strategies. Among these strategies, eradication of opium poppy has been one of the most important. However, eradication of opium poppy is highly controversial. Advocates argue that a credible threat of eradication is necessary for farmers and landowners to refrain from opium cultivation, while critics argue that eradication is inefficient and often even counterproductive (Blanchard, 2009). To predict the outcome of eradication strategies, it is important to understand the role of opium in the rural economy. Opium cultivation does not only provide farmers with an extra source of income in areas where the number of livelihood options is limited, it has also been an important means for farmers to obtain credit and land. The credit is obtained through sales on futures markets through a system called *salaam*. In this system, the opium poppy is sold prior to harvest, usually to shopkeepers or traders, at a significantly lower price than the market price. After harvest, the poppy is delivered to the lender who can resell it and thereby make a profit on the price difference. Opium has also come to play a role in the land market as landlords have been found to prefer sharecroppers that are willing to grow opium poppy (Mansfield, 2003).

Although there have been some studies of the effect of eradication on illegal crop production at the aggregate level, there are few in-depth studies of the choice of growing an illegal crop at the farm level. Ibanez' studies (2007a, 2007b, 2007c) are exceptions; she investigates the choice of growing coca both theoretically and empirically. The main conclusions of these studies are that the decision of whether to grow coca or not can be explained by economic incentives, lack of options, poverty, moral

considerations, social norms, legitimacy and religious beliefs. However, two important aspects of the choice are left out of in these studies, namely that of how imperfect credit and land markets affect the outcome of eradication policies. Those aspects are likely to be particularly important in an Afghan context.

This is where Paper [4] contributes by studying the effects of opium eradication under different credit and land tenure systems. In the next section, the risk strategies and economic policies are connected by the summary of the papers.

5 Summary of the Papers

Summary of Paper [1]

The purpose of this paper is to investigate if a social safety net has the potential of breaking the vicious circle of risk avoidance and low productivity in African agriculture. The underlying hypothesis is that if farmers are assured of always reaching a minimum level of consumption, they may be willing to engage in activities with higher risk and higher average return.

This hypothesis is investigated by studying the effects of the PSNP in Ethiopia on the value, risk and composition of crops in the farmer's crop portfolio. The theoretical outline suggests that the more the safety net can reduce how much of the income variability that spills over in consumption variability, the larger share of the income portfolio will be allocated to crops with higher average risk and higher average return. The theoretical

result is, however, not clear-cut; the outcome will also depend on how the safety net affects the availability of inputs which, in turn, affects the marginal profitability of land devoted to different crops.

The empirical analysis is based on household panel data from the Amhara region in the Ethiopian highlands. The panel structure of the data allows for empirical methods that can control for selection on time invariant unobserved variables into the program. The effects of the safety net on the value and risk in the crop portfolio is studied using a Just-Pope production function and the allocation of land is studied in a set of acreage response models.

The empirical results indicate that the program has brought about some changes in the farmers' choice of income activities. For example, the area allocated to perennials, which in this region are crops with high value and high variability, has increased. This is in line with previous studies that suggest that ability to *ex-post* smooth consumption lead to an income portfolio with higher risk and higher average return. The results also indicate some further minor reallocations of land devoted to different crops that cannot so easily be traced back to any specific risk-value pattern. However, no significant effect from program participation could be found on the mean value and risk of the total crop portfolio. This result could be because the program has had no impact on the crop portfolio, but it could also be due to a number of contradicting forces that are at play at the same time such as for example changes in the timing of input usage. The lack of results could also be due to the short period of running of the program; the increased farming of perennials may have

greater impact in future, when the perennial plants are fully grown and begin to produce at full output.

Summary of Paper [2]

The purpose of this paper is to study how a social safety net affects investments in productive assets. These effects are of interest as investments in productive assets can be an important way for farmers to climb out of poverty. However, although the intention of the social safety net may be to protect productive assets in times of negative income shocks, there is a risk that the safety net crowds out investments in productive assets. This can happen if the role of these assets is to work as buffers against income shocks and if this role is now played by the safety net. Hence, to further explore the underlying mechanisms, this paper also contributes to the literature by studying the role of these assets in terms of *ex-post* and *ex-ante* risk management and if this role has been affected by the implementation of the social safety net.

The data used in this paper is the same panel household data set from the Ethiopian highlands as in Paper [1]. The empirical analysis is based on regression analysis of the effects of PSNP, income shocks, risk aversion and their interaction on changes in livestock and tree holdings. This allows for investigation of i) the direct effect of PSNP on investments in productive assets; ii) the role of these productive assets as buffers against income shocks, i.e., their role in terms of *ex-post* risk management; iii) the role of productive assets in terms of *ex-ante* risk management; and iv) if and how these potential roles of productive assets have been affected by the safety net.

The results indicate no significant effect of the PSNP on livestock holdings. Furthermore, it seems as if livestock holdings are reduced in times of negative income shock (supporting the buffer hypothesis) but that risk aversion is not a determinant of investments in it. No significant support was found for the PSNP affecting the role of livestock as buffers. When it comes to tree holdings, the program seems to have led to increased investments in tree holdings. The results also suggest, contrary to the *a priori* belief, the less risk averse the household is, the higher the investments in trees. Income shocks did not seem to result in disinvestments in trees. These results are interesting as they suggest that investment in trees, with their long planning horizon and illiquid nature is seen as a risky investment, but that the social safety net enables farmers to invest in these kinds of productive assets. However, the short time in which the program has been running should be kept in mind.

Summary of Paper [3]

The purpose of this paper is to explore if there is a problem of adverse selection in formal micro-lending. This is done by studying whether the informal lenders, who can be assumed to have better information about the individual borrower, would be willing to lend money to those farmers who borrow formally.

The theoretical outline departs from the assumption that the informal lender will lend money to a farmer as long as the expected profit from lending to this farmer is at least as great as the expected profit from lending to other farmers. This means that in optimum, where the expected profits from loans to different farmers are equalized, farmers who are

perceived as worse credit risk will be offered higher interest rates than those farmers that are perceived as good credit risks.

The informal lenders' perception of an individual farmer as a credit risk can then be explored by studying the farmer's shadow price for capital. If a farmer has a shadow price that is higher than the average formal interest rate but lower than the average informal interest rate, this is an indication that the farmer is credit constrained but chooses not to borrow informally because most of his credit needs are met by the formal loans. If the farmer has a higher shadow price than the average informal interest rate, this is an indication that the farmer would be willing to borrow at the informal interest rate offered to other farmers, but is not offered this interest rate as he/she is perceived as a poor credit risk by the informal lenders.

The empirical analysis is based on household data from shrimp farmers in the Khulna district in Bangladesh, where formal and informal credit systems continue to coexist. The shadow price approach, originally developed by Lau and Yotopoulos (1971), is used to empirically study difference in shadow prices between farmers who only borrow formally and those who also use informal credit.

The results indicate that all farmers are credit constrained, i.e. all farmers have a higher shadow price that is higher than the formal interest rate. However, the shadow price of capital for those farmers who only borrow formally is substantially higher than the average informal interest rate, and is also substantially higher than the shadow price for the farmers who also borrow informally. This result suggests that the problem of adverse

selection that has troubled formal small-scale credit in the past remains an issue for the current formal microfinance institutions, and that these formal institutions need to find other routes to attain the information that the informal lenders possess.

Summary of Paper [4]

The purpose of this paper is to explore how different kinds of credit markets and land tenure systems affect the outcome of opium eradication policies, both in terms of area allocated to opium poppy and in terms of the distribution of the cost and benefits between landlords and tenants. More specifically, it is studied how the fact that opium can be used as a means to obtain credit and that the crops often are produced in sharecropping arrangements, affects the outcome of increased risk of eradication.

The issues are explored by theoretically modeling the farmers' crop choice under different circumstances. The main modeling framework is based on a two-period inter-temporal utility maximization problem, where the farmer chooses how to allocate land between opium production and another agricultural good, and how to allocate consumption between the two time periods. It is assumed that the decisions are made at the beginning of the first period and that the harvest is realized in the second period. It is also assumed that the farmer faces a risk that all opium is eradicated in the second period.

The results from the baseline model, with functioning credit and land rental markets, suggest that an increased risk of eradication leads to less

area being allocated to opium poppy. Hence, under these circumstances, the eradication strategy is likely to have the intended effects.

However, when it is assumed that the only way to obtain credit is through sales of opium at a futures market, the analysis suggests that the outcome of increased risk of eradication is no longer unambiguous but will depend on the farmer's degree of risk aversion. If the farmer is sufficiently risk averse, an increased risk of eradication will actually lead to more area being allocated to opium poppy.

Furthermore, the results indicate that under the above mentioned credit system and when the opium poppy is produced in sharecropping arrangements, the tenant will always lose from increased risk of eradication. However, if the tenant is sufficiently risk averse, the landlord's expected profit may actually increase with increased risk of eradication.

From a policy perspective, both for understanding the outcome of previous strategies and for forming future counter-narcotic policies, these results are worth reflecting on as there is a risk that the eradication policy can actually be counter-productive if the role of opium in the rural economy is not taken into proper account.

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