REMITTANCES AS A STRATEGY TO COPE WITH SYSTEMIC RISK: PANEL RESULTS FROM RURAL HOUSEHOLDS IN EL SALVADOR

DISSERTATION

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ABSTRACT

This dissertation examines the role of remittances as a strategy to mitigate risk within rural households in an environment characterized by substantial systemic shocks. To accomplish this, a four-survey panel data set is used to analyze the flows of remittances from both national and international migrants for the case of rural households in El Salvador. The period covered by the panel observations (1995-2001) was marked by significant systemic shocks, thereby offering an opportunity to test hypotheses about remittances as informal insurance. The analysis highlights key differences between national and international remittances as informal insurance mechanisms.

This dissertation follows a risk sharing approach. The main test is to verify if, controlling for other things, the amount of remittances received by Salvadoran rural households is higher when they must cope with adverse income shocks. Shocks are measured as deviations from income predicted by an earnings function. The main predictions of the model are that the optimal amount of remittances to the rural household in the home country is decreasing in the expected earnings and positively related to negative income shocks of the household. For a domestic migrant, subject to shocks covariant with those that also afflict the rural household, however, the optimum

amount of remittances will be lower, compared to an international migrant for which this covariant component does not exist.

The econometric results show that both the probability of receiving remittances and the amount of the remittances are decreasing in the expected earnings of the Salvadoran rural household. The empirical results further provide evidence that there is a positive relationship between the amount of remittances and the relative magnitude of negative income shocks. This relationship, however, is significant only for households with international migrants. This result gives empirical support for the greater scope of international remittances as an informal insurance mechanism.

Given a risky rural environment and the limitations of formal credit and insurances markets, it appears that some rural households have followed a strategy of using international migration-cum-remittances as an insurance mechanism capable of protecting them even from systemic shocks. In contrast, national migration cannot generate this important outcome.

Dedicated to Marielos

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CHAPTER 1

INTRODUCTION

This dissertation examines the role of migration and remittances as mechanisms to mitigate risk within rural households. One of the stylized facts about rural areas in developing countries most widely recognized is that income is highly uncertain from one year to another (Ravallion, 1988). As a consequence, a key topic in development economics is how well rural households are able to mitigate the adverse effects of income risk. Although there is a dearth of formal insurance markets in developing countries, rural households can mitigate risk through a wide range of possible strategies.

Alderman and Paxson (1992) identify two broad classes of strategies to mitigate the adverse effects of income risk. First, rural households may undertake actions to reduce the variability of income. These strategies for risk management include, for instance, a diversified portfolio of occupations of the household's labor force and the strategic migration of family members. Second, strategies for risk coping include those that smooth consumption over time, through inter-temporal reallocations (including saving and borrowing), and those that smooth consumption across households, through risk sharing. Risk-sharing arrangements, in turn, can take place through formal

institutions, for instance insurance and futures markets, and informal institutions, including state-contingent remittances.

In the absence of complete formal insurance markets in developing countries, migration and remittances can be viewed as key potential components of a rural household's risk-reduction strategy. Moreover, the new economics of labor migration has shifted the focus of migration theory from independent individuals to larger units of interrelated people, typically families or households, for whom aversion to risk is a major cause of migration (Stark 1991a; Stark and Bloom, 1985). According to Lucas and Stark (1988), the migration of a family member facilitates the pooling of risks and substitutes for formal insurance by its ability to spread risks via broadening the relevant space for income generation. A key dimension in this approach is the recognition that income risks have an important spatial dimension, given the potentially systemic nature of local covariant adverse shocks. Such covariance is high in rural settings in developing countries. Thus, rural households have incentives to self-insure through the geographical dispersion of their members. In the event of adverse income shocks, these households can rely on related migrants for financial support. An important motive for migration, therefore, is the prospect of receiving remittances, rather than the income differential between two locations highlighted in the earlier literature (Gubert, 2002).

In particular, this dissertation analyzes the role of remittances as a risk-coping strategy for the case of rural households in El Salvador. Key characteristics of this country make this research especially relevant. First, Salvadoran rural households must cope with acute income volatility. Moreover, Beneke de Sanfeliú and González-Vega (2000) report that the instability of rural household incomes between 1995 and 1997

results in a high degree of mobility across deciles of the income distribution. Specifically, between two observations of panel data for a sample of Salvadoran rural households, for 1995 and 1997, 40 percent of all households shifted their location more than two deciles within the per capita income distribution. Similar results have been corroborated by Rodríguez-Meza and González-Vega (2004) for all four observations in the longitudinal panel (from 1995 through 2001).

Second, rural credit markets are shallow in El Salvador. In 1999, for instance, based on the survey for the same panel of rural households, only 36 percent of households had access to any source of formal or informal credit (Rodríguez-Meza, 2001).[1] Barriers to participation in credit markets substantially reduce the set of opportunities that households have for income and consumption smoothing.

Third, remittances are extremely important for the Salvadoran economy. In 2003, for instance, international remittances, mainly from the United States, represented 14 percent of GDP. Fourth, in recent years, the rural environment of El Salvador has been vulnerable to numerous systemic shocks, such as severe droughts, tropical storms, and earthquakes. Fifth, given the small size of El Salvador and a risky rural environment, many Salvadoran households have found in migration-cum-remittances a key strategy to facilitate the pooling of risks and substitute for formal insurance.[2]

The idea that remittances can play the role of an informal insurance mechanism is not new, but few empirical tests of this hypothesis have appeared in the recent literature. Most of these tests have been based on cross-sectional data and have

[1] Households with access to credit in 1999 were defined as those having received any new loans or having purchased any goods on credit and/or having had any outstanding balances for loans received in the prior three years.

[2] The land area of El Salvador is 8,124 squared miles, similar in size to Massachusetts.

considered remittances that result either from national or from international migration. This dissertation uses a four-observation panel data set for Salvadoran rural households to analyze the flow of remittances due to both national and international migration. While focusing on the risk-sharing role of remittances, the analysis highlights important differences between national (domestic) and international remittances as informal insurance mechanisms. International remittances should work better than national remittances as an insurance mechanism, since national migrants have to cope with systemic shocks, such as earthquakes, that affect their rural households of origin as well and that cannot be insured domestically.

Further, it is important to highlight that remittances and borrowing are two possible mechanisms that may be used by rural households to cope with the adverse effects of income risk. Both borrowing for consumption smoothing and migrant remittances can be used to mitigate the effects of adverse shocks. Moreover, both the proceeds from remittances and from borrowing may be used to finance income-generating activities, accumulate physical and human capital, and create microenterprises. Finally, differential access to credit to finance the costs of migrating may also influence patterns of migration across households and the flow of remittances over time. The study of remittances and borrowing as alternative risk-coping mechanisms and in other roles is indeed a topic that deserves additional research in the field of development economics, beyond the scope of this dissertation.

In summary, the central objective of the dissertation is to test, based on the four-observation panel data set for a sample of Salvadoran rural households, whether or not remittances can at least be partially explained as an informal insurance mechanism.

Since the relationship over time between adverse shocks and remittances can be sensitive to other mechanisms for consumption smoothing, such as borrowing, it may be fruitful to analyze remittances in the context of access to financial markets. In the presence of loans, the relationship between remittances and contemporaneous shocks may become blurred (Paulson, 1994).[3] Thus, another objective of the dissertation is to consider the case when, in addition to smoothing consumption via remittances, households borrow for this purpose.

More specifically, this dissertation addresses the following questions: Are remittances received by Salvadoran rural households higher when they suffer adverse income shocks? Are there critical differences between international and national remittances as risk-coping mechanisms? What features of rural households are more likely to be associated with the use of remittances as informal insurance mechanisms? In the case that households have access to credit, how is the risk-coping role of remittances affected when rural households have access to loans?

Based on risk-sharing models of remittances, the main hypotheses of the theoretical models of this dissertation are the following:

(a) ceteris paribus, the optimal level of remittances is expected to be decreasing in the earnings generated in the home country by the rural household and increasing in the earnings of the migrant abroad;

[3] The formal derivation of remittances when there is borrowing was beyond the scope of Paulson's dissertation.

(b) ceteris paribus, the optimal level of remittances is expected to increase when the rural household suffers adverse income shocks in the home country and to decrease when the migrant suffers adverse income shocks; and,

(c) ceteris paribus, the level of remittances is expected to be decreasing in the amount of the rural household's borrowing in the current period.

The second hypothesis most directly captures the insurance component of remittances. The opportunities for insurance will be greater, the less covariant are the incomes of the rural household and of the migrant. The spatial nature of this covariance leads to the distinction, on the one hand, between national and international remittances and, on the other hand, between idiosyncratic and systemic shocks. The second hypothesis must be revised to incorporate these circumstances:

(d) ceteris paribus and in the presence of a given local shock, the optimum level of remittances is expected to be lower (and even to become zero or reverse its sign), for a domestic migrant subject to shocks that are covariant with those of the home country household, compared to remittances from an international migrant, for which this covariant component does not exist.

Thus, domestic remittances are less effective as a risk-coping mechanism than international remittances, because of the potentially high covariance between the income of the domestic migrant and that of the rural household. If this is indeed the case, in *ex ante* migration-cum-remittances strategies, rural households will invest in domestic migration as a mechanism to deal with idiosyncratic shocks at the household level and will invest in international migration as an indispensable mechanism to address threats from local systemic shocks.

The data used in this dissertation come from National Rural Household Surveys implemented under the Broadening Access and Strengthening Input Market Systems (BASIS) research program in El Salvador. Under BASIS, the Rural Finance Program at The Ohio State University (OSU) and the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES) implemented the Second and Third National Rural Household Surveys in 1998 and 2000. FUSADES, in collaboration with The World Bank, had implemented the First National Rural Household Survey in 1996. In 2002, beyond the BASIS program, in collaboration with the Rural Finance Program at OSU, FUSADES implemented the Fourth Survey. All the information gathered by the surveys was for the previous calendar year in each case. Household observations correspond, therefore, to the years 1995, 1997, 1999 and 2001.

The dataset contains critical information that makes it possible to analyze remittances as an informal insurance mechanism. Salvadoran rural households were questioned about levels of education, health, occupation, income generation activities, land use, access to markets, migration and remittances, financial transactions, and so forth. Unfortunately, however, there is no information about the migrant's income and shocks experienced abroad. Nevertheless, the dataset remains a rich source of information for the purposes of the dissertation.

In order to adapt the scope of the empirical exercise to the data available, for the regression analysis the hypotheses above were revised as follows:

(a) controlling for other variables, the level of remittances is expected to be inversely related to the expected earnings generated locally by the rural household;

(b) controlling for other variables, the level of remittances is expected to be directly related to adverse income shocks suffered by the rural household and inversely related to positive income shocks to the actual level of income of the rural household;

(c) controlling for other variables, the level of remittances is expected to be inversely related to the amount of the rural household's borrowing in the current period.

(d) controlling for other variables, in the presence of an adverse systemic income shock, the level of remittances is expected to be lower for a national than for an international migrant.

Random-effects Tobit and probit regressions are used to estimate the parameters required for testing the main hypotheses. These regression models explain the amount of remittances and the likelihood of receiving remittances, respectively. Key results from the regression analysis are that both the probability of receiving remittances and the amount of remittances are decreasing in the expected income of the Salvadoran rural household. The Tobit model offers evidence that there is a positive relationship between the amount of remittances and the relative importance of negative income shocks for the home country household. This relationship, however, is statistically significant only for households with international migrants. Moreover, there is a positive and significant relationship between international remittances and the dummy variable for the year 2001, a year characterized by systemic shocks at the national level, but for the case of national remittance the relationship is negative and significant. These results provide some empirical support to hypotheses about the role of international remittances as an informal insurance mechanism capable of protecting the rural household even from

systemic shocks. Given the potential covariance of domestic incomes, national migration cannot generate this important outcome.

The plan for the rest of the dissertation is as follows. Chapter 2 looks at the related literature on remittances, migration and risk mitigation strategies. Chapter 3 builds two theoretical models to analyze the determinants of remittances as an informal insurance mechanism. The first one is a benchmark risk-sharing model. The second model includes consumption credit as a risk-coping mechanism that might be used by rural household to address this challenge in an inter-temporal framework. This chapter also includes the empirical implementation of the remittance function.

Chapter 4 analyses the social and economic context of El Salvador during the 1990s. Specifically, it discusses the process of economic growth, performance of the agricultural sector, and evolution of migration, remittances and rural poverty. This chapter also describes the four-observation panel data set of Salvadoran rural households and highlights key socio-economic characteristics of these households. The econometric results about the remittance functions are presented in Chapter 5. Random-effects Tobit and probit models are used to estimate the parameters required for testing the main hypotheses predicted by theoretical models of remittances. Finally, Chapter 6 includes conclusions and policy implications.

CHAPTER 2

THE LITERATURE ON MIGRATION AND REMITTANCES

This dissertation integrates important strands of the literature on economic development, informal insurance, migration, and remittances. According to this literature, remittances are a risk-coping strategy, among several possible strategies for insuring rural household consumption against income fluctuations. This particular strategy is implemented through risk sharing across the space. The spatially-diversified, income-pooling household is indeed an institution that emerges as a result of the hazardous nature of rural production and of the difficulties of access to market-based insurance and the limitations of self-insurance in developing countries (Rosenzweig, 1988).

The dissertation also draws on studies of migration that consider the household, rather than the individual, as the key decision-making entity in the determination of migration patterns and remittance flows. These studies include risk as a key explanatory variable in understanding migration and remittances. In addition, insights are collected from the empirical lessons documented in the literature on remittances. These strands of the literature are reviewed below.

2.1 Risk-mitigation strategies and the literature on informal insurance

In order to understand risk better, a typology of shocks must be considered. One way to classify risk is by the level at which shocks occur: idiosyncratic, meso, and macro (World Bank, 2001). Idiosyncratic shocks, such as illness, injury and death, affect specific individuals or households. Meso shocks affect an entire community or a group of households, such as a flood, epidemic, or landslide. A key characteristic of meso shocks is that they are covariant to all the households in the group. For this reason, covariant shocks cannot be insured within the community. Insurance would require pooling risk with communities not subject to the same shocks. Macro shocks occur at the regional, national or international level, such as earthquakes, drought, civil war, or a terms-of-trade deterioration. These shocks are systemic at the regional or national level. Again, it is not possible to insure against these risks within the same spatial setting.

Given that there is almost no market-based formal insurance in the rural areas of developing countries, households (especially the poor) have to rely on self-insurance and informal insurance. Households may use group-based mechanisms of informal risk sharing, which rely on reciprocity and are self-enforced by the group. Informal insurance may involve a mutual support network of members of an *extended household* or a village.

This mechanism may be developed between migrants and their households of origin. Typically, when there is an adverse shock, members of a household cope by cashing in their insurance, for instance, by calling on the support network of their extended household for transfers.

Alderman and Paxson (1992) review several strategies for insuring household consumption against income fluctuations. These authors offer a broad classification in two categories: risk-management and risk-coping strategies. Risk-management strategies aim to reduce the variability of income, for instance, through crop and field diversification, a diverse portfolio of occupations, or strategic migration of family members. Risk-coping strategies include those that smooth consumption inter-temporally, for instance, through saving, borrowing, and accumulating and selling assets, and those that smooth consumption across households, through risk sharing.

If insurance and credit mechanisms that would make it possible to smooth consumption in the presence of income shocks do not exist at all or fall short, households may mitigate risk through production and employment decisions. Morduch (1995) highlights the importance of income smoothing measures in dealing with risk when there are not complete markets for credit and insurance. Households may smooth income by making conservative production or employment decisions and by diversifying their economic activities. By giving up specialization and comparative advantages, these income smoothing measures can be very costly, however, in terms of reduced production efficiency. Thus, providing better mechanisms to cope with risk may increase efficiency in production and resource allocation.

Bardhan and Udry (1999) highlight the fact that households in rural areas of developing countries must cope with extremely fluctuating incomes. In their chapter about risk and insurance, they examine the Pareto-efficient allocation of risk within a community, the use of inter-temporal consumption smoothing through saving and credit markets as a substitute for full risk-pooling, and *ex-ante* mechanisms for reducing

income fluctuations. In a Pareto-efficient allocation of risk, idiosyncratic income shocks are completely insured within the community. According to Bardhan and Udry, the hypothesis of Pareto-efficient idiosyncratic risk pooling within rural communities in poor countries has been rejected in every case examined in the empirical literature.

Udry (1994), for instance, claims that reciprocal credit transactions play a direct role in pooling risk among households in rural northern Nigeria. Repayments owed on a loan depend on realizations of random shocks for both borrower and lender. Even though important insurance components are embedded in these loan repayment arrangements, Udry rejects the hypothesis that a fully Pareto-efficient risk-pooling allocation of the village resources is achieved through the use of the mechanism of reciprocal credit transactions.

Townsend (1995) studies the risky environment, information structures, institutions, and risk-response mechanisms in ten villages in northern Thailand. This author highlights that a key property of the Pareto-optimal full risk-sharing allocation is that changes in household consumption should be determined by changes in the group's average consumption. Based on data for the larger household respondents in Yang Pieng, this author concludes that consumption does not commove and that the allocation of risk is not Pareto optimal. Moreover, when Townsend jointly considers the relatively rich and relatively poor households, there is even more evidence contrary to an optimal allocation of risk bearing. The apparent absence of a village mechanism to intermediate funds from the relatively rich to the relatively poor can, in part, explain this result.

Bardhan and Udry (1999) present a model for the case of a household with unlimited access to credit markets and arrive at the permanent income hypothesis.

These authors claim that predictions based on the permanent income model can usually be rejected for households in all parts of the world. For instance, Deaton (1992) tests a strict form of inter-temporal smoothing, by assuming that consumption follows the permanent income hypothesis. Also, he tests for an important implication of the permanent income hypothesis: economic agents will save more when they expect that their incomes will fall. Deaton indeed finds that households that save in one year are more likely to experience a decline in income next year, but he also finds in the case of Côte d'Ivoire that the amount of saving is not well predicted by the permanent income hypothesis. Similarly, Paxson (1992) finds that rural households save a larger proportion of their transitory than of their permanent income, thus highlighting the role of savings in at least some partial smoothing of consumption over time.

Eswaran and Kotwal (1989) argue that consumption credit plays the role of insurance in agrarian economies. In situations involving uncertain income streams, consumption credit enables risk-pooling across time. In this way, consumption credit influences the risk behavior of farmers, which, in turn, affects the level of investment. These authors "show how the per capita investment rate decreases with the amount of uncertainty and increases with the number of participants in the consumption credit market" (Eswaran and Kotwal, 1989, p.39). If migrant remittances contribute to a less costly management of risk, they may also increase investment, an outcome which contradicts the popular Salvadoran view that remittances do not contribute to capital accumulation. Even if they were used for consumption smoothing only, remittances would still influence investment if they modified the risk responses of rural households.

If rural households do not have access to credit markets, when income fluctuates, they may use other consumption-smoothing mechanisms, such as the accumulation of durable production assets (Rosenzweig and Wolpin, 1993).

If *ex post* mechanisms, such as the use of accumulated reserves of precautionary assets, were insufficient for mitigating the effects of adverse income shocks, risk-averse rural households would also use *ex ante* means of reducing income fluctuations. Households may work in a diverse range of activities or may spread their members across space via migration, in order to reduce the variance of aggregate household income (Bardhan and Udry, 1999).

Rosenzweig (1988) studies the role of the household as a risk-mitigating institution in low-income rural settings. This author argues that the desire for consumption smoothing acts as a centrifugal force, spreading the members of a family across space. Thus, the spatially-diversified, income-pooling family is an institution that emerges because of the hazardous nature of rural production and the difficulties of market-based insurance or self-insurance. Rosenzweig also compares the role of credit the role of kin-based transfers in the *ex post* smoothing of consumption. His estimates suggest that rural households view credit arrangements as inferior to familial transfers for this purpose.

Using cross-sectional data, Md-Smail (2001) investigates the effect of remittances on the borrowing activities of households in Pakistan. He finds some empirical evidence that remittances tend to act as a substitute for informal sources of credit, but he also finds that they are not significant in explaining borrowing from the

formal sector. This study, however, does not address the issue that remittances may be endogenous in the borrowing equation.

Seiler (1998) studies the importance of transfers and remittances as an intra-temporal mechanism in order to smooth consumption in three ICRISAT villages of India's semiarid tropics. This author employs the methods developed by Lim and Townsend (1998), which separate and quantify different smoothing mechanisms available to village households. Seiler finds that almost half of the households use net transfers as a mechanism to finance their deficits between income and consumption. This author also finds that remittances and borrowing are complementary mechanisms in helping to finance household deficits in a given period (Seiler, 1998, p.98).

Rosenzweig and Stark (1989) hypothesize that, in rural India, the marriage of daughters to geographically-distant, dispersed and kinship-related households is a manifestation of implicit inter-household contractual arrangements to mitigate income risk and facilitate consumption smoothing, in an environment characterized by spatially covariant risks and information costs. Spatially covariant risks in agricultural societies imply that insurance may play an important role in explaining marriage-cum-migration phenomena. Rosenzweig and Stark find that marriage-cum-migration contributes to a reduction in the variability of consumption when there is variability in income from crop production. Moreover, households exposed to higher income risk are likely to invest in longer distance marriage-cum-migration arrangements.

This review of the literature suggests that a risk-theoretic perspective may offer valuable insights into the study of migration and remittances. An immediate policy implication might be the importance of improving the framework for the emergence of

more efficient insurance mechanisms. The risk-theoretic perspective also suggests, however, that geographical proximity and the relative importance of systemic shocks may decrease opportunities to pool risk through local insurance. This shortcoming also highlights the importance of distinguishing domestic migration, which is subject to local systemic shocks, from international migration, which is not influenced by a covariance with the outcome of local productive activities. While the insurance payoffs are higher, the costs involved are also higher for international than for domestic migration. It is important, therefore, to consider further the determinants of migration.

2.2 Literature on migration and remittances

To explain rural-to-urban migration, the models introduced by Todaro (1969) and Harris and Todaro (1970) have long been the leading view in this field. These models assume that individual potential migrants simply compare the expected utility of migrating with the expected utility of remaining in the countryside, based on the rural-urban expected income differential (that is, the income differential adjusted for the probability of finding an urban job).

Stark and Levhari (1982) propose an alternative approach to explaining rural-to-urban migration in developing countries, based on risk as an explanatory variable. The key argument in this pioneering paper is the following: "In a nutshell, it is suggested that an optimizing, risk-averse small-farmer family confronted with a subjectively risk-increasing situation manages to control the risk through diversification of its income portfolio via the placing of its best-suited member in the urban sector, which is independent from agricultural production" (Stark and Levhari, 1982, p.192).

In general, Stark (1991a) advances three premises for the study of labor migration. First, migration by one person may be undertaken in pursuit of a rational optimizing behavior by a group of persons, such as the family. Second, there is more to the migration of labor than a response to wage differentials. This premise implies the consideration of new variables, such as income uncertainty, and it suggests the usefulness of a study of related phenomena, for instance pooling of risks between the migrant and the home country family. Third, "a great many migratory phenomena would not have occurred if the set of markets and financial institutions were perfect and complete" (Stark, 1991a, p.4).

According to Stark (1991b), therefore, under portfolio investment theory, migration decisions can be understood as derived from family preferences for stable income levels, achieved through a diversified portfolio of laborers, and the need to jointly insure the family's well-being. Thus, the family, rather than the individual, is the critical decision-making entity that determines migration patterns and remittance flows. After migration, family members pool and share their incomes. This co-insurance allows the family to smooth its consumption. Then, the flow of remittances should not be viewed as a random by-product of migration by an individual but as an integral part of the family's migration strategy.

Moreover, intra-family transfers ought to be governed by explicit or implicit contractual insurance arrangements. Claims, in the form of remittances, flow to the family at times, for instance, of crop failure, and they flow to the migrant during spells of unemployment (Stark, 1991b). Stark also points out that these contractual arrangements should be self-enforcing, given that the arrangements between a migrant

and her or his family are voluntary. Mutual altruism and considerations such as an aspiration to inherit or intentions to return might be factors that help to explain why a migrant will not default and why the family is at the center of such arrangements.

Finally, Stark highlights the fact that the pattern of remittances may be affected by the power of the family over the migrant member. For instance, greater family's wealth increases the relative bargaining power of the home family in relation to the migrant member. An implication of this bargaining approach is that higher remittances flow to a higher-income family; in contrast, a pure altruism model implies that higher remittances flow to lower-income families. It is important not to forget, however, that greater wealth may also be needed to fund the high cost of sending a family member abroad. After the migrant has left, nevertheless, the income locally generated by the home country household would decline, with the loss of a member of the household's labor force.

Hoddinott (1994) develops a model that generalizes the Todaro and household risk-management approaches to migration. This author considers migration as the outcome of joint utility maximization by the prospective migrant and other household members. Thus, the Todaro and the household risk-management models are special cases of the Hoddinnott model. In this approach, both individual and household characteristics influence the migration decision. The model also allows the incorporation of migrant remittances into an explanation of migration. Moreover, the derivation of the *remittance function* takes into account that migrants are a non-random sub-sample of the rural population, in a cross-sectional data context. The predictions from uncorrected regression results would suffer in this case from selectivity bias. This

author argues that the flow of remittances is partly a function of the ability of parents to offer rewards to migrant sons, in the form of bequests of land. Empirical evidence from western Kenya provides support for this claim.

Paulson (1994) highlights the fact that remittances may be consistent with risk diversification even if the migration decision were not, because the timing of the remittance and migration decisions differs. The remittance decision is *ex post*, after the migration decision has been made and shocks have been revealed. Thus, Paulson argues that even though migration decisions may be independent of the household's risk diversification strategy, the extended household may pool risk via remittances that respond to local shocks.

Paulson further points out that a network theory of migration is compatible with risk diversification. The key idea is that migrants can use connections based on social networks formed in their communities of origin in order to improve their prospects of obtaining a job, to have support during spells of unemployment, and to reduce transaction costs. For instance, if the information provided by networks of migrants regarding a specific location reduces the probability of unemployment for the arriving migrant, the incoming migrant in this location will be more able to send remittances and help reduce the variance in consumption levels of the rural household. It is important to highlight that one of the contribution of Paulson's dissertation is the use of a risk-sharing model in order to examine the flows of remittances from national migrants in Thailand.[4]

[4] The data used in this study are limited to two cross-sections of Thai households. Also, it is important to highlight that the derivation of remittances when there is borrowing is beyond the scope of this study.

Seiler (1998) also uses a risk-sharing model to examine the use of transfers in three villages of India but, in contrast to Paulson, he considers a multi-period model that includes savings. In Seiler's study, one of the aims is to analyze the empirical relationship between net (rather than gross) transfers or remittances and four types of changes in asset holdings: a net increase in inventory stocks, a net increase in financial assets, the purchase and sale of physical assets, and net increases of cash holdings net of remittances. The data used come from an ICRISAT panel. The main empirical findings are a positive relationship between asset accumulation and remittances, an inverse relationship between remittances and household income, and that transfers are not targeted to liquidity-constrained households.

In general, I found in the literature the following main explanations of why migrants send remittances to their relatives in the home country: (1) remittances as co-insurance; (2) remittances as an informal intra-family loan; (3) remittances due to altruism; and (4) remittances because of self-interest. The implicit co-insurance contract approach views migration as a family strategy, in which the family acts as a coalition that tries to maximize intertemporal utility. According to Stark (1991b), there is an implicit co-insurance contract linking migrant and non-migrant family members, and the contract is self-enforcing because of family loyalty. The family acts as the insurer when it sends a migrant to the urban sector or to another country; then, when the migrant has secured a relatively stable position, he or she acts as the insurer, by sending remittances to the rural family.

Poirine (1997) advances a theory of migration and remittances that assumes the existence of an internal financial market among migrant and non-migrant family

members. He also assumes that the main purpose of this informal market is to finance investments in the human capital of young family members. Thus, the main hypothesis is that "remittances mainly consist of the repayment of an informal and implicit loan taken out by emigrants during their youth in order to secure a better education that later makes them more productive in the modern sector" (Poirine, 1997, p.589).

The pure altruism approach has been the single notion underlying much of the literature on remittances. The main idea is that the care of a migrant for those left behind is the most important motive for remitting (Lucas and Stark, 1985). According to the pure altruism model, remittances are inversely related to per capita income at home before receipt of any remittances and positively related to the migrant's wage level. An important implication of this approach is that remittances steadily decline over time, as the relationship with the family becomes weaker.

The pure self-interest approach identifies selfish motivations such as: (1) the aspiration to inherit, so one can expect larger remittances the larger is the potential inheritance; (2) the interest to invest in assets in the home area and ensure their careful maintenance; and (3) the intent to return home, which may be an important motivation to promote remittances for investment in fixed capital, such as land or a house (Lucas and Stark, 1985).

In general, I expect that all the factors identified by these four approaches influence, in one case or another, the decision to remit and the level of remittances. Lucas and Stark (1985) find some support for insurance motives in the case of remittances in Botswana. A detailed household survey about migration was conducted in this country in 1978-79, to examine the impact of a major drought. A regression

equation estimates the drought to be significantly associated with the amount remitted. This result is also consistent with pure altruism theory, since drought lowers the rural household's income and the remitting migrant may desire to alleviate the specific hardship imposed on the family. However, Lucas and Stark run additional regressions, with new variables, such as the interaction of the amounts of cattle owned by the family with the drought index, the crop area "possessed" and its interaction with drought. These authors find the interactions of drought with these drought-sensitive assets to be associated with larger remittances.

Gubert (2002) tests whether remittances are partly motivated by insurance, using cross-sectional data from the Kayes area (Western Mali). Based on measures of crop income shocks and three different regression estimators (Powell's censored least absolute deviation, Heckman's two-step, and the Tobit), he finds some support for the view that insurance is an important determinant of remittances. His empirical analysis does not account, however, for the fact that households with migrants are a non-random sub-sample of the rural population.

Agarwal and Horowitz (2002) examine the remittance behavior of migrants from Guyana's households with multiple versus single migrants under risk sharing and altruism. These authors find important differences in the remittance behavior of multiple and single migrants and these differences support the altruism motive. Specifically, they find that per-migrant remittances are significantly and negatively related to the number of migrants.

Using a matched sample of international migrants and their home country families together with a two-period model, Osili (2001) studies two types of

remittances: transfers to the home country family and remittances towards the migrant's investments in the home country. He finds evidence in support of altruistic behavior for the transfers to the home country family (wealthier households tend to receive lower transfers), but remittances sent to finance the migrant's investments are positively associated with the home country family's wealth.

Hassan, Zeller and Meliczek (2001) present an econometric analysis of the determinants of the probability and size of remittances based on primary household-level data collected by the authors in rural Botswana in 1999. These authors find that remittances cannot be explained by altruistic behavior only. Insurance and self-interest motives also play important roles. This is also the view adopted in this dissertation. The empirical exercise discussed in Chapter 5 is an attempt to identify insurance motives in an explanation of remittances to Salvadoran rural households.

2.3 El Salvador: literature on migration, remittances and risk management

The pioneering studies of Segundo Montes (1987 and 1990) highlight the great importance in the 1980s of the Salvadoran migration to the United States and of the associated remittances. Some studies consider political conflict as the key explanatory variable for this migration (Montes, 1987). Among them, Stanley (1987), for instance, considers that the fact that "political violence variables account for more than half of the variance in Salvadoran apprehension in the seasonally-adjusted model suggests that fear of political violence is probably the dominant motivation of these migrants" (p.147).

Funkhouser (1997) argues that those findings are sensitive to the period of analysis and the explanatory variables chosen. In fact, Jones (1989) finds that "the

origins of undocumented Salvadoran migrations to the United States between 1982 and 1985 had no systematic spatial relationships to the areas of political killings or to the areas containing large numbers of internally displaced persons" (p.193). Jones instead finds that economic factors were important determinants of Salvadoran migration to the United States during that period. Few would dispute, however, that the economic and political consequences of the civil war are the root cause of mass migration to the United States.

Funkhouser (1995) uses household data from El Salvador and Nicaragua to examine the determinants of remittances from international migration. The data for El Salvador come from a survey undertaken by Segundo Montes in 1987, in a study at the Central American University. Regarding El Salvador, he finds that the familial relationship of the migrant with the remaining members of the household is important. There is also considerable variation in remittance behavior by region of origin of the migrant. Moreover, rural households are less likely than urban households outside of the capital city to receive remittances.

In the 1990s, the existing networks of Salvadoran migrants offered great support to incoming migrants in the United States (Andrade-Eekhoff, 2003). Salvadoran migrants are concentrated in California (especially Los Angeles and San Francisco), Houston, Washington D.C. and New York. In addition, the gap in economic opportunities between the United States and El Salvador helps to explain why the flow of migration is still very important (Pleitez, 2001).

Several recent studies examine the adoption of risk-management strategies by Salvadoran rural households. Using the initial 1995 observation of the rural household

panel considered in this dissertation, Lanjouw (2001) finds that "non-farm activities in El Salvador account for a significant share of rural employment and income for both the poor and the non-poor" (p.529). Moreover, several of the FUSADES-OSU studies under BASIS find that greater participation in labor markets and/or non-agricultural activities is strongly associated with greater ability to cope with adverse shocks and to generate higher incomes. This income-generating ability is, in turn, related to the schooling of the household's labor force and distance to roads and the jobs found in urban areas (Beneke de Sanfeliú, 2000; Lardé de Palomo and Argüello de Morera, 2000).

Conning, Olinto and Trigueros (2001) analyze household land and labor participation strategies using two observations (1995-1997) of the BASIS panel of Salvadoran rural households. The authors find that landless agricultural wage earners were particularly hard hit by the impact of a weather-related downturn in rural economic activity in 1997. Among findings related to human capital formation, holdings of land appear to have been positively related with the decision to keep children enrolled in school during this economic downturn. Using the first observation in the same panel, López (2000) also highlights that access to land is important in the determination of per capita income in rural El Salvador.

Using all four observations of the rural household panel, González-Vega *et al.* (2004) find that the creation of microenterprises and international remittances are the two most important engines of growth of total per capita income at the household level, for the entire period. To analyze factors that influence diversification away from agriculture, in efforts to cope with risk and increase household incomes, these authors

estimate a multinomial probit model. They find that farmed area increases with per capita incomes even for households that experience increasing non-agricultural earnings. This result is consistent with the hypothesis of a precautionary demand for land developed earlier by these authors (Rodriguez-Meza, Southgate and Gonzalez-Vega, 2004). The precautionary demand for land that can be used for subsistence agriculture in the case of adverse shocks declines as income rises. A household's ability to farm more land goes up, however, as income increases. Together, these two linkages imply that the relationship between agricultural land use and per-capita income takes the shape of an Environmental Kuznets Curve (EKC). Increased subsistence cultivation is another mechanism used by Salvadoran rural households to cope with risk.

Furthermore, Gonzalez-Vega *et al.* (2004) also find that both agricultural and non-agricultural wage earners are less dependent on remittances than the self-employed. This suggests some substitution between participation in local labor markets, where outcomes may be highly covariant, and migration-cum-remittances as paths for escaping high-risk, low-productivity agriculture. Households choosing not to have migrants or not able to afford the related expenses allocate a significant portion of their labor force to waged local employment. In contrast, remittances are important for subsistence and commercial farmers and microentrepreneurs. For the latter, the flow of remittances may have been the source of the investment needed to start small businesses, a possibility that contradicts popular beliefs that remittances are not invested.

A recent study by Halliday (2004) investigates the relationship between international migration and risk, using three observations of the BASIS panel of rural households. These three observations correspond to the four-observation panel of Salvadoran rural households used in this dissertation but exclude the initial 1995 observation. There are some other critical differences, moreover, between the two studies.

One of these differences concerns the data actually used. This dissertation uses a four-observation (1995-1997-1999-2001) unbalanced panel of rural households based on the original design of the survey of 1996, which incorporated 628 randomly selected households. All the information gathered by the household surveys was for the calendar period of the previous year. In the survey of 1996, the stratified sample of 628 households was designed to be representative of the rural population of El Salvador at a 10-percent level of significance. It was also designed to reflect the distribution of rural households according to their main economic activity, namely self-employed land cultivators, agricultural wage earners, and non-agricultural wage earners. The 1992 Agricultural Census was used as the sampling framework. A supplemental sample of 110 households, of only self-employed land cultivators, was taken at the same time for further study of land use patterns.

In this dissertation, I am careful to work based on the households included in the main sample of 1996, which is the representative sample of Salvadoran rural households. Halliday, in contrast, uses rural households that come from both the main and the supplemental samples. He uses a three-observation (1997-1999-2001) data set and pools the data in order to conduct the econometric analysis.

Halliday (2004) focuses on the evolution of the stock of international migrants of each household in response to adverse shocks. These adverse shocks come from housing damage due to the 2001 earthquakes and from livestock losses and/or harvest losses during the years of 1999 and 2001. Using the three survey observations, this author measures the household's flow of migrants through differences in stocks of migrants across two biennial observations. The main findings are that Salvadoran households respond to adverse agricultural shocks by allocating more members to the United States' labor market and respond to housing damages from the earthquakes by retaining household members in El Salvador.

From a theoretical perspective, Halliday (2004) explains his findings with a model of investment in migrants by households with no liquidity constraints. Households consume a durable good (housing) and a non-durable good (crops) and decide how to allocate their labor force across two locations. The model predicts that lowered expectations for the profitability of non-durable goods production in El Salvador, which in this case are due to agricultural shocks, induce migration to the United States. In turn, the model predicts that shocks to the household's durable good stock, in this case from the earthquakes, raises the marginal utility of housing in El Salvador, thereby creating a higher labor demand at home, which stunts migration to the United States. It is important to note that the issue of whether or not migrants remit more in the event of adverse shocks at home is beyond the scope of this paper.[5]

[5] The author briefly explores this issue, however, and he finds that events that increase (decrease) the household's stock of migrants also increase (decrease) the flow of remittances from the United States to rural households in El Salvador. He also provides some evidence that these shocks affect remittances through an indirect effect on migration.

Another recent paper by Yang (2003) also examines migration as a risk-coping strategy in El Salvador. This author uses the same rural household data as in Halliday (2004). Yang, however, only uses a two-observation (1999-2001) balanced panel data set that comes from both the main and the supplementary samples. This author focuses on how two different types of shocks are related to changes in migration patterns after the shocks have occurred. His paper explores, therefore, determinants of *ex post* migration, after the shock has actually occurred, in contrast to this dissertation, which examines *ex ante* migration, to eventually use remittances as an insurance substitute.

The shocks considered by Yang are, on the one hand, unusual medical expenses, as an example of an idiosyncratic shock, and, on the other hand, a household's proximity to the area most affected by the two earthquakes of 2001, as an example of an aggregate shock. The main findings are that households are differentially more likely to have a migrant in the year following an idiosyncratic shock, while aggregate shocks lead to large differential declines in migration in areas closest to the epicenter of the earthquakes..

Yang (2003) explains the effects of the earthquakes on migration by arguing that increased difficulty and higher interest rates in obtaining informal credit for migration are likely to help explain declines in migration in the areas closest to the earthquakes. Halliday (2004) challenges this explanation and provides evidence that the earthquakes did not stunt migration through disrupting local credit markets nor through an interaction with liquidity constraints.

The distinction between *ex ante* and *ex post* strategies is important in interpreting these results. The studies by Yang (2003) and Halliday (2004) examine

determinants of migration after the shock has actually taken place. Paulson (1994), in turn, had argued that earlier migration decisions might be independent of state-contingent remittances that occur after migration has taken place. In contrast, in this dissertation, I argue that international migration-cum-remittances are an attractive *ex ante* mechanism to reduce the effect of covariant adverse shocks. From this perspective, international migration is more likely to respond to the threat of systemic rather than idiosyncratic risk, in an effort to avoid this covariance, which is exactly the opposite of the result found by Yang (2003) for *ex post* migration responses. Domestic remittances, in turn, may be sufficient to help the rural household to cope with idiosyncratic risk, but they will not be possible when both the national migrant and the rural household are affected by the same shock.

2.4 Conclusions

In this section, I will highlight the ideas from this literature that are central to this dissertation. First, the spatially-diversified, income-pooling household is indeed an institution that emerges as a result of the risky nature of rural production and of the difficulties of access to market-based insurance and the limitations of self-insurances in developing countries (Rosenzweig, 1988). Second, in developing countries migration-cum-remittances can be examined using risk as a critical explanatory variable (Stark, 1991a). Third, the household, rather than the individual, is the critical decision-making entity that determines migration patterns and remittance flows (Stark, 1991b). Fourth, remittances can be viewed as a risk-coping strategy for smoothing consumption within families, through spatial risk-sharing that reduces the covariance of their aggregate

incomes. Thus, the spatial risk-sharing model is useful in examining the flows of remittances (Paulson, 1994; Seiler, 1998). Fifth, rural households may use both borrowing and remittances as tools for consumption smoothing when income fluctuates and these two mechanisms may be substitutes.

It is important to note that the motives that explain remittances are not the focus of this dissertation; rather, the focus is the role of remittances as an informal insurance mechanism. However, the literature on the motivation for remittances (altruism and exchange motives) is helpful in the interpretation of some econometric results.

While the idea that remittances play the role of an informal insurance mechanism is not new, few empirical tests have appeared in the recent literature. Most of these tests are based on cross-sectional data, and they consider either remittances from national (domestic) or from international migration. This dissertation uses a four-observation panel data set of Salvadoran rural households and analyses remittances resulting from both domestic and international migration. The analysis offers, therefore, insights about important differences between national and international remittances as informal insurance mechanisms. The study of the relationship between remittances and credit as two possible instruments that can be used by rural households to cope with income risk is a topic that deserves additional research.

CHAPTER 3

THEORETICAL AND EMPIRICAL MODELS OF REMITTANCES

The main purpose of this chapter is to develop two models in order to analyze the determinants of remittances as an informal insurance mechanism and to explain the strategy used for the empirical implementation of the models. First, I build a benchmark risk-sharing model, to study the case where the rural household and the migrant members of the extended family pool risks via state-contingent remittances that respond to adverse income shocks. The main predictions of this model are that the optimal level of the remittances to the rural household is decreasing in the expected earnings and in the positive income shocks of the household and increasing in the expected earnings and in the positive income shocks of the migrants. If the rural household suffers a negative shock, the amounts of remittances sent home are expected to increase and the insurance purpose would be accomplished.

When the model is extended to distinguish between idiosyncratic and spatially-related systemic shocks, the basic predictions of the model about insurance are still valid for international migrants, but these predictions may no longer be valid for national migrants. International migrants, immune to the covariance among incomes created by local shocks, will send larger remittances at the time of difficulties.

Remittances from national migrants will be the net result, however, of two opposite effects. On the one hand, there will be an increased willingness and a sense of obligation of the national migrant to send remittances home, in order to fulfill the implicit insurance contract, once the adverse shock has occurred. On the other hand, the ability of the national migrant to send remittances declines at the same time that the rural household is stricken by the common adverse shock. The smaller or even nonexistent remittances from the national migrant will reflect the difficulties of self-insuring against systemic shocks within El Salvador.

In the second model, I introduce consumption credit as an alternative risk-coping mechanism. Credit may be used by the rural household to smooth consumption in an intertemporal setting, as an alternative to using remittances to share risk in a spatial setting. To analyze the relationship between remittances and consumption credit, I use a basic two-period intertemporal optimization exercise. The main predictions of the model are that, in the first period, the optimal level of remittances to the rural household is decreasing in the size of the loan, while in the second period, however, the level of remittances is increasing in the amount of the loan used in the previous period and in the interest rate paid on that loan, to be repaid in the second period.

This chapter also describes the empirical implementation of the remittance function derived from the theoretical models. I am interested in estimating the direction and the level of significance of the relationships between the remittances received by rural households and their expected earnings, income shocks, loan size and several observable socio-demographic characteristics of interest. Information on these variables

is available from the panel data set gathered through the FUSADES/OSU rural household surveys.

From the basic theoretical models, remittances are explained as a function of the rural household's expected earnings. In this dissertation, expected income from local productive activities is computed by the predicted value obtained from the estimation of an earnings function, which in turn is derived as a relationship between actual income and its determinants. Further, in order to estimate income shocks, I use the strategy of identifying a permanent component of income (a deterministic portion) and of interpreting deviations from the permanent component as transitory shocks.

Finally, the dependent variable of the remittance function is a mixture of a discrete component (namely, zero remittances) and a continuous component (that is, a positive amount of remittances) and is therefore censored at zero. Moreover, the remittance decision can be modeled as a one-stage simultaneous process, in which the two decisions, whether to remit and at what level, occur simultaneously. The justification for this approach is the modeling of the extended household as the decision maker. Thus, the remittance function can be modeled as a single equation and estimated using the Tobit model.

3.1 The benchmark risk-sharing model of remittances

I will consider an informal insurance mechanism that involves a support network of members of an extended family.[6] Specifically, I will examine the case where the rural

[6] The extended family includes the rural household in the home country and the migrant members of the family. In the empirical data set, these migrants are not longer members of the rural household surveyed.

household and the migrant family members pool risks via remittances that respond to adverse income shocks at the rural household level. This insurance mechanism allows the rural household to smooth its consumption over time by geographically diversifying the location of relevant income earners.

Suppose that the extended family has M migrant members, each one with identical utility functions $U(C_{mt})$, where C_{mt} is the consumption of each migrant in period t. For simplicity, it is assumed that each migrant is a one-person household. The migrant's utility function is also assumed to be identical to the utility function for the rural household $U(C_{ht})$. All utility functions are assumed to be concave and increasing in consumption; that is, $U'(C_{mt}) > 0$, $U'(C_{ht}) > 0$, $U''(C_{mt}) < 0$, and $U''(C_{ht}) < 0$.

I assume that the rural household can be described by a vector of characteristics, X_{ht}, and that the household's expected earnings from local sources (E_{ht}) depend on these characteristics.[7] The vector of characteristics X_{ht} can be supplied to the labor market and/or it can be employed in the household's own production under self-employment. The vector of income shocks for the rural household is represented by S_{ht}. These income shocks may include idiosyncratic and systemic shocks, both positive and adverse. Similarly, each migrant's earnings have a permanent component (E_{mt}) and a shock component (S_{mt}).

In this model, the extended family is the single decision-making entity, which chooses how to allocate the joint income of all members of the support network to

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For the field work, households were defined as a group of people who share the same housing arrangements and jointly contribute to the household's requirements, such as food expenses.

[7] Expected earnings (E_{ht}) are not directly observed in the surveys. These earnings can be treated as an estimate of a permanent component of actual income. In practice, one way to estimate expected earnings is to compute the predicted income obtained from an earnings function, which is a relationship between income and its determinants (Rodríguez-Meza, Southgate and González-Vega, 2004).

consumption in various locations. The optimum allocation of consumption levels can be found by maximizing the weighted sum of the utilities of the rural household and its migrants, subject to the budget constraints of the extended family network.

The weights assigned to the utilities of the rural household and its migrants represent their relative power in the determination of the consumption levels of the members of the support network. These weights may reflect factors such as: the number of members of each household and their demographic features (such as age and gender), the relationship of the migrant to the members of the rural household, and the extent of altruism of the migrant. The degree of loyalty and altruism of the migrant would facilitate informal enforcement of the implicit insurance contract and would thereby increase the weight of the rural household in the allocation of consumption within the network. Several of these determinants of the utility weights, such as demographic characteristics and degrees of altruism, may change over time.

The model assumes that the extended family network pools risk via remittances that respond to local shocks for the rural household. This offers the household an opportunity to geographically diversify risk. Also, I impose the condition that the total amount of remittances received by the rural household, (R_{ht}), is equal to the sum of the amounts sent by each migrant (R_{mt}); that is, $R_{ht} = \sum_{m=1}^{M} R_{mt}$ where m=1 ...M is the number of migrants.

In the first model, I assume that there is no access to credit markets. The rural household's consumption and each migrant's consumption in period *t* are limited by the following budget constraints, which are locally-specific across space:

$$C_{ht} \leq E_{ht} + S_{ht} + R_{ht} \quad (1)$$

$$C_{mt} \leq E_{mt} + S_{mt} - R_{mt} \quad \text{for m = 1, 2... M.} \quad (2)$$

If these budget constraints are binding, total income adjusted for remittances equals consumption at each location and there are no savings.

The purpose of the optimization exercise is to reallocate consumption opportunities, in order to ensure that the rural household benefits from income flows generated across the network, given specific weights for the utility functions at each location. In this context, the extended family's problem can be viewed as the following maximization problem with respect to consumption:

$$\begin{aligned} &\text{Max } U = \alpha_h U(C_{ht}) + \sum_{m=1}^{M} \alpha_m U(C_{mt}) \\ &\text{s.t. } C_{ht} \leq E_{ht} + S_{ht} + R_{ht} \\ &\quad C_{mt} \leq E_{mt} + S_{mt} - R_{mt} \\ &- C_{ht} \leq 0; \; - C_{mt} \leq 0 \; ; - R_{ht} \leq 0 \end{aligned} \quad (3)$$

where α_h and α_m are the weights that represent the power of the rural household and each migrant, respectively.[8] The sum of the weights is equal to one:

$$\alpha_h + \sum_{m=1}^{M} \alpha_m = 1 \quad (4)$$

Non-negativity constraints apply to the levels of consumption at each of the locations and to remittances. Non-negativity of remittances to the rural household would not be assumed in a full risk-sharing model. This assumption implies that remittances flow from the migrants to the rural household but not in the opposite

[8] Two separate weights could be used, one for the size of each of the separate households that comprise the family network and one their power in the reallocation of consumption throughout the network. In this case, the size of the rural household and the size of the households of the migrants will influence the optimum level of remittances. This is a straightforward extension of the model presented here.

direction. In a full risk-sharing model, transfers to spatially reallocate consumption can occur in either direction. The reason for this assumption is the concern here with the use of remittances as an insurance mechanism for the rural household living in an environment with substantial systemic risk.[9] Moreover, data on transfers sent to the migrant by the rural household are not available from the surveys.

The corresponding Lagrangian function can be written as follows:

$$L = \alpha_h U(C_{ht}) + \sum_{m=1}^{M} \alpha_m U(C_{mt}) - \lambda_h (C_{ht} - E_{ht} - S_{ht} - R_{ht}) - \sum_{m=1}^{M} \lambda_m (C_{mt} - E_{mt} - S_{mt} + R_{mt})$$

$$- \mu_1 (-R_{ht}) - \mu_2 (-C_{ht}) - \mu_{3m} (-C_{mt}) - \mu_{4m} (-R_{mt}) \text{ for m=1.....M} \quad (5)$$

The solution of the Kuhn-Tucker optimization problem satisfies the following first-order conditions:

$$\frac{\partial L}{\partial C_{ht}} = \alpha_h \frac{\partial U(C_{ht})}{\partial C_{ht}} - \lambda_h + \mu_2 = 0$$

$$\frac{\partial L}{\partial C_{mt}} = \alpha_m \frac{\partial U(C_{mt})}{\partial C_{mt}} - \lambda_m + \mu_{3m} = 0 \quad \text{for m = 1,2,....., M.}$$

$$C_{ht} \leq E_{ht} + S_{ht} + R_{ht}$$

$$C_{mt} \leq E_{mt} + S_{mt} - R_{mt} \quad \text{for m = 1,2,....., M.}$$

$$\lambda_h (E_{ht} + S_{ht} + R_{ht} - C_{ht}) = 0$$

$$\lambda_m (E_{mt} + S_{mt} - R_{mt} - C_{mt}) = 0 \text{ for m = 1,2,....., M.}$$

$$\lambda_h \geq 0; \mu_1 \geq 0; \mu_2 \geq 0; \lambda_m \geq 0; \mu_{3m} \geq 0 \text{ and } \mu_{4m} \geq 0 \quad \text{for m = 1,2,……, M.}$$

$$\mu_1 R_{ht} = 0; \mu_2 C_{ht} = 0; \mu_{3m} C_{mt} = 0; \mu_{4m} R_{mt} = 0 \quad \text{for m = 1,2,....., M.}$$

$$- C_{ht} \leq 0; \; - R_{ht} \leq 0; - C_{mt} \leq 0; - R_{mt} \leq 0 \quad \text{for m = 1,2,……, M.} \quad (6)$$

[9] The case of mutual transfers can be modeled with a straightforward optimization exercise. The predictions do not differ from the results obtained here.

In order to find the optimal solution, I assume that $\mu_1 = 0$, $\mu_2 = 0$, and each of the μ_{3m} and μ_{4m} are equal to zero. From the first-order conditions, this implies that consumption is strictly positive at all locations and that remittances from each migrant to the rural household are positive. Remittances flow in only one direction. That is, these results imply that $R_{ht} > 0$, $C_{ht} > 0$, and each $C_{mt} > 0$, $R_{mt} > 0$.

Also, if I leave the possibility of savings out and therefore I assume that the budget constraints are binding in each location, then the Lagrangean multipliers (λ_h, λ_m) are strictly positive. These multipliers measure how an increase in the budget constraint anywhere in the network increases the value of the objective function. That is, the Lagrangean multiplier is the marginal utility of one additional dollar earned by any member in the network.

Manipulating the first-order conditions for maximum utility, we obtain the result that, for optimum consumption allocations, assuming strictly positive consumption levels at all locations, the weighted marginal utilities of consumption are given by:

$$\alpha_h \frac{\partial U(C_{ht})}{\partial C_{ht}} = \lambda_h$$

$$\alpha_m \frac{\partial U(C_{mt})}{\partial C_{mt}} = \lambda_m \text{ for m=1.....M} \qquad (7)$$

Given that each migrant's utility function is assumed to be identical to the utility function for the rural household, which implies that $\lambda_h = \lambda_m$, these first-order conditions imply the following:[10]

[10] This is a standard condition in the context of risk-sharing models. For instance, Bardhan and Udry (1999) and Seiler (1998) get an equivalent condition in their respective applications.

$$\alpha_h \frac{\partial U(C_{ht})}{\partial C_{ht}} = \alpha_m \frac{\partial U(C_{mt})}{\partial C_{mt}} \quad \text{for m = 1, 2,……, M in period } t. \tag{8}$$

This condition indicates that the optimum allocation of consumption to the rural household should be the one that equates the weighted marginal utilities of consumption at each location.

In the unconstrained exercise, remittances may flow from the rural household to the migrants, while some migrants may receive remittances. Under the non-negativity constraints of the Kuhn Tucker exercise above, in the case where $\mu_1 > 0$ the household does not receive remittances (that is, total remittances are equal to zero). Similarly, when $\mu_{4m} > 0$ some migrants do not send remittances. In the cases of these corner solutions, the weighted marginal utilities will not be equated at all locations. The weighted marginal utility of the rural household will be lower than the weighted marginal utility of the migrant when remittances in reverse are not allowed in the model

I will use this simple risk-sharing model in order to analyze the role of both international and national remittances as a risk-coping mechanism in the rural areas of El Salvador. The empirical application will be based on the four-observation panel data set of Salvadoran rural households.[11] The remittance function can be derived using the key result from the risk-sharing model: that the weighed marginal utilities of consumption are equated among the rural household and its migrants, as shown in condition (8).

[11] Paulson (1994) uses a risk-sharing model to examine the flows of national remittances from two cross-sections of Thai households. The derivation of remittances when there is borrowing is beyond the scope of Paulson's study. Seiler (1998) also uses a risk-sharing model to examine the use of transfers in three villages of India but he includes savings and a multi-period model in comparison with the model developed by Paulson.

To facilitate the derivation of the remittance function, I implement a parameterization of the utility function. Specifically, I assume a logarithmic form of the utility function.[12] By using condition (8) and the logarithmic functional form, which implies that the utility function is concave and increasing in consumption, I have the following result:

$$\frac{C_{mt}}{C_{ht}} = \frac{\alpha_m}{\alpha_h} \tag{9}$$

Now, I solve for the remittances received by the rural household R_{ht}, by substituting the budget constraints, using condition (4) and the equality $R_{ht} = \sum_{m=1}^{M} R_{mt}$, and by summing over for all migrants:

$$\alpha_h (E_{mt} + S_{mt} - R_{mt}) = \alpha_m (E_{ht} + S_{ht} + R_{ht})$$

$$\alpha_h (E_{mt} + S_{mt}) - \alpha_m (E_{ht} + S_{ht}) = \alpha_m R_{ht} + \alpha_h R_{mt}$$

$$\alpha_h \sum_{m=1}^{M} (E_{mt} + S_{mt}) - \sum_{m=1}^{M} \alpha_m (E_{ht} + S_{ht}) = \sum_{m=1}^{M} \alpha_m (R_{ht}) + \alpha_h (R_{ht})$$

$$\alpha_h \sum_{m=1}^{M} (E_{mt} + S_{mt}) - \sum_{m=1}^{M} \alpha_m (E_{ht} + S_{ht}) = R_{ht} (\sum_{m=1}^{M} \alpha_m + \alpha_h)$$

$$R_{ht} = \alpha_h \sum_{m=1}^{M} (E_{mt} + S_{mt}) - \sum_{m=1}^{M} \alpha_m (E_{ht} + S_{ht}) \tag{10}$$

Therefore, the optimal level of total remittances received by the rural household (R_{ht}) is increasing in the expected earnings and positive shocks of each migrant and in the number of migrants (M). Optimal remittances to the rural household are decreasing in the expected earnings and positive shocks of the rural household. In the case when

[12] Paulson (1994) highlights that many utility functions deliver the same predictions for remittances, in the context of the risk pooling model for the *ex post* remittance decision.

the rural household suffers a negative income shock, based on (10), remittances are expected to increase. The optimal level of remittances is also directly related to the "power" (weight) of the home household (α_h) and inversely related to the "power" of the migrants (α_m). As already indicated, these levels of power may be related to demographic features and to the result of the internal bargaining within the family.

When a distinction between domestic and international migrants and a distinction between idiosyncratic and systemic shocks are introduced, these results change to reflect the new circumstances. For example, assuming just one domestic migrant for simplicity, condition (10) would become:

$$R_{dt} = \alpha_h (E_{dt} + S^i_{dt} + S_t) - \alpha_d (E_{ht} + S^i_{ht} + S_t) \quad (11)$$

where E_{dt} and E_{ht} are expected earnings for the domestic migrant and the rural household, respectively, S^i_{dt} and S^i_{ht} are idiosyncratic shocks for the domestic migrant and the rural household, respectively, and S_t is a common systemic shock suffered both by the rural household and the domestic migrant. The weight for the domestic migrant's utility in the aggregate utility for the family network is α_d. Rearranging terms in (11):

$$R_{dt} = \alpha_h (E_{dt} + S^i_{dt}) - \alpha_d (E_{ht} + S^i_{ht}) + (\alpha_h - \alpha_d) S_t \quad (12)$$

Comparing the conditions for the optimum level of remittances in (12) and (10), it becomes clear that, for a domestic migrant subject to covariant shocks with the rural household, the remittance will be positively influenced by the common systemic shock if $\alpha_h > \alpha_d$ (that is, if the household carries a higher weight than domestic migrant in the network's aggregate utility) and the remittances will be influenced negatively if $\alpha_h < \alpha_d$

(that is, if the migrant carries a higher weight). This comparison shows, furthermore, that the systemic component of the shocks experienced by the domestic migrant may lower the optimum amount of the remittance, compared to the remittance from an international migrant, for which this covariant component does not exist. The magnitude of the reduction in the remittance will be governed by the size of the term $(\alpha_h - \alpha_d)\, S_t$.

3.2 A model with credit and remittances

Now, I incorporate consumption credit in the model as an alternative risk-coping mechanism, which may be used by the rural household to smooth consumption in an intertemporal rather than spatial framework.

To analyze the relationship between remittances and credit, I use a basic two-period consumption model. In the first period, the rural household earns income subject to random shocks ($E_{h1} + S_{h1}$), receives remittances (R_1), and it must decide how much to borrow in order to optimize consumption levels over the two periods. In the second period, the rural household generates income subject to random shocks and receives remittances again, ($E_{h2} + S_{h2} + R_2$), but it must repay the principal and interest on the loan taken out during the first period, in the amount $(1+r)\, L$, where r is the real interest rate paid on the loan. The rural household cannot borrow in the second period and, to focus on the relationship between remittances and credit, it does not save in either period.[13]

[13] Savings can be easily incorporated in the model by treating them as negative loans, while earnings on deposits replace interest payments on loans.

The budget constraints of the rural household for the first and the second periods are the following:

$$C_{h1} \leq E_{h1} + S_{h1} + R_1 + L$$

$$C_{h2} \leq E_{h2} + S_{h2} + R_2 - (1+r)\, L \tag{13}$$

An intertemporal budget constraint can be derived by substitution in order to remove the loan, which simply reallocates consumption over time. This substitution gives the following expression:

$$C_{h1} + \frac{1}{1+r}\, C_{h2} \leq E_{h1} + S_{h1} + R_1 + \frac{1}{1+r}(E_{h2} + S_{h2} + R_2) \tag{14}$$

For simplicity, I assume that the rural household has only one migrant and that the amount of remittances received by the rural household is equal to the amount sent by its migrant. The intertemporal budget constraint for the migrant is as follows:

$$C_{m1} + \frac{1}{1+r}\, C_{m2} \leq E_{m1} + S_{m1} - R_1 + \frac{1}{1+r}\,(E_{m2} + S_{m2} - R_2) \tag{15}$$

In the context of two-periods, the extended household's optimization problem with respect to remittances in the two periods can be written as follows:

$$\text{Max } U = \alpha_h\, U(C_{h1}) + \beta\, \alpha_h\, U(C_{h2}) + \alpha_m\, U(C_{m1}) + \beta\, \alpha_m\, U(C_{m2})$$

$$\text{s.t. } C_{h1} + \frac{1}{1+r}\, C_{h2} \leq E_{h1} + S_{h1} + R_1 + \frac{1}{1+r}(E_{h2} + S_{h2} + R_2)$$

$$C_{m1} + \frac{1}{1+r}\, C_{m2} \leq E_{m1} + S_{m1} - R_1 + \frac{1}{1+r}\,(E_{m2} + S_{m2} - R_2)$$

$$-C_{hi} \leq 0,\ -C_{mi} \leq 0,\ -R_i \leq 0 \text{ for i = 1 and 2.} \tag{16}$$

where β is a common discount factor rate that reflects the household's and migrant's preference for current consumption relative to future consumption.

Thus, the Lagrangean function can be written as follows:

$$L = \alpha_h U(C_{h1}) + \beta \alpha_h U(C_{h2}) + \alpha_m U(C_{m1}) + \beta \alpha_m U(C_{m2}) - \lambda_h [C_{h1} + \frac{1}{1+r} C_{h2} - E_{h1}$$

$$-S_{h1} - R_1 - \frac{1}{1+r}(E_{h2} + S_{h2} + R_2)] - \lambda_m [C_{m1} + \frac{1}{1+r} C_{m2} - E_{m1} - S_{m1} + R_1 - \frac{1}{1+r}(E_{m2} +$$

$$S_{m2} - R_2)] - \mu_1 (-R_1) - \mu_2(-R_2) - \mu_3 (-C_{h1}) - \mu_4 (-C_{h2}) - \mu_5 (-C_{m1}) - \mu_6 (-C_{m2}) \quad (17)$$

The solution to this Kuhn-Tucker problem satisfies the following first-order conditions:

$$\frac{\partial L}{\partial R_1} = \alpha_h \frac{\partial U(C_{h1})}{\partial C_{h1}} - \alpha_m \frac{\partial U(C_{m1})}{\partial C_{m1}} + \lambda_h - \lambda_m + \mu_1 = 0$$

$$\frac{\partial L}{\partial R_2} = \beta \alpha_h \frac{\partial U(C_{h2})}{\partial C_{h2}} - \beta \alpha_m \frac{\partial U(C_{m2})}{\partial C_{m2}} + \frac{1}{1+r} \lambda_h - \frac{1}{1+r} \lambda_m + \mu_2 = 0$$

$$C_{h1} + \frac{1}{1+r} C_{h2} \leq E_{h1} + S_{h1} + R_1 + \frac{1}{1+r}(E_{h2} + S_{h2} + R_2)$$

$$C_{m1} + \frac{1}{1+r} C_{m2} \leq E_{m1} + S_{m1} - R_1 + \frac{1}{1+r}(E_{m2} + S_{m2} - R_2)$$

$$\lambda_h (E_{h1} + S_{h1} + R_1 + \frac{1}{1+r}(E_{h2} + S_{h2} + R_2) - C_{h1} - \frac{1}{1+r} C_{h2}) = 0$$

$$\lambda_m (E_{m1} + S_{m1} - R_1 + \frac{1}{1+r} (E_{m2} + S_{m2} - R_2) - C_{m1} - \frac{1}{1+r} C_{m2}) = 0$$

$\lambda_h \geq 0$; $\lambda_m \geq 0$; $\mu_i \geq 0$ for i = 1,2,……., 6

$\mu_1 R_1 = 0$; $\mu_2 R_2 = 0$; $\mu_3 C_{h1} = 0$; $\mu_4 C_{h2} = 0$; $\mu_5 C_{m1} = 0$; $\mu_6 C_{m2} = 0$

$- C_{hi} \leq 0$, $- C_{mi} \leq 0$, $- R_i \leq 0$ for i = 1 and 2. (18)

If I assume non-negativity of consumption levels at each location and of the remittance to the rural household, $\mu_i = 0$ for i = 1, 2…6, and then $R_1 > 0$, $R_2 > 0$, $C_{h1} > 0$,

$C_{h2} > 0$, $C_{m1} > 0$ and $C_{m2} > 0$. Also, if I assume that the budget constraints are binding, in order to exclude savings, then the Lagrangean multipliers (λ_h, λ_m) will be positive. The Lagrangean multipliers indicate by how much an additional dollar of earnings anywhere within the network increases utility.

If the rural household and the migrant have the same utility function, then $\lambda_h = \lambda_m$. Thus, the first-order conditions for optimal intertemporal consumption imply that:

$$\alpha_h \frac{\partial U(C_{h1})}{\partial C_{h1}} = \alpha_m \frac{\partial U(C_{m1})}{\partial C_{m1}}$$

$$\beta\, \alpha_h \frac{\partial U(C_{h2})}{\partial C_{h2}} = \beta\, \alpha_m \frac{\partial U(C_{m2})}{\partial C_{m2}} \tag{19}$$

Next, I solve for the remittances received by the rural household (R_1 and R_2) by assuming a logarithmic form of the utility functions and by substituting the budget constraints in the conditions:

$$R_1 = \alpha_h (E_{m1} + S_{m1}) - \alpha_m (E_{h1} + S_{h1} + L_1) \tag{20}$$

$$R_2 = \alpha_h (E_{m2} + S_{m2}) - \alpha_m [E_{h2} + S_{h2} - (1+r) L_1] \tag{21}$$

Therefore, the optimal levels of remittances R_1 and R_2 are increasing in the expected earnings and positive shocks of the migrant in either period and decreasing in the expected earnings and positive shocks of the rural household in either period. In period 1, the optimal level of remittances (R_1) is decreasing in the size of the loan. In the second period, however, the level of remittances (R_2) is increasing in the amount of the loan in the previous period and in the interest rate paid on that loan. In the case when

the rural household faces negative income shocks, remittances are expected to increase in each period.

3.3 Empirical implementation of the remittance function

This section examines the empirical implementation of a remittance function, derived from the theoretical risk-sharing models. I am interested in determining the relationship between, on the one hand, the remittances received by the rural household and, on the other hand, its expected income, shocks, loans, and observable socio-demographic characteristics available from the data gathered through the surveys of Salvadoran rural households described in Chapter 4. Equations (10) and (20) suggest that there is a functional relationship between remittances and expected income, income shocks and loans. Since the surveys do not gather information on the migrant's income and shocks, I cannot include them in the estimation equations.

In equations (10) and (20), remittances are explained as a function of the rural household's expected earnings (E_{ht}). However, this variable is not directly observed. In this dissertation, expected earnings (E_{ht}) are treated as an estimate of permanent income. The latter can be computed as the predicted income obtained from an equation for current income net of transfers, as the dependent variable, estimated using a vector of household characteristics (Rodríguez-Meza, Southgate, and González-Vega, 2004).

Specifically, the equation for actual income net of transfers can be written as follows:

$$Y_{it} = \alpha_i + \gamma' z_{it} + \varepsilon_{it} \quad (22)$$

where:

Y_{it}= current income net of transfers (that is, net of remittances and subsidies);

α_i= a vector of time-invariant, household-specific unobserved characteristics;

z_{it}= a vector of exogenous time-varying explanatory variables;

ε_{it}= error term.

Thus, expected earnings (E_{ht}) are proxied by the predicted value ($\hat{Y}_{it}$) obtained from regression equation (22) for each household. Using panel data, the fixed-effects approach is chosen to estimate equation (22). The fixed-effects panel model has the advantage that it is not necessary to assume that the household-specific unobserved effect is orthogonal to the observed explanatory variables. However, the fixed effects model cannot include time-invariant explanatory variables.

In order to estimate the magnitude of the income shocks, the strategy of identifying a permanent component of actual income and interpreting deviations from it as transitory shocks is adopted here. This measure of income shocks includes both the effects of systemic and idiosyncratic shocks.

According to Bhalla (1980), one approach to the estimation of the permanent income of a household is to approximate it by the predicted value obtained from an earnings function, specified as a relationship between income and its determinants, such

as in Equation (22). Income shocks can then be measured as the residuals generated by the estimation of the earnings function.

I define the absolute value of a negative shock as minus a negative residual, zero otherwise. The positive shock can be defined as the value of the positive residual, zero otherwise. In order to take into account how important the income shock is for each rural household, I actually measure the income shock as a percentage of the household's expected income level.

In order to analyze the relationship of remittances with expected earnings (E_{ht}), income shocks and loan size, I estimate the following model using panel data from the rural household surveys:

$$R_{it} = c + \beta_1' \hat{Y}_{it} + \beta_2' NS_{it} + \beta_3' PS_{it} + \beta_4' L_{it} + \delta' x_{it} + v_i + \varepsilon_{it} \quad (23)$$

where:

R_{it} = remittances received by household i at time t, measured in real colones of 1995;

c = constant term;

$\hat{Y}_{it}$ = estimate of expected income net of transfers, in real colones of 1995;

NS_{it} = absolute value of a negative income shock, as a percentage of the household's expected income;

PS_{it} = absolute value of a positive income shock, as a percentage of the household's expected income;

L_{it} = amount of loans received in period t, weighted by term to maturity for loans of less than one year, in real colones of 1995;

x_{it} = a vector of exogenous explanatory variables;

v_i = a vector of time-invariant, household-specific unobserved characteristics;

ε_{it} = error term.

According to the predictions from equations (10) and (20), it is expected that the coefficients β_1, β_3 and β_4 will be negative and that the coefficient β_2 will be positive. In the econometric analysis of the relationship between remittances and income shocks, I allow for differences between international and national migrants, as reported in Chapter 5. This distinction is critical in examining the role of the two types of remittances in coping with idiosyncratic and systemic shocks. The vector of x_{it} includes the coefficients for observable time-variant and time-invariant explanatory variables that affect the amount of remittances that the household receives. The vector of unobservable characteristics v_i consists of household-specific attributes that also influence the amount of remittances that the household receives, such as the degree of altruism of the migrant towards his/her home family. We treat unobserved heterogeneity as a set of random variables, which are assumed to be orthogonal to the explanatory variables. This assumption provides the basis for using a random-effects estimator, which also allows for the estimation of coefficients for the observable time-invariant variables.

3.3.1 The censored Tobit model

The dependent variable in Equation (23) is a mixture of discrete (zero remittances) and continuous (that is, a positive amount of remittances) components and it is therefore censored at zero. Some of the previous studies ignored this censoring problem with respect to the remittance variable and used ordinary least squares (OLS) for the estimation of the parameters, despite inconsistency (Lucas and Stark, 1985; Walker and Brown, 1995).

The remittance decision can be modeled as a one-stage simultaneous process. Under the assumption that there is just one remittance decision, the process can be modeled in a single equation and this equation can be estimated using the censored Tobit model. The assumption is that the two stages of the remittance decision (whether to remit and at what level) occur simultaneously. For instance, in a cross-sectional context, the Tobit model is used by Schrieder and Knerr (2000), Brown (1997), and Ravallion and Dearden (1988), in their analysis of remittances in Cameroon, the Pacific Islands, and private transfers in Java, respectively.

A prevalent approach for panel data is the random-effects Tobit model (Wooldridge, 2002; Hsiao, 2003). We can state this model as:

$$y^*_{it} = \alpha_i + x_{it}\beta + u_{it}, \quad i=1,....,N; \quad t=1.....,T \tag{24}$$

Under this model, the explanatory variables are exogenous, conditional on the unobserved effects. The observed value y_{it} is equal to y^*_{it} if $y^*_{it}>0$ and is equal to zero when the data are censored. Also, it is assumed that the unobserved effect (α_i) is randomly distributed with density function g (α). The likelihood function of the

standard Tobit model for the censored data takes the following form (Hsiao, 2003, p.240):

$$\prod_{i=1}^{N}\int\left[\prod_{t\in c_i}F(-x_{it}\beta-\alpha_i)\prod_{t\in z_i}f(y_{it}-\alpha_i-x_{it}\beta)\right]\ g(\alpha_i)\ d\alpha_i \qquad (25)$$

where $F(.)$ and $f(.)$ are the distribution and density functions of the standard normal, respectively; the $c_i = \{t \mid y_{it} = 0\}$, and z_i denotes its complement. Maximizing the likelihood function in (25) with respect to unknown parameters yields consistent estimators.

3.3.2 The probit model

In addition to estimating the censored Tobit model to explain the amount remitted, it is possible to estimate a model to explain the probability of receiving remittances. Here, I use probit analysis to estimate the probability that the rural household receives remittances.

A prevalent model for binary outcomes with panel data is the random-effects probit model. The main assumptions of this model are the following (Wooldridge, 2002, p.483):

$$P(y_{it} = 1 \mid x_i, c_i) = P(y_{it} = 1 \mid x_{it}, c_i) = \Phi(x_{it}\beta + c_i), \qquad t= 1,\ldots,T \qquad (26)$$

where c_i is the unobserved effect and x_i contains x_{it} for all t. The first equality implies that x_{it} is strictly exogenous, conditional on c_i. The second equality is the standard probit assumption about c_i. Also, it is assumed that the outcomes are independent, conditional on (x_i, c_i). The last assumption is that c_i and x_i are independent and c_i has a normal distribution [$c_i \mid x_i \sim$ Normal (0, σ^2_c)].

Under the above assumptions, a conditional maximum likelihood approach is available in order to estimate β and σ^2_c. Given that the c_i are unobserved, they cannot appear in the likelihood function. Thus, it is necessary to integrate out c_i. Since c_i has a N $(0, \sigma^2_c)$ distribution, we have that:

$$F(y_1, \ldots, y_T \mid x_i; \theta) = \int_{-\infty}^{\infty} \left[\prod_{t=1}^{T} f(y_t \mid x_{it}, c; \beta) \right] (1/\sigma_c)\ \phi\ (c/\sigma_c)\, dc \qquad (27)$$

where $f(y_t \mid x_t, c; \beta) = \Phi(x_t \beta + c)^{yt} [1 - \Phi(x_t \beta + c)]^{1-yt}$ and θ contains β and σ^2_c. Taking the log-likelihood of Equation (27) gives the conditional log likelihood for each *i.* The log-likelihood for the entire sample can be maximized with respect to β and σ_c to obtain $\sqrt{N}$-consistent asymptotically normal estimators. This conditional MLE is typically called the random-effects probit estimator (Wooldridge, 2002).

3.3.3 Testing for the exogeneity of the loan in the remittance equation

Suppose the the loan variable in the Tobit model of equation (23) is endogenous. Consequently, loan size will be defined by a second equation:

$$L_{it} = c + \beta_1' \hat{Y}_{it} + \beta_2' NS_{it} + \beta_3' PS_{it} + \delta_1' x_{it} + \delta_2' z_{it} + v_i + u_{it} \qquad (28)$$

where all the variables are defined as in equation (23) plus a vector, z_{it}, of additional exogenous explanatory variables. The potential correlation between u_{it} and ε_{it} is the source of endogeneity.

Following Smith and Blundell (1986), a procedure can be developed to test for the endogeneity of L_{it} with a few assumptions. Under joint normality of (μ, ε) with mean zero, then $\varepsilon = \theta\mu + \xi$, where $\theta = \text{Cov}(\mu, \varepsilon)/\text{Var}(\mu)$ and ξ is independent of z and μ. From

the distributional assumptions about *(μ, ε),* it follows that E (ξ) = 0 and Var(ξ)= τ^2. (Wooldridge, 2002, p.531).

Consequently, equation (23) can be rewritten as:

$$R_{it} = c + \beta_1' \hat{Y}_{it} + \beta_2' NS_{it} + \beta_3' PS_{it} + \beta_4' L_{it} + \delta_1 ' x_{it} + \delta_2 ' z_{it} + v_i + \theta\mu_{it} + \xi_{it} \quad (29)$$

where ξ / z, L, $\mu \sim N(0, \tau^2)$ and where z is the vector of all explanatory variables of Equation (23) other than *L*.

The parameters of equation (29) can be consistently estimated using the random effects Tobit estimator. The new regressor in equation (29), μ_{it}, is the unknown error term of equation (28). It can be estimated from the residuals of the Tobit estimation of equation (28) as a prior step to the final estimation of equation (29). Then, the *t* statistic on the coefficient (θ) provides the test for the null H_0: $\theta = 0$, which indicates that the loan variable is exogenous.

CHAPTER 4

THE SALVADORAN CONTEXT AND RURAL HOUSEHOLD DATA

4.1 Social and economic context in the 1990s

In the 1990s, the economy of El Salvador experienced three critical transformations. The first transformation reflected the transition from the economic decline and civil war of the 1980s to the economic reconstruction and social reconciliation processes that emerged from the Peace Accords in 1992. The second transformation responded to the replacement of the protectionist import-substitution industrialization strategy by a market-oriented reform agenda, based on a program of macroeconomic stabilization and structural adjustment. The third transformation resulted from the evolution from the external support of official donations of the 1980s to the increasing private sector flows of remittances, trade, earnings and capital flows (Gonzalez-Vega, 2001).

International migration, especially to the United States, and the accompanying remittances have been among the most important phenomena of the recent history of El Salvador. In turn, the economic and political consequences of the civil war were among the root causes of mass migration to the United States in the 1980s. Moreover, the networks of Salvadoran migrants already in the United States offered great support in

the 1990s to incoming migrants (Andrade-Eekhoff, 2003). Thus, contrary to earlier expectations, migration continued in a large scale in the 1990s, up to this date. As a consequence, the flow of international remittances increased 2.7 times, from 790 million US dollars in 1991 to 2,105 million US dollars in 2003 (Table 1).

A brief historical review of the evolution of the Salvadoran economy includes four sections in this chapter. First, the process of economic growth in the 1990s is briefly described. Second, the fact that the agricultural sector lagged considerably behind the rest of the Salvadoran economy is highlighted. Third, the importance of the Salvadoran migration-cum-remittances phenomenon is evaluated. Fourth, the influence of remittances on levels of poverty is assessed.

4.1.1 The process of economic growth

Economic growth in the 1990-2003 period went through two phases. In the first phase, rapid output growth lasted until 1995. In the second phase, the growth of Gross Domestic Product (GDP) has decelerated (Graph 1). Thus, while the average annual rate of growth of GDP was 6 percent in the 1990-1995 phase, this rate declined to 2.6 percent in the 1996-2003 phase. Despite this slowdown, the average annual rate of GDP growth was higher in El Salvador (4.9 percent) than in the Latin America and Caribbean region.(3.4 percent) during the 1990-1999 period (World Bank, 2001).

In the first phase, rapid output growth was in part explained by the economic policy reforms implemented since 1989 and by the consequences of the Peace Accords adopted in 1992. Trade and financial liberalization were the most important areas of policy reforms. Trade liberalization brought about the end of protectionism under the

import-substitution industrialization strategy, while financial liberalization aimed to eliminate the financial repression associated with the nationalized banking system of the 1980s (Rivera Campos, 2000). The Peace Accords encouraged positive expectations about the economic and political prospects of El Salvador and thereby promoted the expansion of aggregate demand. The outcome was rapid growth of total factor productivity between 1992 and 1995. According to Edwards (2003), more than half of the average annual rate of growth of GDP in the 1992-1995 period was due to improvements in productivity.

The lower rates of economic growth of the second phase are, in turn, explained by a complex combination of external and internal causes. One of the key weaknesses of the Salvadoran economy has been a low level of gross domestic investment. As a proportion of GDP, gross domestic investment was already a modest 19.2 percent in the 1992-1995 phase of rapid output growth; this ratio further declined to 16.3 percent in the 1996-2002 period (Graph 3). Edwards (2003) argues that these low levels of investment are incompatible with the achievement of a sustained process of rapid output growth, unless growth in total factor productivity is maintained at extraordinarily high rates.

In part, the slowdown can be explained by external factors, including the recession in the United States, deterioration of the country's terms of trade (mainly due to falling international coffee prices and increasing oil prices), and the reduction of international capital flows to emerging markets. Edwards (2003) estimated that, because of negative effects from the world economy, in the 2000-2002 period the average rate of

growth of GDP in El Salvador was between one or two percentage points lower than it would have been otherwise.

Internal factors have also contributed to the slowdown. Edwards (2003) highlights the urgency of institutional reform in areas such as property rights, legal framework, and judiciary system. A reduction of the levels of corruption and red tape is also critical. Mechanisms to facilitate secure transactions and protect personal safety are badly needed. These institutional reforms are necessary to stimulate private investment to rise to the levels required for rapid and sustained output growth.

Economic growth has been accompanied by sustained macroeconomic stability. Inflation rates have been very low, financial deepening ratios increased after the nationalized commercial banks were privatized during the 1990s, and El Salvador adopted the US dollar as its currency in 2001, thereby substantially restricting the ability of the Central Government to run inflationary fiscal deficits.

Remittances from international migrants have been large compared to GDP (Table 1). They may have been the source of the equivalent of overvaluation due to Dutch disease, therefore reducing the international competitiveness of several sectors of the Salvadoran economy, including agriculture. These effects may explain why, despite the fact that El Salvador was very aggressive, during the early stages of liberalization, in reducing barriers to international trade and was one of the beneficiaries of the Caribbean Basin Initiative, which allowed its exports free entry into the United States market, the degree of openness of the Salvadoran economy has lagged behind that of other Central American countries (Monge-Gonzalez, and Gonzalez-Vega, 2004).

The debate about the macroeconomic consequences of remittances is beyond the scope of this dissertation. At the microeconomic level, however, remittances play significant roles in the Salvadoran economy. This dissertation addresses the role of remittances as an insurance substitute for households exposed to substantial systemic shocks in the rural areas. Given the particular circumstances of rural El Salvador, remittances from international migration play a larger than usual role in the management of household risk. It seems that alternative mechanisms for consumption smoothing tend to be less powerful in the circumstances of this small country. Domestic migration is vulnerable to the same threats of systemic shocks as the household of origin and thereby encounters limited opportunities for diversification. For several reasons, financial markets are very thing; rural households in El Salvador have enjoyed less access to credit than their counterparts in many other Latin American countries. Moreover, the volatility of income has been accompanied by very low profitability of agriculture, thus creating additional incentives for migration and for shifts out of agricultural into non-agricultural occupations (Gonzalez-Vega *et al.*, 2004). The next section examines the sources of the low profitability of agriculture.

4.1.2 The agricultural sector

Throughout the period after the Peace Accords, the agricultural sector lagged considerably behind the rest of the Salvadoran economy. The sector's share of GDP fell from 17 percent in 1990 to 12.5 percent in 2000 (FUSADES, 2001). During 1990-2003, the average annual rate of growth of agricultural value added was 1.3 percent (Graph 1). Moreover, agricultural value added was quite volatile during the 1990s (Graph 1). This

poor performance of agriculture raises concerns about the ability of the sector to increase incomes and employment in the rural areas, where 41 percent of the population lived and where the incidence of poverty was 54 percent by 2000.

Among factors that explain the poor performance of agriculture are the following: an appreciation of the real exchange rate, mostly due to high volumes of remittances; international price shocks, particularly in the coffee sector; and adverse climate shocks. Since 1993, in response to the growing inflows of foreign exchange, the Central Bank of El Salvador implemented a policy that aimed at stabilizing the nominal exchange rate at a value around 8.75 colones per 1 US dollar. These efforts were not sufficient, however, to avoid a real overvaluation. Given a fixed nominal exchange rate and a rate of domestic inflation higher than the rate of international inflation up to 1997, the result was a real appreciation that negatively affected agricultural exports. Moreover, international coffee and sugar prices considerably declined in recent years. Average coffee prices for domestic producers declined 29 percent per year during the 1998-2000/01 period (FUSADES, 2001).

In the 1990s, El Salvador suffered from important episodes of drought due to "El Niño". The most important episodes took place in 1991-1992, 1994-1995, 1997-1998 and 2001. The eastern region of El Salvador, specifically the departments of La Unión, Morazán, San Miguel, and Usulután, were most affected by the droughts, especially in 2001. These events created major risk-management challenges for rural households.

In 2001, El Salvador was hit by two major earthquakes (January 13 and February 13). These earthquakes caused significant damage throughout most of the

country, with the exception of four departments (Chalatenango, Cabañas, Morazán, and La Unión). In the rural areas, most of the estimated losses came from damage to dwellings, the coffee sector, and infrastructure, in particular roads (Pérez, 2001). The coffee sector was among the most affected, with estimated losses of US$53 million, mainly because of damage to 59 *beneficios*, the industrial plants where coffee berries are processed. The estimated loss of 3,861 permanent jobs in the coffee sector was also a significant impact (Pérez, 2001).

Given its very small territory, many adverse climate events become systemic shocks at the national level in El Salvador. Therefore, one of the most important challenges to the development of formal insurance and credit institutions has been to find ways to cope with these persistent systemic shocks, particularly in the rural areas of El Salvador. In this dissertation, I argue that Salvadoran rural households have followed a strategy to diversify their sources of income through international migration-cum-remittances, as a way to cope with systemic risks at the national level.

4.1.3 Migration, remittances and poverty

During the civil war of the 1980s, international migration was substantial. The migration flows were expected, however, to decline after the Peace Accords of 1992. Migration, nevertheless, continued in large scale.. In the rural areas, the crisis of profitability in agriculture and adverse shocks such as droughts, earthquakes, and declining coffee prices increased the willingness to migrate. The existence of social networks formed through years of migration to the U.S. reduced, in turn, the transaction costs involved and increased the ability to migrate. These factors may explain the

continuity of international migration in El Salvador. This dissertation does not attempt to explain migration, *per se*. Rather, it focuses on the patterns of remittances that accompany these migration flows and on their role as an informal insurance mechanism to address systemic risk in the rural areas.

Nobody exactly knows how many Salvadorans there are in the United States. The data from the United States Census may be considered as the minimum number. Table 2 shows the estimated number of Salvadorans in the United States and in El Salvador. Based on the U.S. censuses, between 1990 and 2000, Salvadoran immigration grew by 16 percent. However, according to the Mumford Institute, while the 2000 Census did a very good job of counting Hispanics, it performed poorly in identifying their origin. In the last two decennial censuses, people who identified themselves as Hispanic were asked to check as Mexican, Puerto Rican, or Cuban, or to write in another Hispanic category. The problem with the 2000 Census was that no examples of other categories were provided. As a result, an unprecedented number were counted as "Other Hispanic" and the numbers of specific Hispanic groups were severely underestimated. The Mumford Institute improved the estimates of the size of every Hispanic group, compared to those relying solely on the Hispanic origin question in Census 2000.[14] Based on the Mumford estimates, Salvadoran immigration in the last decade grew 92 percent. That is, the number of migrants almost doubled.

Data from Salvadoran sources about migration may suffer from less measurement errors. Based on the Multi-purpose Household Survey of El Salvador, 16 percent of households reported at least one member of the family living abroad in 1999

[14] (See: http://www.albany.edu/mumford/census for details of the procedure.

(Andrade-Eekhoff, 2003). However, as Graph 2 shows, there are important differences among the three geographic regions that encompass the 14 departments of El Salvador: western (Ahuachapán, Santa Ana, Sonsonate), central (Chalatenango, La Libertad, San Salvador, Cuscatlán, La Paz, Cabañas, San Vicente), and eastern (Usulután, San Miguel, Morazán and La Unión). On average, the households that reported at least one member living abroad are 14 percent in the western region, 16 percent in the central region, and 25 percent in the eastern region. The eastern region was affected by the civil war in the 1980s and by droughts in the 1990s.

The Multi-purpose Household Surveys provide information about the number and proportion of households that receive remittances in El Salvador. Table 3 shows the data for the years 1992-1993, 1995, and 2000. In 2000, almost one-fifth of all households reported remittances. The proportion of households that receive remittances increased in the 1990s, especially in rural compared to urban areas. In rural areas, this proportion increased from 13 percent in 1992-93 to 20 percent in 2000.

Based on the head-count index of poverty, given by the proportion of the number of people or of households for whom income is less than a given poverty line, the incidence of poverty is higher in the rural than in the urban areas of El Salvador.[15] Indeed, 65 percent of rural households and 53 percent of urban households were poor in 1992 (Table 4). Thereafter, the reduction in the incidence of poverty was more rapid in urban than in rural areas. Between 1992 and 2002, the incidence of poverty declined

[15] In El Salvador, households are considered to be relatively poor when their incomes are more than the cost of the basic basket of food but less than the cost of two food baskets, according to the methodology of The World Bank. The Direction General of Statistics and Censuses of El Salvador establishes the cost of the basic food basket for the urban and for the rural areas. This cost is the basis to estimate the extreme or absolute poverty line.

22 percentage points in urban areas, compared to a decline of 16 percentage points in rural areas (Table 4). The main reduction of rural poverty has occurred since 1998, despite the slowdown in economic growth and the earthquakes of 2001. This recent reduction in rural poverty at a time when economic growth has decelerated most likely reflects the process of structural transformation that has been taking place in the rural areas, as rural households have shifted their labor force from agricultural to non-agricultural occupations, into local non-agricultural jobs, the creation of microenterprises, and international migration (Gonzalez-Vega *et al*., 2004).

Incomes and, therefore, the poverty status of rural households are very volatile in El Salvador. The panel data for rural households used in this dissertation reveals that, throughout the entire 1995-2001 period, 12 and 25 percent of the households were always non-poor and always poor, respectively. This means that 63 percent of the households in this sample were poor at least in one of the four years for which there was a survey (Table 5). Therefore, the majority of Salvadoran rural households enters or exits the category of the poor each year. This is one more indication of the significance of risk management in the livelihood strategies of these rural households.

Table 6 reports the sources of household income by poverty status. Agricultural income is relatively more important for those households that are always poor or are poor in three out of the four years of survey observations. Non-agricultural income is, on average, comparatively more important for households that are non-poor or poor in just one out of the four years. Transfers, among which remittances are the most important component, are higher for those households that are sometimes poor in comparison to those that are always poor or non-poor. Therefore, it seems that

remittances play a critical role for households that may become poor in specific years due to income shocks.

To explore the influence of remittances on levels of rural poverty, Table 7 compares the head-count index on the basis of levels of household income with and without remittances. If remittances were subtracted from household income, on average the incidence of poverty would increase 3.4 percentage points in 1995 and1997 and 7.8 percentage points in 1999 and 2001. The effect of remittances is even more important in the reduction of extreme poverty. For instance, in 2001, if remittances are added to household income, the incidence of extreme poverty decreases by 9 percentage points. The importance of remittances in allowing rural households to keep their consumption levels above the poverty line, despite adverse shocks, brings them to the center of household livelihood and risk management strategies.

4.2 Description of the surveys of rural households in El Salvador

4.2.1 General information about the National Rural Household Surveys

To analyze remittances as an informal insurance mechanism, I use the National Rural Household Surveys of El Salvador. Under the Broadening Access and Strengthening Input Market Systems (BASIS) research program in El Salvador, the Rural Finance Program at The Ohio State University (OSU) and the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES) implemented the Second and Third National Rural Household Surveys in 1998 and 2000. FUSADES, in collaboration with The World Bank, had implemented the First National Rural Household Survey in 1996. In 2002, after completion of the BASIS program,

FUSADES and OSU implemented the Fourth Survey. All the information gathered by the surveys was for the previous calendar year (that is, the information refers to 1995, 1997, 1999 and 2001). The design and careful implementation of these surveys allowed the construction of the longitudinal panel used in this dissertation.

The survey of 1996 incorporated 628 households, randomly selected from all regions of El Salvador. The stratified sample was designed to be representative of the rural population, at a 10-percent level of significance. It was also designed to reflect the distribution of rural households according to their main economic activities, namely into categories of self-employed land cultivators, agricultural workers, and non-agricultural workers (López, 2000; Rodríguez-Meza and González-Vega, 2004). Each department is represented in the sample according to the proportion of households within the three categories of occupational status that resides in the department, based on the 1992 census.

The interviews used a questionnaire adapted from the World Bank's Living Standards Measurement Survey. Rural households were questioned about levels of education, health, occupation, assets, income generation activities, land use, access to markets, migration and remittances, financial transactions, shocks and so forth. There is no detailed information, however, regarding household consumption or about income flows generated by migrants, except for the remittances they send home.

4.2.2 Description of the four-observation panel data set of Salvadoran rural households

The four-observation unbalanced panel of rural households is based on the survey of 1996, which incorporated 628 randomly selected households. A supplemental survey of 110 households, including only self-employed land cultivators, was taken at the same time. Twenty-four households of the main sample, all self-employed land cultivators, which had been interviewed only in 1996, were replaced by households in the supplemental sample. This method made it possible to have observations for these households for the four years of the panel. Given that the survey of 1996 was proportionately stratified by department, these replacements were carefully selected from residents of the same department. This reduced somewhat the importance of attrition. In the resulting unbalanced panel, the total number of observations (households times the number of years that each household was actually surveyed) is 2,040.

Table 8 shows the distribution of households in the panel by migration and remittance status. In 1995, two-thirds of the households did not have migrants. Almost one-fourth of the households had at least one international migrant, typically to the United States. Almost one-fifth of the households received remittances in that year, mostly international remittances. The year of 1997 shows a similar pattern, but the proportion of households with international migrants and no remittances declined from 10 percent in 1995 to 6 percent in 1997. In general, it is reasonable to expect that an international migrant does not start sending remittances to the rural household

immediately upon arrival to the United States. Changes in the pace of migration would then be reflected in this lag. With sustained migration, the share of rural households with remittances rapidly augmented. The proportion of households that received international remittances increased from 14 percent in 1997 to 22 percent in 1999 (following Hurricane Mitch) and 30 percent in 2001 (the year of the earthquakes).

The cumulative rate of attrition in the panel is 28 percent between 1996 and 2002. Most of the attrition took place during the second wave of interviews in 1998.[16] The first survey in 1996 had been thought out to generate a cross-sectional data set; then, the specific address of the households was not carefully recorded for return visits. As a consequence, the rate of attrition for the second wave was 22 percent of the original sample. Table 9 shows the distribution of attritors by migration and remittances status. The distribution of households interviewed in 1996 that became attritors by 1998 is very similar to the distribution of households that continued in the second wave. For instance, almost two-thirds of both groups of households did not have migrants and about 14 percent of them received international remittances in 1997. The main difference is that the proportion of households with international migrants and no remittances is 6 percent in the second wave and 8 percent in the group of attritors. A test for the lack of endogeneity of remittances in the explanation of attrition is presented in Chapter 5.

Table 10 shows socio-economic features for the rural households in the four-observation unbalanced panel data set. Some of the most important features are the

[16] The surveys were implemented early in 1996, 1998, 2000 and 2002, to record information about the preceding calendar year.

following: (a) the proportion of households with a woman as head of the household increased from 8 percent in 1995 to 16 percent in 2001, which may in part reflect the migration of husbands ahead of the rest of the family; (b) the median number of persons per bedroom, as a proxy for levels of poverty, decreased from 4 persons in 1995 to 3 persons in 2001; (c) the level of schooling of the labor force increased, as children with higher levels of education than their parents joined the labor force each year; (d) the average number of microenterprises per household increased, reflecting a substantial diversification of the sources of household income; (e) the average number of household members who do not work for each worker in the household (that is, a dependency ratio) decreased; (f) the average distance to a paved road, measured by the time spent, decreased, as the authorities invested in a substantial expansion of the network of rural roads. In general, these statistics show improvements in many key socio-economic features of rural standards of living in El Salvador (Gonzalez-Vega *et al*., 2003).

Table 11 shows the evolution of income for the rural households in the panel. The household's total income is computed as the sum of three main components: agricultural income, non-agricultural income, and transfers. In turn, agricultural income equals the sum of three components: net income from own agricultural production, agricultural wages earned, and other incomes related to agriculture, such as rents on land. Non-agricultural income has the equivalent three components: net income from household enterprises, non-agricultural wages earned, and other incomes from non-agricultural sources. Transfers are computed as the sum of remittances and subsidies. Income is measured in colones of constant 1995 purchasing power. Per capita average

income increased from 3,367 colones in 1995 to 6,272 colones in 2001. Incomes almost doubled, as by 2001 per capita average income was 1.9 times its level in 1995.

Two main sources of the growth of total income are non-agricultural income (mostly from microenterprises) and remittances. Average household non-agricultural income increased from 8,932 colones in 1995 to 18,646 colones in 2001. Reflecting a substantial process of structural transformation, on average, non-agricultural income is the most important component of a rural household's income in El Salvador (57 percent by 2001). In contrast, the share of agricultural income decreased, on average, from 39 percent in 1995 to 24 percent in 2001. At the aggregate level, the share of the agricultural sector in the GDP fell from 17 percent in 1990 to 11.7 percent in 2002 (FUSADES, 2002).

Moreover, the importance of remittances compared to average total income net of transfers increased from 8 percent in 1995 to 17 percent in 2001, when we take into account all rural households including those that did not receive remittances (Table 11). Furthermore, in the case of those households that received international remittances, their importance compared to average total income net of transfers was 64 percent in 2001 (Table 12). This suggests that some Salvadoran rural households have followed a strategy of diversifying their sources of income through international migration. One key advantage of this type of diversification is that these households can cope with systemic risks that practically affect the whole country, such as the two earthquakes and the drought of 2001.

Table 12 reports the levels of income for the households in the panel, by migrant and remittance status, for the year 2001. Households are classified into five categories:

(1) households with only national remittances; (2) households with only national migrants, but with no remittances; (3) households with at least one international migrant and remittances; (4) households with at least one international migrant, but with no remittances; and (5) households without migrants.

The households that receive international remittances have the highest average and median per capita income, except for the average per capita income of households with national migrants and no remittances.[17] Total household income net of transfers is higher, however, for households without migrants than for those with international remittances. In the case of migration, less household members are left behind as part of the local labor force. This would put downward pressure on household income net of remittances. In the case of households without migrants, however, the household's total labor force generates incomes locally. In diversifying away from agriculture, therefore, households can chose to engage in non-agricultural activities locally or send some household members abroad (Gonzalez-Vega *et al*., 2004). Because of the high fixed costs of migrating, some households may be constrained in this option.

In contrast, in 2001 households with only national remittances had the lowest average and median per capita income among the five categories (Table 12). These are most likely households with limited opportunities in their place of residence and limited resources to finance international migration. Domestic migration does not generate, however, high levels of transfers for the rural household. Actually, in 2001 the average amount of international remittances was 3.4 times the average amount of national

[17] This result is due to one household with a very large income. Actually, in 2001, the median per capita income of households that received international remittances is 1.9 times higher compared to those households with national migrants and no remittances (Table 12).

remittances. Since El Salvador suffered important systemic shocks in that year, it is likely that national remittances were negatively affected by these events as well. Thus, it seems that it is important to distinguish between households that receive international remittances and those that receive just national remittances, because of the greater ability of the former to diversify the sources of income.

4.3 Summary

In this dissertation, the empirical analysis of remittances as a risk-coping mechanism is based on a four-observation unbalanced panel data set of Salvadoran rural households. All the information gathered by the surveys was for the calendar period of the previous year: 1995, 1997, 1999 and 2001.

Four dimensions of the socio-economic context must be highlighted. First, since the second half of the 1990s, the rate of growth of GDP was lower than in the earlier phase. Second, the agricultural sector lagged considerably behind the rest of the Salvadoran economy. Moreover, agricultural value added was quite volatile during the 1990s. Third, in recent years, El Salvador suffered important international price shocks, particularly in the coffee sector, and adverse climate shocks, such as droughts and earthquakes.

Fourth, international migration, especially to the United States, and the associated remittances play a key role in the recent history of El Salvador. These phenomena seem to reflect rural household strategies to diversify the sources of income away from agriculture and toward non-agricultural activities and migration-cum-remittances. Non-agricultural income is the most important component of the

Salvadoran rural households' income. One key advantage of remittances as diversification is that these households can cope with systemic risks that practically affect the whole country.

CHAPTER 5

ECONOMETRIC RESULTS

5.1 Estimation of the permanent component of income

The theoretical model indicates that expected earnings should be a major determinant of the amount of remittances received by a rural household. In this dissertation, *expected* earnings (E_{ht}) are treated as the outcome of an estimation of the permanent component of income. According to the approach adopted here, a household's permanent income can be approximated by the predicted value obtained from the estimation of an earnings function, specified as a relationship between income and its determinants (Equation 22). To implement this approach, I estimate Equation (30). The estimation generates a predicted value of income net of transfers for each household, in each period. I use the fixed-effects estimator, according to the following specification:

$$Y_{it} = c + \gamma_1 \, eductotal + \gamma_2 \, workout + \gamma_3 \, work\ agric + \gamma_4 \, nmicro + \gamma_5 \, animalv + \gamma_6 \, crowding + \gamma_7 \, asist + \gamma_8 \, yr01 + \gamma_9 \, yr99 + \gamma_{10} \, yr97 + \alpha_i + \varepsilon_{it} \quad (30)$$

The definition of the variables used is as follows. The dependent variable is the observed annual income of the household net of remittances and subsidies, measured in Salvadoran colones of 1995. Household income is computed as the sum of earnings

from two main sources: agricultural and non-agricultural activities. Agricultural income equals the sum of three components: net income from the household's own agricultural production, agricultural wages earned by household members, and other incomes related to agriculture, such as rents on land. Non-agricultural income results from the equivalent three components: earnings from self-employment (mostly microenterprises), waged employment, and other sources.

Equation (30) explains income net of transfers as a function of human capital, diversification of the household's portfolio of sources of income, and opportunities for market participation. The explanatory variables are described below.

- *Eductotal* is a proxy for the stock of education of the rural household's labor force actually employed during the year. Specifically, it is measured as the sum of the years of schooling for all members of the household who work in income-generating activities.
- *Workout* is the number of members of the household who work outside the household's farm and microenterprises, in someone else's activities.
- *Work agric* is the number of members of the household who work in agricultural production within the household.
- *Nmicro* is the number of microenterprises operated by the household.
- *Animalv* is the value of livestock, at the end of the year.
- *Crowding* is the number of household members per bedroom in the household.
- *Assist* is a dummy variable for the use of agricultural technical assistance. If technical assistance is used, the variable is equal to one, zero otherwise.

- Three dummy variables for the years 2001, 1999 and 1997. The dummy is one for observations in a given year, zero otherwise.

The results for the regression equation (30), using the fixed-effects estimator and the four survey observations of the unbalanced panel data of Salvadoran rural households (2,040 observations) are shown in Table 13.[18] First, the overall predictive power of the equation and the significance of the coefficients provide a good foundation in order to obtain the predicted value of income net of transfers as a proxy for the permanent component of income. Second, all coefficients have the expected sign and are statistically significant, except for the coefficient of *assist*, which is not significant, and the coefficient of *crowding*, which does not exhibit the expected sign and is not significant.

Higher levels of schooling of the workforce actually employed, as a proxy for human capital, are associated with higher household incomes (Table 13). A larger number of microenterprises, a larger number of jobs held outside the household, and a higher value of livestock, as indicators of the ability of the household for income diversification, result in higher incomes. Households that allocate a larger number of the members of their labor force to their own agricultural activities generate lower incomes. Finally, the year-specific dummy variables, which capture effects not included in other explanatory variables, are positive and statistically significant for the years 1999 and 2001, with respect to 1995. The higher incomes generated in the more recent years may reflect the positive impact of the expansion of the road infrastructure and provision of

[18] Rodríguez-Meza, Southgate and González-Vega (2004) estimated a similar equation using income per capita net of transfers as the dependent variable and four survey observations of a balanced panel data set of 427 Salvadoran rural households.

other public services, such as water and electricity (critical for the development of microenterprises), which have allowed these rural household to diversify away from agriculture.

5.2 Relationship of remittances with income, borrowing and income shocks

5.2.1 Relationship between remittances and expected income

In order to analyze the relationship between remittances and expected rural household earnings (E_{ht}), I use the model described in Equation (23). For this purpose, I estimate random-effects probit and Tobit regressions, using the four survey observations for the unbalanced panel of Salvadoran rural households. The probit and Tobit models determine the likelihood of receiving remittances and the monetary outcome of the remittance decision (whether to remit and at what level), respectively.

To accomplish this, I estimate Equation (31) using the random-effects estimator.

$$R_{it} = c + \beta_1\, income\_p + \beta_2\, NS_{it}*IM + \beta_3\, PS_{it}*IM + \beta_4\, NS_{it}*NM + \beta_5\, PS_{it}*NM + \beta_6\, L_{it} + \delta_1\, woman\ head + \delta_2\, age\ head + \delta_3\, (age\ head)^2 + \delta_4\, nmigrants + \delta_5\, dland + \delta_6\, deast + \delta_7\, dyr01 + \delta_8\, dyr99 + \delta_9\, dyr97 + \alpha_i + \varepsilon_{it} \quad (31)$$

The dependent variable in the probit regression is one if the household receives a positive amount of remittances; otherwise it is zero. In the Tobit regression, the dependent variable is the amount received when the household gets a positive remittance; otherwise it is zero. The explanatory variables are described below.

- *Income_p* is the predicted value of income net of transfers obtained from Equation (30). This is the proxy for expected household earnings.

- NS_{it}*IM is the negative income shock, measured as the absolute value of a negative deviation of actual from expected income, as a percentage of the household's expected income, for the case of households with international migrants.
- PS_{it}*IM is the positive income shock, measured as the value of a positive deviation of actual from expected income, as a percentage of the household's expected income, for the case of households with international migrants.
- NS_{it}*NM is the negative income shock, measured as the absolute value of a negative deviation of actual from expected income, as a percentage of the household's expected income, for the case of households with national migrants.
- PS_{it}*NM is the positive income shock, measured as the value of a positive deviation of actual from expected income, as a percentage of the household's expected income for the case of households with national migrants.
- L_{it} is the annualized amount of the loan received in the current year, in real colones of 1995;[19]
- *Woman head* is a dummy variable equal to one if the head of the household is a woman, zero otherwise.
- *Age head* is the age of the head of the household, in years.
- (*Age head*)^2 is the age square of the head of the household.
- *Nmigrants* is the number of migrants per household.
- *dland* is a dummy variable equal to one if the household possesses land, under any type of tenure status, zero otherwise.

[19] The amount of the loan is weighted by the term to maturity, if less than a year.

- *deast* is a dummy variable for the eastern region of El Salvador, which has been more affected by adverse climate shocks, such as drought, during the period of study.
- Three dummy variables for the years 2001, 1999 and 1997. The dummy is one for observations in a given year, zero otherwise.

The results of the estimation of regression equation (31), using the random-effects probit and Tobit estimators, are shown in Table 14. The coefficients for the expected income variable, both in the probit and Tobit models, have the correct signs, as predicted by a remittance function based on risk-sharing models (Equations 10 and 20). The likelihood of receiving remittances decreases if expected household income increases; this relationship is confirmed at the one percent of level of significance.

Expected income increases when the household's endowment of resources (human capital and land) increases and productive opportunities for the allocation of this endowment improve. Everything else constant, including the unobserved income of the migrant, higher expected household income would reduce the claim of the rural household in the risk-sharing exercise. An inverse relationship between the amount of remittances and expected income is confirmed at the 5 percent of level of significance. In this respect, the result is also compatible with the prediction of a model of remittances based on altruism. Both the probability of receiving a remittance and the amount of the remittance are decreasing in the Salvadoran rural household's expected income.

5.2.2 The relationship between remittances and income shocks

Their insurance nature requires the presence and amounts of remittances to be contingent on the materialization of shocks. Therefore, we expect remittances to be directly related to the size of adverse shocks. To analyze this relationship, income shocks are measured as the residual in the fixed-effects estimation of Equation 30. In the analysis, I allow for asymmetrical effects of positive and negative income shocks and for differences between international and national migrants. The latter distinction is critical in examining the role of the two types of remittances in allowing the household to cope with systemic shocks. In order to take into account how comparatively important the income shock is for each rural household, I actually measure the income shock as a percentage of the household's expected income.

Focusing first on the results from the random-effects probit model, the coefficients for the negative income shock variables, for both types of migrants, exhibit positive signs and are statistically significant. Thus, the likelihood of receiving a remittance increases when a rural household has to cope with a negative income shock. This relationship is confirmed at the one-percent level of significance in the case of rural households with international migrants and at the five-percent level of significance in the case of households with only domestic migrants. This difference offers additional support to the hypothesis about the more powerful role of international remittances, compared to national remittances, as a risk-coping strategy.

In contrast, the coefficients for the positive income shock variables do not have the signs as expected; the coefficient for households with international migrants, however, is not statistically significant and the coefficient for households with national migrants

is significant only at the 10 percent level. This suggests that remittances are indeed equivalent to an insurance mechanism. If there is a loss, the payment materializes, as there is a pay-off only in the case of adverse outcomes. That remittances do not significantly decline when the household enjoys a positive shock suggests, moreover, that other motives, in addition to insurance, explain remittances.

Second, based on the results from the random-effects tobit model, a positive relationship between the amount of remittances and the relative magnitude of negative income shocks is also found. This relationship, however, is statistically significant only for households with international migrants, at the one-percent of level of significance. Thus, as predicted by the risk-sharing model, the amount of remittances is increasing in the Salvadoran rural household's negative income shocks, and it is significant when risk sharing is accomplished in a broader spatial context. The combined interpretation of the probit and Tobit results for national migrants suggests that they are more willing to send remittances in the case of an adverse shock for the rural household but that, possibly as a consequence of covariant outcomes that may reduce their ability to do so, the amount sent is not significantly dependent on the relative magnitude of the shock.

These results offer empirical support to the hypothesis about the role of international remittances as a very effective informal insurance mechanism. Given the risky rural environment, the small size of El Salvador, and the limitations of formal credit and insurances markets, some rural households have found in international remittances a key mechanism to insure against adverse income shocks. Domestic remittances cannot serve so well as a risk-coping mechanism, possibly because of a

potentially high covariance of the rural household's and the domestic migrant's incomes.

5.2.3 Relationship between remittances and borrowing

Following the theoretical model, I expect that remittances and consumption credit are alternative mechanisms for risk-coping. The coefficient for the loan amount exhibits the expected sign (negative) in both the probit and Tobit regressions, but it is not statistically significant in the random-effects probit regression. Based on the random-effects Tobit model, a negative relationship between the amount of remittances and loan size is confirmed at the 10 percent of level of significance.

There is a possibility that the loan variable is endogenous in the remittance equation, however. In order to test for the exogeneity of this variable, I follow the two-step procedure described in Chapter 3. Thus, I first obtain the residuals from estimating the Tobit model for the loan variable, using the explanatory variables of Equation 31 plus two other variables: *workout* (the number of members of the household who work outside the household's farm and microenterprises) and *animalv* (the value of the livestock at the end of the year). When the residual term is added to the random-effects Tobit model, the coefficient is 0.043 with t statistic = 0.32. Thus, there is no evidence that the loan variable (L_{it}) is endogenous in this equation.

5.2.4 Relationship between remittances and other household characteristics

First, focusing on the random-effects probit regression, the probability of receiving a remittance is increasing in the number of migrants associated with a rural household.

Also, the likelihood of receiving a remittance increases if the rural household is located in the eastern region of El Salvador, if it has a woman as a head, or if it has access to land.

A larger number of migrants reflects both a greater income generation ability located abroad as well as a smaller labor force left behind. Both of these circumstances would explain why the probability of remittances increases with the number of migrants.

The eastern region, which includes the departments of San Miguel, Usulután, La Unión, and Morazán, has two key characteristics: (a) this area has been particularly affected by adverse climate shocks, such as drought, tropical storms and earthquakes, during the period of the study (1995-2001), and (b) this region was the most affected by the civil war in the 1980s, and as a consequence substantial international migration already took place. Moreover, in the 1990s, the network of Salvadoran migrants in the United States facilitated the migration of more Salvadorans, especially from this region. These two characteristics help to understand the strong positive relationship between the likelihood of receiving remittances and the dummy variable for this region.

Second, focusing on the random-effects Tobit regression, the amount of the remittance is increasing in the number of migrants and in the age of the head of the household. If the household has a woman as a head, if it is located in the eastern region or if it possesses land, the amount of remittances tends to increase. All these relationships are confirmed at the one percent level of significance. One the head of the household is a woman, there is a strong probability that the husband has migrated ahead of the family and this would explain a large amount of remittances. The strong positive

relationship between remittances and the fact that the rural household possesses land may reflect an exchange motive, such as the aspiration of inheritance by the migrant. It may also reflect that the household had levels of wealth sufficient to finance migration.

The year of 2001 was especially difficult for Salvadoran rural households because of two earthquakes and a major drought. Thus, the significant positive relationship, confirmed at the one percent level of significance, between the amount of remittances and the dummy variable for this year may be viewed as evidence of the key role of remittances as a risk-coping mechanism. In another section in this chapter, I will compare the role of international and national remittances as a risk-coping mechanism. I expect that international remittances play a more effective role as an informal insurance mechanism than national remittances, especially in a year like 2001, characterized by systemic shocks that affected both rural and urban areas.

5.3 Comparison between international and national remittances

First, it is important to compare the determinants of the decisions to migrate abroad or within the country. In order to accomplish this, I estimate Equation (32) by using the random-effects probit model for the two decisions, whether to migrate abroad or to migrate nationally.

$$M_{it} = c + \gamma_1\ workout + \gamma_2\ work\ agric + \gamma_3\ nmicro + \gamma_4\ crowding + \gamma_5\ yr01 + \gamma_6 yr97 + \gamma_7\ yr95 + \gamma_8\ deast + \gamma_9\ dcentral + \gamma_{10}\ landholding + \alpha_i + \varepsilon_{it} \quad (32)$$

For the decision whether to migrate abroad, the dependent variable is one if the rural household has at least one international migrant and zero otherwise. For the

decision to migrate nationally, the dependent variable is one if the household has only national migrants and zero if it has international migrants or no migrants at all.

Table 15 compares the results for the random-effects probit regressions for the decisions of international and national migration. For the case of whether or not to migrate abroad, the probability to migrate is decreasing in the number of household members who work outside the household's farm and/or microenterprise; this relationship is statistically significant at the one percent level. This may reflect the fact that households attempting to diversify away from agriculture may find non-agricultural jobs or create microenterprises in El Salvador or may migrate abroad. When they do not want to or cannot migrate abroad, they will seek employment opportunities in non-agricultural sectors. Once one considers the broader national and welfare implications of international migration, better job opportunities in the rural areas of El Salvador can be seen as a more attractive an alternative to sending a member of the family abroad. The improvement of these job opportunities should be, therefore, a goal of national policies.

Also, the likelihood to migrate abroad is decreasing in the number of people per bedroom in the household, as a proxy for the level of poverty. This finding may imply that the poorest households cannot send their members abroad and thereby face more constrained opportunities for risk coping. If the adverse shocks are sufficiently strong and repeated, they may fall in a poverty trap (Rodriguez-Meza and Gonzalez-Vega, 2004).

The probability to migrate abroad is increasing if the rural household is located in the eastern region; this relationship is statistically significant at the one percent level

of significance (Table 15). Given that in the 1980s most of the international migration came from rural areas of the eastern region, it appears that the network of Salvadoran migrants, especially in the United States, has helped the migration of more people from this region.

In order to examine the likelihood to migrate abroad through the 1995-2001 period, the year of 1999 was taken as the reference. It appears that the probability to migrate abroad in 1995 or 1997 is lower than in 1999.[20] However, the likelihood to migrate in 2001 is not significantly higher than in 1999 (the *t*-statistic is 0.7, see Table 15). Thus, it seems that in 2001 systemic shocks, two earthquakes and an important drought, had negative effects on international migration from the rural areas.

Actually, Halliday (2004) finds that Salvadoran rural households that experienced home damage due to the 2001 earthquakes were less inclined to send household members to the United States. He explains this result as a consequence of increased marginal utility of allocating the corresponding household members to rebuilding the housing stock. For different reasons, Yang (2003) also finds that the 2001 earthquakes had negative effects on migration in El Salvador. He claims that the systemic shock caused an increase in interest rates in informal credit markets and that this made financing of migration more difficult. Indeed, if greater wealth is needed to pay for the costs of migrating, the 2001 earthquakes would have reduced wealth to levels associated with smaller migration flows.

[20] These relationships are statistically significant at the one and five percent levels of significance for the years of 1997 and 1995, respectively (Table 15).

For the case of national migration, the probability to migrate is decreasing in the number of microenterprises in the household and the relationship is statistically significant. This is an important finding, because it implies that an opportunity for the rural household to begin its own non-agricultural enterprise is an alternative to sending household members to the urban areas of El Salvador.

Some key differences between the likelihood to migrate abroad or nationally are the following: (a) the number of household members that work outside the household's farm or microenterprise is significant in decreasing the probability to migrate abroad, but not nationally; (b) the number of microenterprises in the household is significant in decreasing the likelihood of national migration, but not of international migration; and, (c) if the rural household is located in the eastern region, the probability to migrate abroad increases, but the likelihood for national migration decreases and in both cases the relationship is statistically significant. For the eastern region, the relative cost of migrating abroad, in contrast to domestic migration, seems to have been lowered by the network effects described above.

Table 16 compares the results for regressions of international and national remittances, using the random-effects Tobit estimator. In both cases, a negative relationship between remittances and expected income is confirmed, at the one-percent level of significance for national remittances and at the 10-percent level of significance for international remittances. The coefficient of the age of the head is positive in both cases, but it is only significant for the case of national remittances. In both cases, the amount of remittances is increasing in the number of migrants and when the household possesses land.

There are two key differences between international and national remittances identified here. First, there is a positive and significant relationship between the amount of the international remittance and the dummy variable for the year 2001. In contrast, for the case of national remittances the relationship is negative and also significant.[21] Given that 2001 is characterized by important systemic shocks at the national level, this result confirms the view of this dissertation that international remittances are a superior risk-coping mechanism over national remittances. International remittances only have the ability to destroy the covariance of incomes that results from systemic shocks.

Thus, given the small size of El Salvador, it is very difficult for rural households to insure against systemic shocks at the national level. In this context, international migration-cum-remittances is one of the few options that these households have in order to diversify against this type of risks. Also, there is a positive and significant relationship between international remittances and the dummy variable for the eastern region, but this relationship is negative in the case of national remittances. This result may imply that most of the national remitters did not come from the eastern region and national remittances can not insure their home families for systemic shocks that characterized the region.

5.4 The role of the size of the rural household

In the risk-sharing model developed in Chapter 3, the weights assigned to the utility of the rural household and of its migrants represent their relative power in the

[21] In order to analyze the relationship between remittances and the dummy for 2001, it is important to note that the year of reference is 1999 (see Table16).

determination of the consumption levels of the members of the support network. These weights may reflect, among other factors, the number of members of each household. Thus, the size of the rural household is one factor that may influence the optimum level of remittances.

In order to control for the size of the rural household, I estimate Equation 31 again, this time including this variable. The estimation results are shown in Table 17. There are few differences with the results obtained so far. Most importantly, the positive and statistically significant relationship between the amount of remittances and negative income shocks is found only for households with international migrants. This result confirms that domestic remittances are not as powerful as risk-coping mechanism as international remittances are. Also, a negative relationship between the amount of remittances and expected income is confirmed only at the 10 percent of level of significance. Without including household size as a variable, this relationship is significant at the 5 percent of level of significance. This may reflect some correlation between household size and the total income it generates. The coefficient for the loan amount is not statistically significant. The relationship between remittances and other household characteristics are the same as those I found in the specification that does not include household size, except for the age of the head of the household, which is no longer significant.

Also, I estimate the regressions for international and national remittances again, including the size of the rural household. The estimation results are shown in Table 18. There are two key differences between international and national remittances in this case. First, although, a negative relationship between remittances and expected income

is found in both cases, it is only significant for national remittances. Second, there is a positive and significant relationship between national remittances and household size. In contrast, for the case of international remittances the relationship is negative and also significant. In order to explain this finding, it may be important to note that a key difference between international and national migrants is the distance to their home family. It seems that distance plays an important role in influencing the relationship between the amount of remittances and size of household. Domestic migrants are closer to home and as a result will have, through family pressure, less ability to compensate for the weight implied by a larger rural household. The amount of their remittances will be positively influenced by household size as a result. This power of the larger household gets diluted as distance increases, as with international migration. Moreover, smaller household size may be an indicator of a family that is going through the gradual transition of moving from El Salvador to the United States, while larger households may reflect a recent migrant with less ability to send remittances.

5.5 An analysis of the effect of remittances on attrition

In this dissertation, the four survey observations (1995-1997-1999-2001) for the unbalanced panel of rural households are based on the original design of the survey of 1996, which incorporated 628 households. The accumulated rate of attrition of this panel is 28 percent. Most of this attrition came during the second wave of interviews in 1998 (22 percent), as already discussed.

The specific objective of this analysis is to examine the effect of remittances on the attrition of rural households in this panel data set. Fitzgerald, Gottschalk, and

Moffitt (1998) study the effect of attrition in the Michigan Panel Study on Income Dynamics (PSID). They provide a statistical framework for conducting tests for attrition bias. Specifically, they develop a test for the case of selection on observables variables. They define *A* as an attrition dummy equal to one if the observation (in this case, for a particular household) is missing the value of the dependent variable (*y*) because of attrition, zero otherwise. They next define the probability function Pr ($A = 0 \mid y, x, z$). These authors claim that selection on observables occurs when the following condition holds:

$$\Pr(A = 0 \mid y, x, z) = \Pr(A = 0 \mid x, z) \tag{33}$$

Thus, the critical variable in the selection on observables is *z*, a variable that affects attrition propensities and is also related to the density of *y* conditional on *x*. These authors define the following weights:

$$w(z, x) = \left[\frac{\Pr(A = 0 \mid z, x)}{\Pr(A = 0 \mid x)} \right]^{-1} \tag{34}$$

The numerator of the weights is the probability of retention in the sample. If *z* is not a determinant of attrition, the weights equal one and no attrition bias is present.

The application of this method to attrition in panel data is straightforward if a lagged value of *y*, such as *y* at the initial wave of the panel, when all observation units are present, plays the role of *z*. Two sufficient conditions for the absence of attrition bias on observables is that the weights equal one, which implies that *z* does not affect attrition, or that *z* is independent of *y* conditional on *x (*Fitzgerald, Gottschalk, and Moffitt 1998, p.262).

In this dissertation, remittances at the initial wave of the panel (1995) can play the role of *z*. Thus, one test is just to determine whether 1995 remittances significantly affect attrition. I use attrition probability equations as a function of 1995 characteristics (Fitzgerald, Gottschalk, and Moffitt, 1998). I then estimate probit equations for the probability of having ever been a nonresponse by 2001. Thus, the estimates of the attrition probits can be viewed as a model of cumulative attrition.

Table 19 shows attrition probits focus on the effect of remittances on the attrition of rural households. The dependent variable is equal to one if the household is an attritor in any of the three survey observations after 1995; zero otherwise. The results show that the 1995 remittances do not have a significant correlation with future nonresponse in Models 1 and 3. Regarding Model 2, remittances are barely significant at the 10 percent level (the p-value is 0.092). The difference between Model 2 and Model 3 is just the variable about size of the household. With this addition, remittances are no longer significant at the 10 percent level. In general, there is no strong empirical evidence that 1995 remittances significantly affect the probability of being an attritor by 2001.

As an additional step in this analysis, I can compute the weights defined in Equation (34) and estimate the equation of remittances using the inverse selection probabilities. If the weights equal one or close to one, I can expect that the results between the weighted and not weighted remittances equations should not vary significantly. I compute the weights using the Model 2. The results of the weighted regression of remittances compared with the not weighted regression are shown in Table 20. In general, the sign and the statistical significance of the coefficients are the

same, except for the year 1997. Thus, the key results regarding the relationship between remittances, expected income, negative income shocks, loan and other characteristics of the household do not change under this comparison.

CHAPTER 6

CONCLUSIONS

This dissertation analyzes the role of national and international remittances as risk-coping strategies in an environment characterized by substantial systemic risk. Several hypotheses about this role are tested for the case of rural households in El Salvador. This is a useful illustration, given pronounced features of the rural areas of this country and a long history of migration to the United States. Moreover, to accomplish this, I use observations of a four-survey panel data set in to the analysis of flows of remittances from both national and international migrants. This panel is exceptional in the breadth of the information available and the careful field work that accompanied the processes of data collection and construction of household income and other composite variables. Moreover, the period covered by the panel observations (1995-2001) was marked by significant systemic shocks from nature and from international markets, thereby offering an opportunity to test hypotheses about remittances as informal insurance. The analysis highlights key differences between national and international remittances. I also explore the relationship between remittances and borrowing as alternative mechanisms that rural households may used to smooth consumption.

In the study of the relationships between remittances, on the one hand, and expected household earnings, income shocks, and loans, on the other, I follow a risk sharing approach. The main test is to verify if, controlling for other things, the amount of remittances received by Salvadoran rural households is higher when they must cope with adverse income shocks. First, I develop a benchmark model of risk sharing within a network of family members with geographically diversified locations and without considering access to credit. The main predictions of the benchmark model are that the optimal amount of remittances to the rural household in the home country is decreasing in the expected earnings and positively related to negative income shocks of the household.

For a domestic migrant, subject to shocks covariant with those that also afflict the rural household, however, the optimum amount of remittances will be lower, compared to an international migrant for which this covariant component does not exist. These circumstances also reduce the probability that the domestic migrant will remit in the presence of an adverse systemic shock, in contrast with the larger remittance that will be expected from the international migrant in these circumstances. The model that includes the possibility of borrowing for consumption purposes by rural households predicts that the optimal amount of the remittance is decreasing in the size of the loan, in the same period when the loan is taken.

Using the four survey observations of an unbalanced panel data set for Salvadoran rural households, the econometric results show that both the probability of receiving remittances and the amount of the remittances are decreasing in the expected earnings of the Salvadoran rural household, as predicted by the risk-sharing model. The Tobit

model further provides evidence that there is a positive relationship between the amount of remittances and the relative magnitude of negative income shocks. This relationship, however, is statistically significant only for households with international migrants. This result gives empirical support for the greater scope of international remittances as an informal insurance mechanism.

Moreover, a key difference between international and national remittances is that there is a positive and significant relationship between international remittances and the dummy variable for the year 2001. In contrast, for the case of national remittances, this relationship is negative and also significant. Given that the year of 2001 was characterized by important systemic shocks at the national level, this result confirms that domestic remittances are less effective as a risk-coping mechanism than international remittances, because of the potentially high covariance between the income of the domestic migrant and that of the rural household.

Given a risky rural environment, the small size of El Salvador, and the limitations of formal credit and insurances markets, it appears that some rural households have followed a strategy of using international migration-cum-remittances as an insurance mechanism capable of protecting them even from systemic shocks. In contrast, national migration cannot generate this important outcome.

Regarding the relationship between remittances and consumption credit as potential alternative mechanisms for risk-coping, controlling for other variables, the level of remittances is expected to be inversely related to the amount of the rural household's borrowing in the current period. A negative relationship between the amount of remittances and loan size is confirmed only at the 10 percent level of

significance. Moreover, when household size is included as a control variable the relationship is still negative, but no longer significant. In interpreting this result, it is important to acknowledge that credit plays different roles in the economic activities of the household. If credit and remittances are used for consumption smoothing, it could be expected that they would be partial substitutes. However, credit may finance the costs of migrating and may influence patterns of migration across households as well as the flow of remittances over time. In this case, the relationship between credit and remittances would be positive. Also, the proceeds from borrowing may be used to finance income-generating activities or to accumulate physical and human capital, which may have different effects on the patterns of migration-cum-remittances. Therefore, the study of remittances and borrowing as alternative risk-coping mechanisms and in the other roles of credit is indeed a topic that deserves additional research in the field of development economics, beyond the scope of this dissertation.

I find that the amount of remittances increases if the rural household is located in the eastern region of El Salvador. Two key characteristics of the eastern region help to understand the strong positive relationship between remittances and the dummy variable for this region. First, this area has been particularly affected by adverse climate shocks, such as drought, tropical storms, and earthquakes, during our period of study (1995-2001). Second, this region was the zone most affected by the civil war in the 1980s, and as a consequence important international migration has taken place in the region since that time. In the 1990s, the network of Salvadoran migrants already in the United States facilitated the migration of more Salvadorans from this region.

I also find that remittances increase if the rural household has access to land or if the household has a woman as a head. The strong positive relationship between remittances and the fact that the rural household possesses land may reflect an exchange motive, such as the aspiration of inheritance by the migrant. It may also reflect that the household initially had levels of wealth sufficient to finance migration or possessed an asset that could be pledged as collateral in order to borrow for that purpose. When the head of the household is a woman, there is a strong probability that the husband has migrated ahead of the family and that this would explain a large amount of remittances.

The last finding that I want to highlight in this section is that the probability to migrate abroad is decreasing in the number of household members who work outside the household's farm. This may reflect the fact that households attempting to diversify away from agriculture may either find non-agricultural jobs in El Salvador or migrate abroad. When they do not want to or cannot migrate abroad, they will seek employment opportunities in non-agricultural sectors. This finding is important, because it implies that better job opportunities in the rural areas of El Salvador may be an alternative to sending a member of the family abroad. The improvement of these job opportunities should be, therefore, a goal of national policies.

There are important policy implications from this dissertation. First, given the crucial role of international remittances as a risk-coping mechanism in rural areas of El Salvador, the reduction of transaction costs in sending and receiving remittances from abroad is vital. To reduce the fee for the transaction is central, but the fee is not the only component of the costs that restrict the flows of remittances (Orozco, 2002). In general, transaction costs depend on factors such as distance, infrastructure, technology and

bureaucracy. For instance, the transaction cost is not the same if a member of the rural household must travel to the capital of El Salvador in order to receive the remittance, rather than travel to a closer location. Thus, Salvadoran financial institutions, which are in the business of delivering remittances, should develop a network of branches in several regions of El Salvador. In general, any improvement in technology or reduction in the level of bureaucracy in order to deliver the remittances in less time will have a positive impact on the reduction of transaction costs.

Second, financial institutions in El Salvador should develop insurance instruments that international migrants may be willing to buy for their relatives. For instance, given the recent experience of the earthquakes of 2001, which destroyed or damaged thousands of rural dwellings, many extended households (the rural family and its migrants) would be willing to by earthquake insurance for their houses. Given the systemic nature of these shocks, as discussed in this dissertation, however, the development of such insurance instruments would not be possible without access to international reinsurance. Attracting reinsurers requires, in turn, an improvement of the institutional infrastructure in El Salvador that would make these transactions possible. Third, to increase non-agricultural job opportunities in rural areas of El Salvador may reduce the likelihood of international migration. If there are social costs from this migration, the creation of diversification opportunities within El Salvador would be welfare improving.

Indeed, the diversification of systemic risks in rural areas of El Salvador is a major challenge for any financial or insurance institution. Practically, it is not possible to diversify against these shocks domestically. Salvadoran insurance companies will

require international mechanisms for the pooling of these risks, similar to the efforts at the rural household level, which must follow a strategy to diversify against systemic risks by international migration-cum-remittances. From this perspective, El Salvador cannot have its fate separated from its linkages to external markets.

Finally, I want to acknowledge one limitation in the dissertation. I do not have critical information about the migrants, such as their income, the shocks they suffer, and the demographic characteristics of their households. Ideally, a study of migration and remittances would be based on survey information on both sides of the equation: the rural household and the migrants. Future research with this information would allow further insights into these issues. The exceptional features of the panel data that I have used has allowed me, however, to arrive at important implications for those interested in the welfare of rural households, in El Salvador and similar countries.

APPENDIX A

TABLES

Year	Millions US$	% of GDP	% Growth
1991	790.0	14.9	-
1992	858.0	14.4	8.6
1993	864.1	12.5	0.7
1994	962.5	11.9	11.4
1995	1061.4	11.2	10.3
1996	1086.5	10.5	2.4
1997	1199.5	10.8	10.4
1998	1338.3	11.1	11.6
1999	1373.8	11.0	2.7
2000	1750.7	13.3	27.4
2001	1910.5	13.8	9.1
2002	1935.2	13.5	1.3
2003	2105.3	14.0	8.8

Source: Banco Central de Reserva de El Salvador (Central Bank of Reserve). *Revista Trimestral* (various issues) and own computations.

Table 1: Evolution of Remittances

Salvadorans in	1990	2000
El Salvador	5,110,176	6,276,037
United States (Census)	565,081	655,165
As % of population in ES	11.1	10.4
United States (Adjustment of the census by the Mumford Institute)	583,397	1,117,959
As % of population in ES	11.4	17.8

Source: Dirección General de Estadística y Censos de El Salvador; Census of the United States, 1990 and 2000; Mumford Institute, University of Albany, New York.
Taken from: Andrade-Eekhoff, 2003, p. 9.

Table 2: Salvadorans in El Salvador and the United States

Geographical region	1992-1993		1995		2000	
	Number	Percentage	Number	Percentage	Number	Percentage
Urban	88,532	15.5	111,183	16.2	173,824	19.3
Rural	68,403	13.1	68,219	14.1	109,826	20.4
El Salvador	156,935	14.4	179,402	15.3	283,650	19.7

Source: Multipurpose Household Survey, 1992-1993; 1995; 2000
Taken from: Andrade-Eekhoff, 2003, p. 20.

Table 3: Salvadoran Households with Remittances

	Total	Urban	Rural
1992	58.9	53.2	65.2
1993	60.6	53.1	68.9
1994	52.9	44.2	65.3
1995	46.3	38.3	57.8
1996	51.7	42.4	64.9
1997	48.1	38.7	61.6
1998	44.8	37.8	56.2
1999	41.4	33.2	55.1
2000	38.8	29.9	53.7
2001	38.8	31.2	51.6
2002	36.8	29.5	49.2

Source: PNUD computations based on the Multipurpose Household Survey, various years.
Taken from: PNUD, Informe sobre desarrollo humano: El Salvador 2001; 2003

Table 4: Percentage of Poor Households in El Salvador

Type of family	Number of families	Percentage of families
Always poor	114	25.3
Sometimes-poor 3	108	24.0
Sometimes-poor 2	96	21.3
Sometimes-poor 1	78	17.4
Non-poor	54	12.0
Total	450	100.0

Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 5: Rural Poverty Dynamics (Four-Observations of Panel Data, 1995-2001)

Source of income	As % of average total income
Agricultural	
Always poor	51.9
Sometimes poor-3	41.9
Sometimes poor-2	33.4
Sometimes poor1	27.0
Non-poor	16.7
Non-agricultural	
Always poor	36.8
Sometimes poor-3	38.2
Sometimes poor-2	49.1
Sometimes poor1	55.9
Non-poor	74.2
Transfers	
Always poor	11.3
Sometimes poor-3	19.9
Sometimes poor-2	17.5
Sometimes poor1	17.1
Non-poor	9.1

Note: Only families in the four-years balanced panel of 450 households
Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 6: Source of Income by Poverty Status (Four-Observations of Panel Data)

	Headcount (%)		
	Absolute poor	Relative poor	Total poor
1995			
Income with remittances	38.7	31.4	70.1
Income without remittances	44.1	29.6	73.7
1997			
Income with remittances	43.0	28.4	71.4
Income without remittances	48.1	26.5	74.6
1999			
Income with remittances	24.5	26.5	51.0
Income without remittances	32.0	27.1	59.1
2001			
Income with remittances	15.8	25.8	41.6
Income without remittances	24.9	26.0	49.1

Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 7: Rural Households by Poverty Status with and without Remittances (Four-Observations of Panel Data)

Household with	1995		1997		1999		2001	
	N	%	N	%	N	%	N	%
No-migrants	415	66.1	332	67.3	271	57.8	263	58.4
International migrants and remittances	86	13.7	68	13.8	108	23.0	135	30.0
International migrants- no remittances	63	10.0	29	5.9	40	8.5	16	3.6
Sub-total international migrants	149	23.7	97	19.7	148	31.6	151	33.6
National migrants and remittances	33	5.3	39	7.9	28	6.0	23	5.1
National migrants- no remittances	31	4.9	25	5.1	22	4.7	13	2.9
Sub-total only national migrants	64	10.2	64	13.0	50	10.7	36	8.0
Total before attrition	628	100	493	100	469	100	450	100
Attriters			135	21.5	159	25.3	178	28.3
Total	628		628		628		628	

Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 8: Four-Observation Panel of Salvadoran Rural Households by Migrant and Remittances Status

Household with	1995		1997		1999	
	N	%	N	%	N	%
No-migrants	88	65.2	13	54.2	9	47.4
International migrants and remittances	18	13.3	5	20.8	7	36.8
International migrants- no remittances	11	8.1	3	12.5	3	15.8
National migrants and remittances	11	8.1	1	4.2	0	0.0
National migrants- no remittances	7	5.2	2	8.3	0	0.0
Sub-total	135	100.0	24	100.0	19	100.0
Total	135		159		178	

Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 9: Panel of Salvadoran Rural Households Attriters by Migrant and Remittances Status

Variable	1995	1997	1999	2001
	(n=628)	(n=493)	(n=469)	(n=450)
Household size				
mean	5.9	6.1	6.0	6.0
median	6.0	6.0	6.0	6.0
Age of the head				
mean	46.1	50.1	51.8	53.8
median	45.0	50.0	51.0	54.0
Schooling of the head				
mean	2.9	2.6	2.8	2.6
median	2.0	2.0	2.0	2.0
% of households with a woman as head	8.0	11.8	14.9	16.4
Number of persons per bedroom				
mean	4.3	4.0	4.2	3.9
median	4.0	3.5	3.5	3.0
Total schooling of the labor force				
mean	8.9	10.0	12.4	12.8
median	6.0	7.0	9.0	10.0
Average schooling of the labor force				
mean	3.6	3.5	3.8	3.7
median	3.0	3.0	3.5	3.4
Number of microenterprises				
mean	0.1	0.2	0.3	0.4
Distance to paved road (minutes)				
mean	36.0	36.0	32.0	25.0
median	25.0	25.0	20.0	20.0
Dependency ratio				
mean	2.0	1.9	1.5	1.2

Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES).

Table 10: Four-Observations Panel Data of Rural Households: Socio-Economic Features

Variable in colones of 1995	1995	1997	1999	2001
	(n=628)	(n=493)	(n=469)	(n=450)
Income per capita				
mean	3,367	3,689	5,469	6,272
median	2,400	2,422	3,668	4,503
Total household income				
mean	17,250	19,774	29,042	32,906
median	13,333	13,021	20,273	23,632
Income net of transfers				
mean	15,644	17,884	24,679	26,708
median	11,458	11,514	16,487	18,272
Agric. income				
mean	6,712	7,396	8,016	8,062
median	4,166	3,960	3,620	2,619
Non-agric income				
mean	8,932	10,488	16,663	18,646
median	2,000	1,980	5,953	10,394
Transfers				
mean	1,607	1,891	4,363	6,199
median	0	0	0	1,487
Remittances				
mean	1,313	1,624	3,604	4,753
median	0	0	0	0

Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 11: Four-Observation Panel Data of Salvadoran Rural Households: Income

Variable in colones of 1995	Migrant and Remittances status in 2001					
	1 (n=23)	2 (n=13)	3 (n=135)	4 (n=16)	5 (n=263)	All (n=450)
Income per capita						
mean	3,432	12,202	7,990	4,854	5,431	6,272
median	3,159	3,569	5,991	4,296	4,036	4,503
Total income						
mean	22,498	63,620	39,873	19,561	29,534	32,906
median	16,193	24,724	27,320	18,242	23,082	23,632
Income net of transfers						
mean	16,781	62,368	23,405	18,186	28,026	26,707
Agric. income						
mean	4,910	20,626	6,344	7,169	8,652	8,062
median	2,447	3,767	2,100	7,068	3,436	2,619
Non-agric income						
mean	11,871	41,741	17,061	11,017	19,375	18,646
median	3,430	9,379	6,290	9,822	13,400	10,394
Transfers						
mean	5,717	1,252	16,468	1,375	1,508	6,199
median	4,313	251	10,993	84	63	1,487
Remittances						
mean	4,470		15,082			4,753
median	2,848		10,155			0

1= Households only with national migrants and received remittances.
2=Households only with national migrants, but do not received remittances.
3=Households with at least one international migrant and received remittances.
4=Households with at least one international migrant, but do not received remittances
5=Households without migrants
Source: Own computations based on the surveys of rural households in El Salvador conducted by the Fundación Salvadoreña para el Desarrollo Económico y Social (FUSADES). FUSADES implemented three out of the four observations of this panel data in collaboration with the Rural Finance Program at OSU.

Table 12: From the Four-Observation Panel Data of Rural Households: Income by Migrant and Remittances Status in 2001

Variables	
eductotal	616.3 (7.35)**
work out	3179.2 (6.08)**
work agric	-1990.8 (-4.2)**
nmicro	9718 (8.03)**
animalv	0.31 (5.58)**
crowding	399.2 (1.41)
assist	2594.8 (1.22)
dyr 01	6621.3 (4.85)**
dyr 99	6004.6 (4.6)**
dyr 97	1523.3 (1.21)
constant	3188.9 (1.93)*
p-value F(10,1402)	0.0000
R-squared	0.324
Number Obs.	2040

T-values are in parentheses
An asterisk indicates significance at 10% level; a double asterisk at 1%

Table 13: Fixed-Effects Estimator of Income Net of Transfers

Variables	Probit	Tobit
income_p	-0.00001	-0.102
	(-2.7)***	(-2.06)**
woman_head	0.616	9803.3
	(4.28)***	(6.3)***
*neg_shock_int. m (NS*IM)*	0.01	38.7
	(5.45)***	(3.88)***
*pos_shock_int. m (PS*IM)*	5.70E-06	0.898
	(0.02)	(0.24)
*neg_shock_nat. m (NS*NM)*	0.005	42.1
	(2.31)**	(1.60)
*pos_shock_nat. m (PS*NM)*	0.003	25.1
	(1.68)*	(1.35)
loan	-4.27E-06	-0.073
	(-1.3)	(-1.72)*
age_head	0.03	454
	(1.50)	(1.93)*
(age_head)^2	-0.0001	-3.37
	(-0.91)	(-1.55)
nmigrants	0.784	6263.6
	(16.34)***	(17.36)***
dyr01	0.324	4683
	(2.11)**	(2.83)***
dyr99	0.037	2232.8
	(0.25)	(1.37)
dyr97	-0.069	-2060
	(-0.5)	(-1.32)
deast	0.353	5097
	(3.08)***	(3.8)***
dland	0.506	5638
	(3.65)***	(3.55)***
constant	-3.147	-39292
	(-5.84)***	(-6.39)***
Number Obs.	2040	2040

The dependent variable in the probit is 1 if the household received remittances, otherwise it is zero. In the tobit it is the amount when the remittance is positive, otherwise it is zero. T-values are in parentheses. An asterisk indicates significance at 10% level; a double asterisk at 5%; a triple asterisk at 1%. There are 520 uncensored observations in the tobit model.

Table 14: Random-Effects Probit and Tobit Estimates of Remittances

Variables	Int_Migration	Nat_Migration
work out	-0.187 (-5.23)***	-0.043 (-1.26)
work agric	0.032 (1.08)	0.011 (0.36)
nmicro	0.114 (1.37)	-0.225 (-2.29)**
crowding	-0.055 (-2.85)***	0.016 (0.87)
dyr01	0.073 (0.70)	-0.169 (-1.32)
dyr97	-0.582 (-5.31)***	0.103 (0.89)
dyr95	-0.235 (-2.26)**	-0.074 (-0.63)
deast	0.664 (4.31)***	-0.625 (-4.53)***
dcentral	0.135 (0.94)	-0.242 (-2.10)**
landholding	0.018 (1.64)*	0.02 (1.82)*
constant	-0.572 (-3.46)***	-1.124 (-7.37)***
Number Obs.	2040	2040

T-values are in parentheses.
An asterisk indicates significance at 10% level; a double asterisk at 5%; a triple asterisk at 1%. In each regression, the p-value chi2 is: 0.000.

Table 15: Random-Effects Probit Estimates for International and National Migration.

Variables	Int_Remittance	Nat_remittance
income_p	-0.105 (-1.67)*	-0.131 (-2.52)***
woman_head	12449 (6.16)***	2563 (1.74)*
age_head	79.5 (1.42)	145 (3.61)***
nmigrants	6535 (14.32)***	2792 (8.18)***
dyr01	4595 (2.89)***	-2705 (-1.68)*
dyr97	-6590 (-3.53)***	642 (0.43)
dyr95	-2491 (-1.19)	404 (0.23)
deast	9988 (5.57)***	-6258 (-4.46)***
dland	6911 (3.31)***	3221 (2.02)**
constant	-37495 (-8.87)***	-26778 (-7.45)***
Number Obs.	2040	2040

T-values are in parentheses
An asterisk indicates significance at 10% level; a double asterisk at 5%; a triple asterisk at 1%. In each regression, the p-value chi2 is: 0.0000.
There are 397 and 123 uncensored observations in the models for international remittances and national remittances respectively.

Table 16: Random-Effects Tobit Estimates for International Remittances and National Remittances.

Variables	Probit	Tobit
income_p	-0.00001	-0.082
	(-2.41)**	(-1.69)*
woman_head	0.615	8917
	(4.26)***	(6.37)***
*neg_shock_int. m (ns*im)*	0.01	51.3
	(5.42)***	(4.99)***
*pos_shock_int. m (ps*im)*	1.78E-06	2.5
	(0.01)	(0.64)
*neg_shock_nat. m (ns*nm)*	0.005	40.7
	(2.28)**	(1.48)
*pos_shock_nat. m (ps*nm)*	0.003	15.3
	(1.7)*	(0.80)
loan	-4.36E-06	-0.056
	(-1.3)	(-1.42)
age_head	0.03	333
	(1.54)	(1.56)
(age_head)^2	-0.0001	-2.47
	(-0.96)	(-1.25)
nmigrants	0.784	6770
	(16.31)***	(19.01)***
dyr01	0.315	4087
	(2.04)**	(2.35)***
dyr99	0.028	1431
	(0.19)	(0.83)
dyr97	-0.07	-2318
	(-0.51)	(-1.39)
deast	0.355	4659
	(3.08)***	(4.2)***
dland	0.513	6156
	(3.68)***	(3.85)***
household size	-0.12	26.59
	(-0.6)	(0.13)
constant	-3.116	-36308
	(-5.75)***	(-6.51)***
Number Obs.	2040	2040

T-values are in parentheses. An * indicates significance at 10%; ** at 5%; *** at 1%. There are 520 uncensored observations in the Tobit model

Table 17: Controlling for the Size of the Rural Household: Random-Effects Probit and Tobit Estimates of Remittances

Variables	Int_Remittance	Nat_remittance
income_p	-0.071	-0.173
	(-1.08)	(-3.19)***
woman_head	12430	2642
	(6.15)***	(1.82)*
age_head	75.8	150
	(1.35)	(3.74)***
nmigrants	6488	2828
	(14.24)***	(8.34)***
dyr01	4547	-2727
	(2.86)***	(-1.71)*
dyr97	-6261	244
	(-3.35)***	(0.16)
dyr95	-2109	-165
	(-1.00)	(-0.1)
deast	9957	-6143
	(5.54)***	(-4.45)***
dland	7187	2740
	(3.43)***	(1.74)*
household size	-576	584
	(-1.80)*	(3.04)***
constant	-34945	-28937
	(-7.91)***	(-7.76)***
Number Obs.	2040	2040

T-values are in parentheses. An * indicates significance at 10%; ** at 5%; *** at 1%. There are 397 and 123 uncensored observations in the models for international remittances and national remittances respectively.

Table 18: Controlling for the Size of the Rural Household: Random-Effects Tobit Estimates for International and National Remittances.

Variables	Model 1	Model 2	Model 3
intercept	-0.1792	-.2494	-.1452
	(-0.91)	(-0.54)	(-0.31)
remittances	1.95e-05	2.65e-05	2.58e-05
	(1.33)	(1.69)*	(1.62)
income_p	-3.13e-06	-2.50e-06	2.71e-06
	(-0.47)	(-0.37)	(0.38)
woman_head	0.0301	.0253	-.0199
	(0.15)	(0.13)	(-0.10)
age_head	-.0028	.0013	.0077
	(-0.69)	(0.06)	(0.39)
(age_head)^2		3.51e-05	-.0001
		(-0.18)	(-0.50)
nmigrants	-.0127	.0296	.0307
	(-0.25)	(0.57)	(0.59)
deast	-.2075	-.2500	-.2514
	(-1.63)	(-1.91)*	(-1.91)*
dland	-.6947	-.6736	-.6543
	(-4.99)***	(-4.72)***	(-4.56)***
neg_shock_int.m		-.0186	-.01898
		(-2.36)**	(-2.37)**
pos_shock_int.m		-.0000161	-.00003
		(-0.04)	(-0.08)
neg_shock_nat.m		-.0250	-.0261
		(-2.19)**	(-2.20)**
pos_shock_nat.m		-.0028	-.0027
		(-0.78)	(-0.72)
Loan		-2.40e-06	-2.21e-06
		(-0.62)	(-0.58)
household size			-.0576
			(-2.27)**
R^2	0.05	0.079	0.086
Sample size	628	628	628
Attritors	178	178	178

The dependent variable is 1 if the household is attritor, otherwise it is zero. There are 178 attritors. T-values are in parentheses. An asterisk indicates at 10% level; a double asterisk at 5%; a triple asterisk at 1%.

Table 19: Attrition Probits

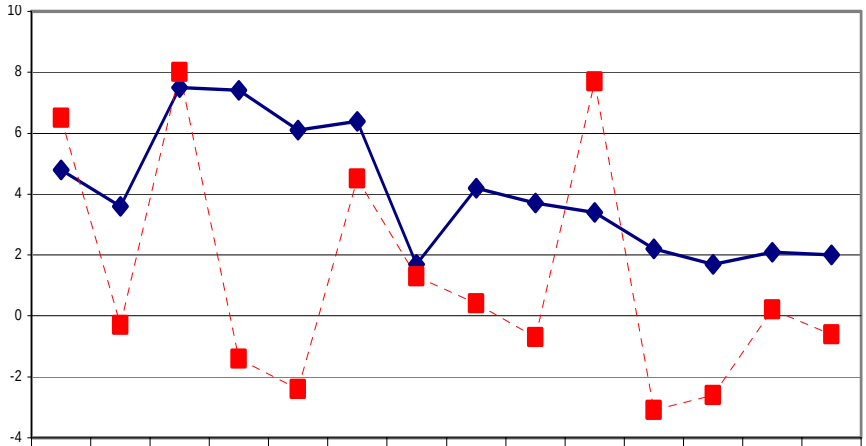
Variables	Weighted Tobit	Tobit
income_p	-0.113	-0.102
	(-2.27)**	(-2.06)**
woman_head	9917.9	9803.3
	(6.3)***	(6.3)***
*neg_shock_int. m (NS*IM)*	37.1	38.7
	(3.69)***	(3.88)***
*pos_shock_int. m (PS*IM)*	1.480	0.898
	(0.40)	(0.24)
*neg_shock_nat. m (NS*NM)*	40.5	42.1
	(1.52)	(1.60)
*pos_shock_nat. m (PS*NM)*	23.4	25.1
	(1.24)	(1.35)
loan	-0.074	-0.073
	(-1.73)*	(-1.72)*
age_head	468	454
	(1.99)**	(1.93)*
(age_head)^2	-3.48	-3.37
	(-1.60)	(-1.55)
nmigrants	6351.1	6263.6
	(17.45)***	(17.36)***
dyr01	4091	4683
	(2.48)**	(2.83)***
dyr99	1844.9	2232.8
	(1.13)	(1.37)
dyr97	-2591	-2060
	(-1.67)*	(-1.32)
deast	5436	5097
	(4.03)***	(3.8)***
dland	5415	5638
	(3.43)***	(3.55)***
constant	-38976	-39292
	(-6.32)***	(-6.39)***
Number Obs.	2040	2040

T-values are in parentheses. An asterisk indicates at 10% level; a double asterisk at 5%; a triple asterisk at 1%. There are 520 uncensored observations.

Table 20: Comparison of Random-Effect Tobit Estimates of the Remittance Function

APPENDIX B

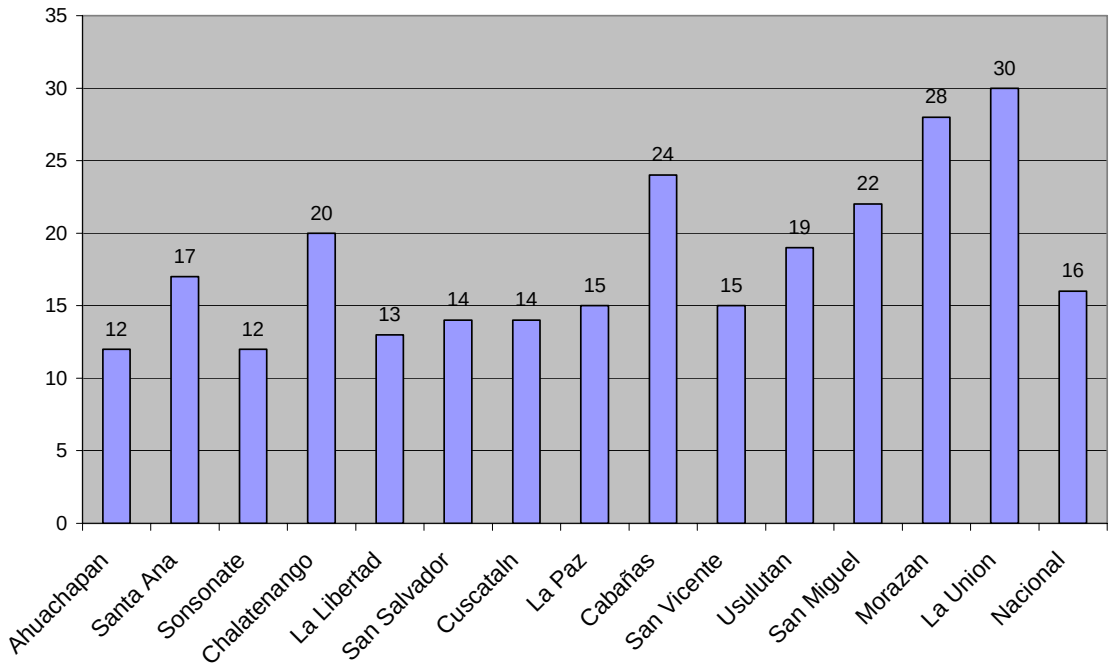
GRAPHS



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
GDP	4.8	3.6	7.5	7.4	6.1	6.4	1.7	4.2	3.7	3.4	2.2	1.7	2.1	2.0
AGDP	6.5	-0.3	8.0	-1.4	-2.4	4.5	1.3	0.4	-0.7	7.7	-3.1	-2.6	0.2	-0.6

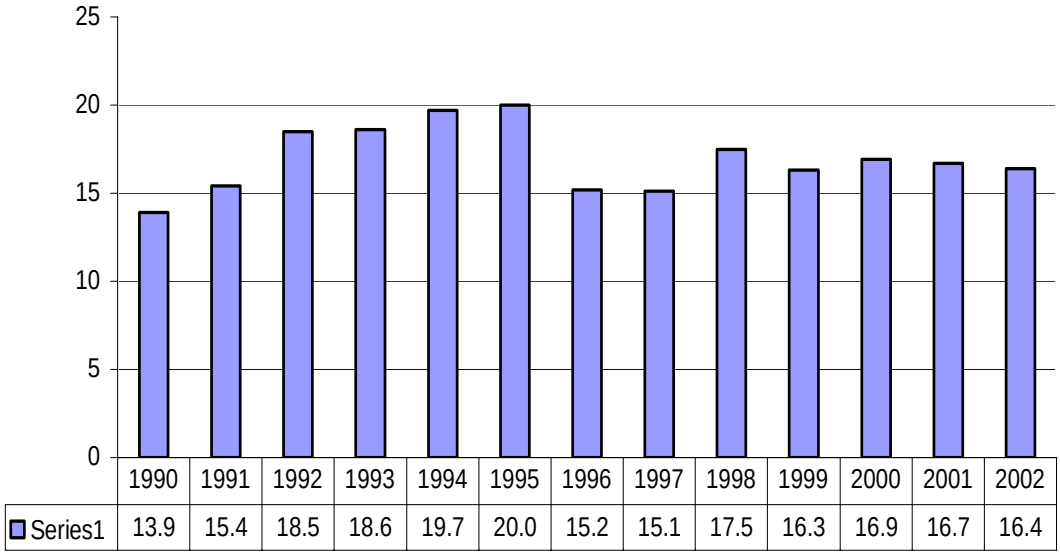
Source: Central Bank of El Salvador
Taken from: www.bcr.gob.sv and FUSADES (2001)

Graph 1: Growth Rates of the GDP and Agricultural GDP, 1990-2003



Source: Encuesta de Hogares de Propósitos Múltiples (EHPM), 1999.
Take from: Andrade-Eekhoff (2003).

Graph 2: Percentage of Households with International Migrants by Department



Source: Banco Central de Reserva de El Salvador (Central Bank of Reserve). *Revista Trimestral* (various issues) and own computations.

Graph 3: Gross Domestic Investment of El Salvador (As a Percentage of GDP)

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