SHOCKS, MIGRATION AND WELFARE DYNAMICS IN SOUTH-EAST ASIA

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To Senait, Christina and Kirubel

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ZUSAMMENFASSUNG

Die Ergebnisse der Arbeit werden in drei Essays in Kapitel 2-5 dargestellt. Der erste Studie untersucht den Zusammenhang zwischen Schocks, geographischem Kapital und Armutsfallen mithilfe von Haushalts- und Dorf-Paneldaten aus drei ländlichen Provinzen in Vietnam. Es werden nicht-parametrische sowie parametrische Methoden angewandt, um den Einfluss von Schocks, Bewältigungsstrategien und geographischem Kapital auf die Vermögensakkumulation eines Haushaltes zu messen. Hansens (2000) Methode zur Abschätzung von Schwellenwerten wird genutzt um zu testen, ob die Haushalte in zwei Gruppen geteilt werden können, die über oder unter einem kritischen Anfangswert des Vermögens liegen, ab dem die Dynamik der Vermögensakkumulation auseinanderdriftet. Der Studie identifiziert einen Schwellenwert ($L*$) von $US 3,92 (gemessen in Kaufkraftparitäten), der die Stichprobe in zwei bezüglich des Vermögenswachstums statistisch signifikant unterschiedliche Teile unterteilt. Das äquivalente Einkommen zu diesem Vermögensschwellenwert beträgt ungefähr zweimal die Armutslinie, die von dem vietnamesischen statistischen Büro (General Statistics Office (GSO)) für ländliche Regionen festgelegt wurde. Dies bedeutet, dass Haushalte, die sich knapp oberhalb der Armutslinie befinden, nicht unbedingt tatsächlich auch die Armut überwunden haben, da viele von ihnen keinerlei Vermögen aufbauen können. Zumindest mittelfristig werden ca. 60% der ungefähr 2000 Haushalte, die in der Stichprobe enthalten sind, in der Armutsfalle gefangen sein. Diese Ergebnisse zeichnen ein ganz anderes Bild als die Armutsrate, die in der Stichprobe von 2007 bis 2010 zwischen 25% und 33% liegt. Der Studie zeigt, dass Haushalte vor allem aufgrund von solchen Schocks in die Armutsfalle geraten, die den Verlust von Vermögenswerten nach sich ziehen und die Haushalte zwingen, teure Bewältigungsstrategien anzuwenden. Andere Faktoren, die die Armut aufrechterhalten, sind der anfängliche Vermögenswert, die geographische Lage und die Qualität von Institutionen und Infrastruktur.

Der zweite Studie verbindet Erkenntnisse der neuen Ökonomie der Arbeitermigration (NELM) mit dem vermögensbasierten Ansatz zur Wohlfahrtsdynamik. Die Kombination beider Ansätze erlaubt eine Unterscheidung, ob ein von Migration induzierter Übergang aus der Armut strukturell, das heißt auf Vermögenswachstum basiert und daher langfristig erfolgt, oder stochastisch ist, also begründet auf einem eher kurzfristigen Anstieg von Einkommen oder Konsum, und daher ein hohes Risiko beinhaltet, wieder in die Armut zurück zu fallen. Der Studie basiert auf Panel-Daten auf Haushalts- und Dorfebene aus drei ländliche Provinzen in Vietnam. Um die Endogenität von Migration und Rücküberweisungen zu kontrollieren, nutzt die Studie Haushalts-Fixed-Effects- und Instumentvariablen-Modelle (FEIV). Die Ergebnisse zeigen, dass nur ein Drittel der Haushalte mit Migranten auch tatsächlich Rücküberweisungen erhält. Es wird gezeigt, dass Migration ohne

Rücküberweisungen keinen signifikanten Einfluss auf das Vermögenswachstum hat, wohingegen Migration mit Rücküberweisungen einen signifikant positiven Einfluss auf das Vermögenswachstum hat. Die Ergebnisse zeigen zudem einen heterogenen Einfluss von Rücküberweisungen auf das Vermögenswachstum je nach Wohlfahrtsstatus und Ethnie. Der Wachstumseffekt von Rücküberweisungen ist am höchsten für die Haushalte, die strukturell (also Vermögens-) arm sind - unter der Bedingung, dass sie nicht einer ethnischen Minorität angehören. Für Haushalte ethnischer Minoritäten haben Rücküberweisungen keinen Einfluss auf das Vermögenswachstum. Der Studie zeigt außerdem, dass Rücküberweisung den höchsten Einfluss auf das Vermögenswachstum haben, wenn sie genutzt werden, um die Produktivität der Vermögenswerte zu vergrößern.

Der dritte Studie zielt auf ein besseres Verständnis dafür, welche Implikationen Migration für das Wohlergehen sowohl der Personen, die im Dorf zurückbleiben, als auch der Migranten in der Stadt beinhaltet. Es wird ein Paneldatensatz von 2000 ländlichen Haushalten genutzt, der 2008 und 2010 in drei Provinzen Nordost-Thailands erhoben wurde, sowie eine Befragung von 650 Migranten in der Umgebung von Bangkok beinhaltet. Die Studie legt einige neue Ergebnisse bezüglich Migration in Thailand offen. Erstens zeigt ein Modell zur Migrationsentscheidung, dass es stark von den Haushaltsmerkmalen abhängt, ob ein Haushaltsmitglied als Migrant nach Bangkok geschickt wird. Im Allgemeinen schicken vor allem ärmere ländliche Haushalte die zumeist jungen Haushaltsmitglieder nach Bangkok, um dort zu arbeiten. Mangelnde soziale und physikalische Infrastruktur auf Distrikt- und Provinzebene scheint ein starker Push-Faktor für Migration zu sein. Zweitens zeigt der Studie, dass die Qualität der Beschäftigung und die relative Verbesserung der Bedingungen der Migranten sowohl von den Merkmalen der Migranten selbst, aber auch von den Merkmalen der Ursprungshaushalte beeinflusst werden. Genauer gesagt haben vor allem Migranten aus bessergestellten Haushalten mit relativ gut ausgebildeten Migranten bessere Chancen auf eine Beschäftigung von höherer Qualität. Drittens zeigen die Ergebnisse, dass Migranten aus armen Haushalten vor allem Aktivitäten ausüben, die wenig Gewinn bringen, wogegen die wohlhabenderen Haushalte auch die besser ausgebildeten Migranten haben und so einen größeren Nutzen aus der Migration ziehen. Letztendlich hat Migration daher das Potenzial, die Ungleichheit zu vergrößern.

Der vierte Studie belegt empirisch die Auswirkungen von Klimaveränderungen und Schocks auf außerlandwirtschaftliche Beschäftigung in ländlichen Gebieten Thailands. Der Studie nutzt einen umfangreichen Panel-Datensatz, der Informationen über vergangene Schockerfahrungen und Niederschlagsdaten der vergangenen 20 Jahre auf Dorfebene enthält. Der Studie zeigt, dass der Arbeitsmarkt heterogen in Bezug auf Anpassungen gegenüber klimatischen Veränderungen und Bewältigungsstrategien gegenüber Schocks ist. Haushalte nutzen außerlandwirtschaftlichen Lohn, um landwirtschaftliche und demographische Schocks zu bewältigen. Der Studie zeigt außerdem, dass

Niederschlagsvariabilität , außerlandwirtschaftlicher Lohn und selbstständige Beschäftigung in einem konkaven Verhältnis stehen. Konjunkturflaute und idiosynkratrische Schocks, wie z.B. demographische Schocks, führen zu erheblichen Einschränkungen der außerlandwirtschaftlichen Beschäftigung. Die Ergebnisse unterstreichen, wie wichtig es ist, die Auswirkungen von Klimaveränderungen auf außerlandwirtschaftliche Beschäftigung im Zusammenhang sowohl mit demographischen als auch mit ökonomischen Schocks zu untersuchen. Insgesamt deuten die Ergebnisse darauf hin, dass der Arbeitsmarkt weniger effektiv als Instrument zur Anpassung an stärkere Niederschlagsvariabilität, ökonomische und demographische Schocks dient. Es kann zudem beobachtet werden, dass ärmere Haushalte weniger gut in der Lage sind, potenzielle Einkommensmöglichkeiten des außerlandwirtschaftlichen Arbeitsmarktes zu nutzen, um landwirtschaftliche Schocks zu überwinden.

Keywords: Schocks, Niederschlagsvariabilität, Geographischem Kapital, Wohlfahrtsdynamik Vermögenswert, Armutsfallen, Migration, Rücküberweisungen, Thailand, Vietnam

ABSTRACT

The core results of the thesis are presented in four studies referring to the chapter two to five. In the first study, the aim is to investigate the link between shocks, geographic capital and poverty traps by using household- and village-level panel data from three provinces in rural Vietnam. The study employs both direct tests of asset dynamics and indirect tests of differentiated behavioral responses to shocks to assess the existence of poverty traps in rural Vietnam. The Hansen (2000) threshold estimator technique is also used to test whether the data can be split into two groups above and below a critical initial asset value at which asset accumulation dynamics diverge; and test the presence of the asset threshold that split our data into two distinct behavioral regimes. The analysis identified the threshold ($L*$) at $US3.92, which is measured in purchasing power parity that splits our sample into two statistically significant different asset growth regimes. The income equivalent of our asset threshold equates to approximately twice the poverty line set by the Vietnamese General Statistics Office (GSO) for rural areas. In other words, households that are able to surpass the poverty line are not necessarily out of poverty because the majority of them do not accumulate assets. At least from a medium term perspective, approximately 60% of the approximately 2,000 households in the three provinces included in our sample are trapped in poverty. This tells a different story from that of the poverty head count which ranges from 25% to 33% in our sample over three panel waves from 2007 to 2010. To identify the causes of poverty traps, both parametric and non-parametric estimation techniques are used. The study shows that households become trapped in poverty mainly because of shocks that cause asset loss and force them to adopt costly coping measures. Other factors that perpetuate poverty include households' initial asset positions, geographic location and the quality of institutions and infrastructure.

The second study combines insights of the New Economics of Labor Migration with the asset-based approach to welfare dynamics. The combination of theories allows us to assess whether poverty transitions induced by migration are actually structural, based on asset growth and therefore long-term, or stochastic, based only on short term increases in income or consumption, which implies a risk of falling back into poverty. The study is based on household- and village-level panel data from three provinces in rural Vietnam. To control the endogeneity of migration and remittances, the study employs household fixed effects and instrumental variables estimation (FE-IV). The study finds that only one-third of households with migrants actually receive remittances. The paper shows that migration without remittances has no significant impact on asset growth, whereas migration with remittances has a positive impact on asset growth. Results show a heterogeneous impact of remittances on asset growth across welfare status and ethnicity. The growth effect of remittances is highest for households which are structurally (asset-) poor provided they are not ethnic minority

households. Remittances have no impact on the asset growth of ethnic minorities. The study additionally shows that remittances best contribute to household asset growth if they are used to improve or increase the productivity of endowments.

The third study aims at contributing to a better understanding of how ongoing adult migration can have implications for the well-being of those left behind in the village as well as the well-being of migrant in urban areas. It draws upon a panel data base of 2,000 rural households collected from 2008 to 2010 in three provinces in Northeast Thailand and a survey of 650 migrants in the Greater Bangkok area. The study offers some new findings on migration in Thailand. First, the migration decision model indicates that sending one or more members for work or education to the Bangkok metropolitan area is strongly related to household characteristics. It is found that the less advantaged rural households send mostly younger family members away to work in the Greater Bangkok area. Also, there seem to be strong push factors of migration embedded in poor access to social and physical infrastructure at district or provincial levels. Second, the study shows that employment quality and relative improvement in migrants' conditions are affected by both the characteristics of the migrant and of the native household. Precisely, the results indicate that migrants' chances of obtaining better quality employment are higher for those in the better-off and better-educated rural households. Third, the results revealed that migrants from poor households tend to engage in low-return activities, whereas the wealthier rural households make better migrants and benefit more from migration such that migration ultimately has a tendency to increase inequality.

Finally, the fourth study offers empirical evidence on the link between rainfall variability, shocks and non-farm activities as adaptation strategies in rural Northeast Thailand. The paper utilizes a large panel data set that includes detailed and retrospective information about shock experience and a corresponding 20-year historical village-level monthly rainfall data set from rural Thailand. The study find that the non-farm activities are heterogeneous in terms of adapting to rainfall variability and coping with shocks. Households use non-agricultural wage and self-employment as a means of adapting to rainfall variability, whereas they use agricultural wage to cope with agricultural and demographic shocks. The study also shows that there is a non-linear relationship between rainfall variability and both non-agricultural wage and non-farm self-employment. Economic slowdown and idiosyncratic shocks, such as demographic shocks, lead to substantial non-agricultural wage employment reduction. Overall, the findings show that the non-farm activities can be less effective as a means for adapting rainfall variability in the presence of economic and demographic shocks. It is also observed that poorer households are less able to exploit the high returns non-farm activities to cope with shocks because of a lack of start-up human and physical capital. Overall our findings

suggest the importance of enhancing both the capacity of adaptation measures in the agricultural sector and making complementary efforts to shore up the economy and create jobs.

Keywords: Shocks, Rainfall Variability, Geographic Capital, Assets, Welfare dynamics, Poverty Traps, Migration, Remittances, Thailand, Vietnam

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

$US	United States Dollar
ADB	Asian Development Bank
AEL	Ausschusses für Entwicklungsländer
ATT	Average Treatment Effects on the Treated
CV	The coefficient of variation
DFG	Deutsche Forschungsgemeinschaft
DiD	Difference -in- difference matching estimates
FAO	Food and Agriculture Organization
FE	Fixed effects
FE-IV	Fixed effects instrumental variables
FGT	Foster Greer Thorbecke
GDP	Gross domestic product
GEWISOLA	Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues
GSO	General Statistics Office
Ha	Hectare
IPCC	Intergovernmental Panel on Climate Change
IV-probit	Instrumental variable probit
Kg	Kilogram
Km	Kilometer
mm	Millimeter
MT	Micawber Threshold
NELM	New Economics of Labor Migration
NSO	National Statistical Office
OLS	Ordinary least squares
PEGNet	Poverty Reduction, Equity, and Growth Network
PPP	Purchasing Power Parity
PSM	Propensity Score Matching
Se	Standard errors
std. dev.	Standard deviation
VHLSS	Vietnam household living standards survey

1 MOTIVATION AND OBJECTIVES

1.1. Background of the Study

This thesis report compiles four studies exploring the link between shocks, migration and welfare dynamics in Vietnam and Thailand. In these two emerging market economies overall poverty reduction has been successful but at the same time 'pockets of poverty' remain and overall inequality has increased. The context of rural Vietnam and Thailand is particularly suitable for exploring the link between shocks, migration and welfare dynamics for several reasons. First, although these countries have constantly recorded high growth rates and have enjoyed great success in reducing poverty during recent decades, albeit to different degrees show strong evidence of growing inequality, particularly between rural and urban areas, ethnic groups and regions (ADB, 2012). In 2008, for instance, 19% and 12% of the rural population—compared with 3.5% and 3% of the urban population—was poor in Vietnam and Thailand, respectively (World Bank, 2012). More than 66% of ethnic minorities in Vietnam, mainly those who live in mountainous and remote villages, remained poor in 2010 compared with only 13% of the Kinh majority (Nguyen Viet, 2012).

Second, high levels of risk caused by weather, i.e., tropical cyclones and storms (in Vietnam) and floods and drought (in Thailand) threaten many rural households in both countries and have strong implications for the economy because a large proportion of the population lives in rural areas (ADB, 2012). Since livelihoods of rural households in both countries increasingly rely on non-farm income, agricultural production related shocks are no longer the only source of risks, but shocks related to economic slowdown in the industrial or services sectors, and idiosyncratic shocks like health shocks can also negatively affect rural households. Financial crisis in the mid-1990s and 2007-08 economic slowdowns in the industrial and service sectors, for instance, have caused many rural households who diversified into non-farm employment to lose their jobs in Thailand. Shocks can have permanent adverse consequences on the well-being of rural households because of their effects on income and asset loss and because of their effects on ex-ante and ex-post behavioral responses to uninsured risk (Barrett et al., 2008; Carter et al., 2007; Hoddinott, 2006). These effects can get worse because of inequalities between regions in natural and geographic conditions (Jalan and Ravallion, 2002; Barrett et al., 2008), which include natural conditions such as topography, in addition to access to roads, public services, and political and economic centers. Returns on assets are therefore lower for households living in mountainous areas and limited access to roads, public services, and political with economic centers, and such conditions may lead them to avoid risky but promising investment options (Dercon and Christiaensen, 2011). Most research on poverty traps has been

undertaken in African countries, where chronic poverty is widespread. However, there is less evidence on the state of welfare dynamics that explore the long-term welfare path and the behavioral implication of shocks in emerging market economies in South-East Asia. Hence, this thesis contributes to the scant literature and bridges the gap in the literature by analyzing how uninsured risks and shocks shape rural welfare dynamics.

Third, rural-urban migration is common in emerging market economies in South-East Asia thanks to rapid urbanization and industrialization and the improvement of transportation and communication networks. Disparities in both the economic and social status among the urban and rural areas, land pressure, and the seasonal nature of agriculture, particularly, rice cultivation are considered to be the factors responsible for the constant movement of people from the rural to the urban areas. In the literature, it is argued that migration will benefit the rural population and eventually close the gap in poverty between urban and rural areas (Brown and Jimenez, 2008). The New Economics of Labor Migration considers that income from migration can improve rural well-being and offer rural households pathways for structural transitions by enabling them to overcome liquidity and risk constraints (Stark, 1985; Taylor and Lopez-Feldman, 2010).Thus, remittances can increase asset accumulation through improving the returns on assets owned by households by enabling liquidity constrained households to take advantage of previously inaccessible opportunities. However, not all migration decisions may lead to the success that is expected. Ongoing rural urban migration is associated with the social costs of being away from the family, the difficulty of obtain documentations for resident registration in major cities, or the limited access to social services such as affordable health care, education and housing, which in turn exposes migrants to multiple risks. Migration of adult household members can also affect the age structure and dependence ratio of rural people left behind. For example the elderly left behind avoid high-return, labor- and technology-intensive farm activities, which thereby can reduce rural well-being (e.g., de Brauw and Rozelle, 2008). Additionally, because of the costs and risks associated with migration, particularly high-return migration, better-off households are better able to migrate (Mckenzie and Rapoport, 2007; Adams, 2011). As a result, poor households tend to engage in low-return migration whereas better-off rural households benefit more from migration which leads to worsening inequality as well as changes in the nature of inequality in the community of origin (Adams, 2011). The overall impact of remittances on household well-being left behind in migrants' rural areas of origin remains an empirical question. Following these developments, addressing the link between migration and welfare dynamics in emerging economies in South-East Asia has major policy implications in terms of achieving sustainable growth and reducing vulnerability.

Fourth, several studies in various developing countries have focused on the effects of migration and remittances on poverty and inequality based on retrospective assessments of flow variables, such as income and consumption (e.g., Amare et al., 2012; Adams and Cuecuech, 2010; Nguyen et al., 2011; Acosta et al., 2008). However, a limitation of such variables is that they do not distinguish between structural or stochastic poverty transitions. Migration and remittances can lead to structural transitions out of poverty if they improve asset growth. However, if migration and remittances only increase current income and consumption, these transitions may be stochastic, which implies that migrants may fall back into poverty. Moreover, income and consumption data are subject to recall and measurement errors that can inadvertently lead to an overestimation of the impact of migration and remittances on poverty transitions (Barrett, 2005). This thesis addresses the issues by combining insights of the New Economics of Labor Migration with the asset-based approach to welfare dynamics. The combination of theories allows us to assess whether poverty transitions induced by migration are actually structural, based on asset growth and therefore long-term, or stochastic, based only on short-term increases in income or consumption, which implies a risk of falling back into poverty (Lybbert et al., 2004).

Fifth, exploring the level and shape of household welfare dynamics is subject to a number of econometric challenges, such as unobserved heterogeneity, sample selection and measurement error problems. The panel datasets with detailed information regarding household characteristics such as education, demography and village-level migration experience make it possible to overcome the time invariant unobserved heterogeneity and potential endogeneity problems. Besides, thesis report in the papers different econometric estimation techniques are used that can control for time-invariant unobserved heterogeneity and reduce measurement error problems. Furthermore, the thesis applies different empirical strategies that can control for unobserved heterogeneity and reduce measurement error problems. Both direct tests of asset dynamics and indirect tests of differentiated behavioral responses to shocks are used to assess the existence of poverty traps and validate the correspondence in results across methods. Hansen's (2000) threshold estimator technique is used to test whether the data can be split into two groups above and below a critical initial asset value at which asset accumulation dynamics diverge; and to test the presence of the asset threshold that split our data into two distinct behavioral regimes. Non-parametric and parametric techniques are also used to identify the causes of poverty traps. Analyzing the welfare implications of migration and remittances may be affected by endogeneity and sample selection problem. This thesis acknowledges that the differences in welfare outcome variables between migrant and non-migrant households could be caused by unobserved heterogeneity. To deal with potential endogeneity problems of migration decisions, the thesis report employs household-level

fixed-effects (FE) and a difference-in-difference propensity score matching estimator. The thesis complements fixed-effect with instrumental variables (IV) in an estimation model designed to control for time-variant heterogeneities.

1.2. Research Objectives

The overall objective of the papers collected in this thesis report is to explore the link between shocks, coping strategies, migration and welfare dynamics. The specific objectives of this thesis, which are addressed in four different studies, are as follows:

1) In the first study, the aims are to empirically test the existence of poverty traps and identify the causes of poverty traps. The first study therefore examines the link between shocks, geographic capital and poverty traps. In a first step, it aims to investigate the existence of poverty traps in rural Vietnam using both direct tests of asset dynamics and indirect tests of differentiated behavioral responses to shocks. In a second step, it scrutinizes the cause of poverty traps using both non-parametric and parametric techniques.

2) The aim of the second study is to combine insights of the New Economics of Labor Migration with the asset-based approach to welfare dynamics to identify whether and under which conditions rural-urban migration lead to long-term structural growth, or to stochastic growth, based on short term growth of income and consumption with a high risk of falling back into poverty. Second, the study explores the impact of with and without remittances on household asset growth. Third, the study provides evidence on the heterogeneous impact of migration and remittances on welfare dynamics by initial welfare status and ethnicity,

3) The third study aims at contributing to a better understanding of how ongoing adult migration can have implications for the rural well-being of those left behind in the village as well as the well-being of migrants in urban areas. The study therefore addresses three questions. First, what are the underlying forces that motivate rural households to send some of their members to urban industrial centers for work? Second, what determines the success of such livelihood strategies from the point of view of the rural household and from the point of view of a migrant? The third question is to what extent the migrant's success in finding quality employment is supportive of the welfare of his/her natal household,

4) The fourth study investigates the link between rainfall variability, shocks and non-farm activities in rural households in Northeast Thailand. It first splits non-farm activities into agricultural wage, non-agricultural wage and non-farm self-employment categories to

address the possible heterogeneity of the non-farm activities in terms of risk-mitigation and coping strategies and returns. Second, the study incorporates not only rainfall variability but also other sources of shocks such as demographic shocks and shocks in the non-farm activities. Third, the paper investigates how dealing with income diversification to mitigate climate variability can be limited in the presence of economic and idiosyncratic shocks like health shocks. Fourth, the paper examines whether the risk-bearing capacity of households differs with the level of assets and whether shocks have a smaller effect on households with a greater level of assets.

By addressing this set of general research questions, the thesis report provides some insights into how climate variability, shocks, migration and remittances influence welfare dynamics in emerging market economies in South-East Asia.

1.3. Key Findings

The first study (chapter 2) which studies the link between shocks, geographic capital and poverty traps in an emerging market economy, combines two methodologies, a direct and an indirect approach for testing the existence of poverty traps. The Hansen (2000) threshold estimator technique was used to test whether the data can be split into two groups above and below a critical initial asset value at which accumulation dynamics diverge; and to test the presence of the asset threshold that split our data into two distinct behavioral regimes. The analysis was based on a comprehensive set of household- and village-level panel data from rural Vietnam. Non-parametric and parametric techniques were also used to identify the causes of poverty traps.

The study identified the threshold (L^*) at $US3.92, which is measured in purchasing power parity that splits our sample into two statistically significant different asset growth regimes. The income equivalent of our asset threshold equates to approximately twice the poverty line set by the Vietnamese General Statistics Office (GSO) for rural areas. In other words, households that are able to surpass the poverty line are not necessarily out of poverty because the majority of these do not accumulate assets. At least from a medium-term perspective, approximately 60% of the approximately 2,000 rural households in the three provinces in Vietnam included in our sample are trapped in poverty. This adds a new dimension to the poverty reduction success story in Vietnam and shows that the poverty head count which ranges from 25% to 33% in our sample over three panel waves from 2007 to 2010 is a problematic measure. The study further identified three major causes of the existence of poverty traps in Vietnam. First, households below the threshold experience more shock and are much more affected by such shocks than those above the threshold.

Second, the consistent results show that ethnic discrimination, geographic locations, and the allocation of infrastructure and public goods and services are factors responsible for the existence of poverty traps. Third, the dynamic perspective introduced in this paper also provides information about the costs of uninsured risks as the causes of poverty traps. Households trapped in poverty tend to be those that are forced to adopt costly coping strategies which further suggest that those generally give up future prospects to maintain current levels of well-being as much as possible mainly because they have less access to formal insurance mechanisms.

The second study (chapter 3) combines the findings of the New Economic Theory of Labor Migration (NELM) with welfare dynamics applied to rural-urban migration in rural Vietnam. The combination of theories allows us to assess whether poverty transitions induced by migration are actually structural, based on asset growth and therefore long-term, or stochastic, based only on short term increases in income or consumption, which implies a risk of falling back into poverty. Second, the study provides empirical evidences on the impact of migration with and without remittances on households' asset growth. Third, the study provides evidence on the heterogeneous impact of migration and remittances on welfare dynamics by initial welfare status and ethnicity. To control endogeneity of migration and remittances, household fixed effects and instrumental variables estimation (FE-IV) were used. First, the study finds that only one-third of households with migrants actually receive remittances, possibly because of the high cost of living, difficulty in obtaining documentation for resident registration in major cities and low-quality employment. Second, the results indicate that if migrants are able to supply remittances to natal households this has a positive effect on poverty transitions. Third, it finds that structurally poor migrant households receiving remittances experienced greater asset growth than non-poor households. Fourth, the study shows that remittances improve the asset growth of ethnic majorities only and have no impact on the asset growth of ethnic minorities, who are the poorest of the poor in rural Vietnam. This suggests that the enormous welfare gap that exists between ethnic minorities and the Kinh majority in Vietnam cannot be overcome by rural-urban migration. Finally, the Blinder–Oaxaca decomposition indicates that remittances accelerate asset growth and offer poor rural households pathways for structural transitions by increasing the returns on the resources they own.

The third study (chapter 4) aimed to empirically infer implications of rural urban migration in Thailand on the socio-economic conditions of migrants in urban areas as well as household well-being in the natal villages. In the paper a panel data base of 2,000 rural households collected from 2008 to 2010 in three provinces from Northeast Thailand and a survey of 650 migrants in the Greater Bangkok area conducted in 2010 was used. The analysis was based on two models, namely

migration decision and difference-in-difference propensity score matching. The migration decision model indicated that sending one or more members for work or education to the Bangkok metropolitan area is strongly related to rural household characteristics. It is found that less well-off rural households send mostly younger family members away for work in the Greater Bangkok area. Also, it is found that strong push factors of migration are embedded in poor access to social and physical infrastructure at district or provincial levels. Second, in addressing the determinants of the success of livelihood strategies from the point of view of rural households and the point of view from of a migrant, the study indicates that migrants' chances of obtaining better quality employment are higher for those in the better-off and better-educated rural households. Third, our results revealed that migrants from poor households tend to engage in low-return activities, whereas wealthier rural households send 'better' migrants, migrants with higher livelihood status in urban areas, and thus benefit more from migration. Overall, therefore, rural urban migration in Thailand ultimately has a tendency to increase inequality.

The fourth study (chapter 5) empirically investigated the link between rainfall variability, shocks and rural households' adaptation strategies in Northeast Thailand. The analysis was based on the same household- and village-level panel data set combined with a 20-year district-level historical rainfall data set. The study employed both household fixed-effects and fixed-effects Tobit estimator. The study tested the following hypotheses: (1) households use different types of non-farm activities as a means of adaption to rainfall variability and other sources of shocks, and the non-farm activities are heterogeneous in terms of adapting to rainfall variability and coping with shock; (2) dealing with the non-farm activities as a means of adapting to rainfall variability is less effective in the presence of severe rainfall variability, economic shocks and idiosyncratic shocks; and (3) the risk-bearing capacity of households differs with the level of assets. Several inferences can be extracted from the results. First, it was found that rural households use both non-farm agricultural wages and non-farm self-employment as a means of adapting to rainfall variability and households use agricultural wage employment to cope with agricultural shocks which confirms our first hypothesis. Second, the study finds a non-linear relationship between rainfall variability and using non-agricultural wage and non-farm self-employment as means of adaptation strategies. This finding suggests that there is a threshold of rainfall variability after which the use of the non-farm activities as a means of adapting to rainfall variability is limited. Third, both demographic and economic shocks lead to substantial reductions in non-agricultural wage employment, which confirms the second hypothesis. Fourth, it is found that non-land assets play a very important role in determining adaptation strategies: households with lower levels of non-assets find it difficult to engage in non-farm activities, particularly in high-return activities such as non-agricultural wage employment and non-farm self-

employment. Also, the study showed that risk-bearing capacity and buffering against shocks vary widely across households.

Table 1.1 History of the papers

Title	Presented	Journal/Proceedings
Shocks, Geographic Capital and Poverty Traps in Rural Vietnam	German Economic Association of Ausschuss für Entwicklungsländer (AEL) Annual Conference 2013, June 21-22, München, Germany.	German Economic Association Conference Proceedings 2013
	5th EAAE Biannual Conference 2013, May 29-31, Leuven, Belgium.	
Poverty Transition in Rural Vietnam: The Role of Migration and Remittances	PEGNet Conference 2013, October17-18, Copenhagen, Denmark.	Arnoldshain Seminar XI Conference Proceedings 2013
	Arnoldshain Seminar XI June 25-28, Antwerp, Belgium.	
Rural–Urban Migration and Employment Quality: A Case Study from Thailand	German Economic Association of Ausschuss für Entwicklungsländer (AEL) of Verein für Socialpolitik Annual Conference 2011, June 24-25, Berlin, Germany.	Asian Development Review (2012) 29:1, 57-79.
Rainfall Variability, Shocks and Non-farm Activities: Evidence from Rural Households in Northeast Thailand	German Association of Agricultural Economists (GEWISOLA) 54th Annual Conference, Gottingen, Germany, September 17-19, 2014.	Association of Agricultural Economists(GEWISOLA) Conference Proceedings 2014
	PhD Conference on International Development, Ruhr-University Bochum 2012, September 18-19, Bochum, Germany.	

REFERENCES

Acosta, P., Calderon, C., Fajnzylber, P., & Humberto L. (2008). What is the Impact of International Remittances on Poverty and Inequality in Latin America? *World Development* 36:1, 89-114.

Adams, R.H. (2011). Evaluating the Economic Impact of International Remittances on Developing Countries Using Household Surveys: A Literature Review. *Journal of Development Studies* 47:6, 809-828.

Adams, R. H. & Cuecuecha, A. (2010). Remittances, Household Expenditure and Investment in Guatemala. *World Development* 38:11, 1626-1641.

Amare, M., Hohfeld, L., Jitsuchon S. & Waibel H. (2012). Rural–Urban Migration and Employment Quality: A Case Study from Thailand. *Asian Development Review* 29:1, 57-79.

Asian Development Bank (ADB). (2012). Asian Development Outlook 2012: Confronting Rising Inequality in Asia. Asian Development Bank, Philippines, Mandaluyong City.

Barrett, C. B., Barnett, B. J., Carter, M. R., Chantarat, S., Hansen, J. W., Mude, A. G., Osgood, D. E., Skees, J. R., Turvey, C. G., & Ward, M. N. (2008). Poverty Traps and Climate Risk: Limitations and Opportunities of Index-Based Risk Financing." *IRI Earth Institute at Columbia University Technical Report No. 07-02: Columbia University.*

Barrett, C.B. (2005). Rural Poverty Dynamics: Development Policy Implications. *Agricultural Economics* 32, 45–60.

Barrett, C.B., & Carter, M.R. (2013). The Economics of Poverty Traps and Persistent Poverty: Policy and Empirical Implications. *The Journal of Development Studies* 49: 976–990.

Brown, R., & Jimenez, E. (2008). Estimating the Net Effects of Migration and Remittances on Poverty and Inequality Comparison of Fiji and Tonga. *Journal of International Development* 20(4):547–571.

Carter, M. R., Little, P. D., Mogues, T., & Negatu, W. (2007). Poverty Traps and Natural Disasters in Ethiopia and Honduras. *World Development* 35:835–856.

de Brauw, A. & Rozelle S. (2008). Household Investment through Migration in Rural China. *China Economic Review* 19, 320–335.

Dercon, S., & Christiaensen, L. (2011). Consumption Risk, Technology Adoption and Poverty Traps: Evidence from Ethiopia. *Journal of Development Economics* 96:159–173.

General Statistics Office (GSO). (2010). *Result of the Vietnam Household Living Standards Survey (VHLSS)*. Statistical Publishing House, Hanoi, Vietnam.

Hansen, B.E. (2000). Sample Splitting and Threshold Estimation. *Econometrica* 68: 575–603.

Hoddinott, J. (2006). Shocks and Their Consequences across and Within Households in Rural Zimbabwe. *The Journal of Development Studies* 42: 301–321.

Jalan, J., & Ravallion, M. (2002). Geographic Poverty Traps? A Micro Model of Consumption Growth in Rural China. *Journal of Applied Econometrics* 17:329–346.

Lybbert, T. J., Barrett, C. B., Desta, S., & Coppock, D. L. (2004). Stochastic Wealth Dynamics and Risk Management among a Poor Population. *The Economic Journal 114:750*–777.

Mckenzie D., & Rapoport, H. (2007). Network Effects and the Dynamics of Migration and Inequality: Theory and Evidence from Mexico. *Journal of Development Economics* 84:1, 1-24.

Nguyen, V. C., Van Der Berg M., & Lensink, R. (2011). The Impact of Work and Non-Work Migration on Household Welfare, Poverty and Inequality: New Evidence from Vietnam. *Economics of Transition* 19:4, 771-799.

Nguyen Viet, C. (2012). Ethnic Minorities in Northern Mountains of Vietnam: Poverty, Income and Assets. *MPRA Paper No. 40769, Munich University*.

Stark, O., & Bloom, D. E. (1985). The New Economics of Labor Migration. *American Economic Review*, 75:2, 173–178.

Taylor, J., & Lopez-Feldman, A. (2010). Does Migration Make Rural Households More Productive? Evidence from Mexico. *Journal of Development Studies* 46:1, 68–90.

The World Bank (2012). Well Begun, Not yet Done: Vietnam's Remarkable Progress on Poverty Reduction and the Emerging Challenges. *The World Bank Report Number 74910, Washington, DC: The World Bank*.

2 SHOCKS, GEOGRAPHIC CAPITAL AND POVERTY TRAPS IN RURAL VIETNAM

With Herman Waibel

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2.1. Introduction and research objectives

Households in developing countries are exposed to a variety of uninsured risks because of insurance and credit market imperfections and because they are often highly dependent on subsistence agriculture for their livelihoods (Dercon and Christiaensen, 2011; Barrett and Carter, 2013). When a shock occurs, households that are unable to cope with income risk may draw down upon their assets to smooth their consumption (Deaton, 1991; Fafchamps et al., 1998). However, the absence of asset market integration and the positive covariance between asset prices and covariant shocks prevent some households from holding or accumulating assets (e.g., Dercon 2002). Other poor households might choose to retain assets to maintain their subsistence asset levels and future income, but such households must reduce their consumption levels to cope with shocks (Zimmerman and Carter, 2003), which may mean reducing health-related expenditures and removing children from school (Hoddinott, 2006; Alderman et al., 2006; Carter and Lybbert, 2012).

Shocks can have permanent adverse consequences on the well-being of rural households directly by affecting current income and asset level and obliquely by influencing households' ex-ante and ex-post behavioral responses to uninsured risk (Barrett et al., 2008; Carter et al., 2007; Hoddinott, 2006). Such effects can be compounded by inequalities in the coverage and the effect of natural conditions such as topography in addition to access to roads, public services, and political and economic centers[1] (Jalan and Ravallion, 2002; Barrett et al., 2008). Therefore, returns to assets are lower for households living in such areas, and such conditions may lead them to avoid risky but promising investment options (Banerjee and Newman 1993). Both factors can result in such households remaining trapped in poverty.

Most research on poverty traps has been undertaken in African countries in which chronic poverty is widespread. However, there is less evidence about poverty traps in emerging market economies in Asia where overall poverty reduction has been successful but in which inequality has increased and "pockets of poverty" remain. The context of rural Vietnam is particularly suitable for exploring the linkage among geographic capital, shocks, and poverty traps for several reasons. First, although

[1]We defined the term "geographic capital" for the wide range variables: natural and geographic location, the quality of institutions and infrastructure at village level based on village level surveys thus in subsequent discussion we use the term geographic capital in the interests of brevity.

Vietnam has constantly recorded high growth rates and has enjoyed great success in reducing poverty during recent decades, there is strong evidence of rising inequality, particularly between rural and urban areas (ADB, 2012). For instance, 19% of the rural population—compared with 3% of the urban population—was poor in 2008 (World Bank, 2012). More than 66% of ethnic minorities, mainly those who live in mountainous and remote villages, remained poor in 2010 compared with only 13% of the Kinh majority (Nguyen Viet, 2012). The income gap between both groups increased by 14.6% between 1995 and 2004 which was after long periods of economic growth (Baulch et al., 2011).

Second, high levels of risk caused by weather, i.e., storms, flooding and drought, threaten many rural households in Vietnam and have strong implications for the economy because a large share of the population lives in rural areas and agriculture continues to account for approximately one-half of total household incomes in Vietnam (GSO, 2007). Third, locational and natural conditions in Vietnam are highly diverse and lead to substantial heterogeneity of livelihood strategies, including highly diversified subsistence agriculture in the marginal, remote and mostly mountainous areas, and specialized and input-intensive farming in the more accessible regions.

The objective of this paper is to investigate the linkage between shocks, geographic capital and poverty traps in Vietnam. Our analysis is organized around four questions. First, how do initial household conditions drive welfare dynamics? Second, do shocks have a long and lasting impact on asset accumulation? Third, what is the role of geographic capital in mitigating the impact of shocks and in explaining differences in welfare dynamics? Fourth, do behavioral responses to shocks vary with different levels of initial wealth? Answering these questions allows us to test for the existence of poverty traps and to assess the cost of uninsured risk in an emerging market economy such as Vietnam. Our analysis is based on a comprehensive set of household- and village-level panel data from rural Vietnam (Phung et al., 2013).

The contributions of this study to the literature are two-fold. First, we provide empirical evidence about the conditions of poverty traps in Vietnam, an emerging market economy in Southeast Asia. Second, we assess the existence of poverty traps in rural Vietnam by comparing direct tests of asset dynamics and indirect tests of differentiated behavioral responses to shocks. In this regard we believe that our study is novel by validating the correspondence in results between two methods. Hansen's (2000) threshold estimator technique is used first to test whether the data can be split into two groups that are above and below a critical initial asset value at which asset accumulation dynamics diverge. Second it is used to examine whether there is a difference in behavioral response

to shocks for households above and below the asset threshold. In addition, non-parametric and parametric techniques are used to identify the factors responsible for poverty traps.

Our main findings are that nearly 60% of the 2,000 households in our panel dataset qualify as households trapped in poverty which is in sharp contrast to the poverty headcount, ranging from 33 % to 25% between 2007 and 2010 in these three provinces. Most of the households trapped in poverty are located in areas with poor infrastructure, little access to public services and that are marked by social conflicts. Households trapped in poverty require a per capita income that is more than twice the rural poverty line set by the General Statistics Office (GSO) to move out of poverty traps. The main factors that could be responsible for the existence of poverty traps in rural Vietnam are severe shocks, ethnic discrimination, geographic locations, the allocation of infrastructure and public goods and services.

This chapter is organized as follows. The next section describes the conceptual framework and summarizes the existing empirical evidence regarding micro-level poverty traps. The empirical strategies that we applied to obtain answers to the research questions are discussed in section 3. In section 4, we elaborate on the data with a particular emphasis on the income poverty trend and the distribution of households that are experiencing different periods of poverty. Estimation results and discussions are presented and discussed in section 5, which are followed by conclusions in section 6.

2.2. Conceptual Framework and Literature Review

In this section, we introduce the concept of poverty traps followed by a review of the literature focusing on the empirical evidence of poverty traps.

2.2.1. The concept of poverty traps

The macroeconomic literature on growth dynamics, the unconditional and conditional convergence hypotheses and multiple dynamic equilibriums associated with a critical capital threshold has inspired several micro-level analyzes of poverty traps in poor countries. Carter and Barrett (2006) developed the conditional convergence hypothesis test for such micro-level analysis. Following neoclassic theory of economic growth, they establish two hypotheses. First, poorer households will grow faster than wealthier households and will eventually converge in the same long-term equilibrium as the marginal returns to assets decline. Second, there is the threshold at which accumulation dynamics diverge, which is called the “Micawber Threshold” (MT) by Carter and Barrett (2006) and below which households do not grow and are therefore trapped in poverty. The literature presents a range of reasons that explain why households may be trapped in poverty,

including limited access to insurance and credit markets, which affects their behavior regarding risk response to shocks (Banerjee and Newman, 1993). As shown in studies conducted in Burkina Faso (Carter and Lybbert, 2012) and Ethiopia (Carter et al., 2007), households trapped in poverty tend to be those that are forced to adopt costly coping strategies (Barrett et al., 2008; Carter et al., 2007) and that resort to low-return strategies to generate income. Conversely, households above the critical minimum asset threshold are often situated in wealthier areas that tend to adopt high-return strategies for income generation (e.g., Dercon and Christiaensen, 2011). Spatial inequality in geographic capital may shape households' behavioral response to uninsured risks and returns on their assets (Barrett et al., 2008; Jalan and Ravallion, 2002). Poor households living in less favorable and weakly integrated areas may have lower returns on their assets and slower growth rates and are thus more likely to remain in poverty for a long time.

A third hypothesis has been advanced regarding how households below and above the MT cope with shocks (Zimmerman and Carter, 2003); households above the MT depend on their assets to maintain their consumption levels, whereas households below the MT reduce their consumption levels in response to shocks—such as by reducing health and education expenditures, withdrawing children from school and reducing nutrient intake (Hoddinott, 2006; Emerson and Souza, 2003; Basu, 1999). These latter coping strategies can force rural households into permanent destitution (Barrett and Carter, 2013; Zimmerman and Carter, 2003; Banerjee and Duflo, 2003).

2.2.2. Empirical evidence of poverty traps

Before turning to a more complete test for shock-induced poverty traps and the behavioral implications of poverty traps, we briefly review the empirical literature that has tested for poverty traps, in general. The literature on poverty traps has focused on testing the existence of a multiple equilibria poverty trap, for example, in Hungary, Russia (Lokshin and Ravallion, 2004) and China (Jalan and Ravallion, 2004), and has used income and consumption to measure household welfare. These studies did not find evidence for a multiple equilibria poverty trap but did find evidence of the lasting effects of shocks.

A growing literature uses assets to test for the existence of poverty traps by applying various techniques. There is mixed evidence for the existence of a multiple equilibria poverty trap. The pioneering study by Lybbert et al. (2004) found evidence for the existence of a poverty trap among Ethiopian pastoralists when using a single asset, i.e., herd size. Similarly, Barrett et al. (2006) provide evidence for the existence of a poverty trap among Kenyan pastoralists. Households above the MT (those with five to six livestock units) were able to accumulate livestock and eventually reached a

higher equilibrium, while pastoralists with livestock below the MT converged toward a lower level equilibrium. Similarly, using livelihood regression estimation, Adato, et al. (2006) found an S-shaped curve in the asset accumulation process in South Africa. Some studies (e.g., Quisumbing and Baulch, 2011 in Bangladesh; Giesbert and Schindler, 2012 in Mozambique) have found a single stable state at a low level of wellbeing near the poverty line. Carter et al. (2007) provide evidence that natural disasters in Honduras and Ethiopia drive poor households permanently below the critical minimum asset threshold because of the direct asset and income effects of shocks and that shocks such as long droughts push poor households in Ethiopia to reduce consumption to maintain their assets for future income generation.

As an alternative to using a direct test of asset dynamics to detect a Micawber threshold, other studies have tested for the existence of poverty traps on the basis of behavioral response to shocks. For example, Dercon and Christiaensen (2011) indicate that a lack of insurance and alternative consumption-smoothing strategies serve to trap poor households in low return and lower risk activities and thereby perpetuate poverty. In a similar analysis, Hoddinott (2006) finds that poor households maintain a minimum number of animals to ensure that they can plough their fields, whereas households above the MT prefer to smooth their consumption and reduce assets in response to weather shocks. Using the Hansen estimation technique and panel data from Burkina Faso, Carter and Lybbert (2012) found that households below the estimated threshold are reluctant to liquidate assets even in the face of economic shocks, whereas those above the estimated threshold are able to completely insulate their consumption from weather shocks.

2.3. Empirical strategies

2.3.1. Constructing an asset index

To obtain a measure of aggregate household assets[2], first we estimate livelihood regression model following the Adato et al., (2006). The fitted values of the livelihood regression model are interpreted as an estimated household asset index. In this model, a bundle of assets that are likely to shape a household's future well-being are utilized to derive an asset index. A livelihood regression model (Adato et al., 2006) that is used to contract asset index is specified as follows:

[2]We also constructed an asset index using principal components and factor analysis of all relevant assets. We find that the pattern of asset dynamics does not substantively vary across the two alternative methods of constructing the asset index. In the following we use the livelihoods regression methodology as the unit of the resulting asset index has a more intuitive interpretation.

$$L_{it} = \alpha + \sum_{j=1} \beta_j (A_{ijt}) + \sum_{j,k} \beta_{jk} (A_{ijt})(A_{ikt}) + \beta_g G_{vt} + \lambda_{pt} + \gamma_i + \pi_{it} \quad (2.1)$$

where livelihood (L_{it}) is defined as income per capita of household i in period t divided by rural poverty line (P). L_{it} below 1 indicates that a household is below the poverty line, and a value greater than 1 identifies households as non-poor. A_{ijt} is the amount for all assets j and k, including the human, social, physical and natural capital of household (i) owned at time (t). β are vectors of the coefficient of the current assets owned by households. G_{vt} represents village-level (v) geographic capital. γ_i is the household fixed effect, which controls for a variety of fixed factors that shape its wellbeing. Province-year fixed effect (λ_{pt}) are added to control time-invariant province heterogeneity and an arbitrary time series of annual shocks affecting provinces uniformly in each year. The brackets indicate that the marginal contribution of assets depend on all of household i's assets and characteristics at time t.

The literature suggests that a wide range of human, social, physical, natural and geographic capital factors likely to shape a household's future well-being (Naschold, 2012). We included various proxies for human capital such as average number of years of schooling of household members, the proportion of adult members in the household and the proportion of dependents and the gender and age of the household head. We used memberships in local social and political organizations and migration status of the household as proxies for social capital. The physical and natural capital effect were captured through value of agricultural and transportation equipment, livestock, housing household utilities and land in hectares. To capture the geographic capital such as topography, social problem categorization, infrastructure and basic public goods were included. The squared terms of several variables were included to account for potential diminishing returns on assets and lifecycle effects. We also included interaction effects between all basic assets to allow the marginal return of assets to varying with the level of other assets. A complete list and definitions of variables are provided Table 2.1.

The livelihood regression provides a set of weights that project expected household well-being. We only focused on the projection of the household asset index as precisely as possible. We derive the realized level of wellbeing using a fixed effects model because our test indicated that endogeneity problems due to unobserved characteristics did not support the random effects model. We constructed an asset index (A_{it}) based on the fitted values of livelihood regression model in which assets are weighted according to marginal contributions of each asset to household i's well-being. Asset index scaled in poverty line units, allows the direct identification of different types of poverty,

i.e., structural and stochastic. The full estimation results using household fixed effects are reported in Appendix 2.1A.

2.3.2. Asset growth model

We use non-parametric and parametric techniques to investigate the effect of shocks, coping strategies and geographic capital in shaping a household's asset accumulation over time. Parametric specifications cannot detect a possibly unstable threshold when there are a limited number of observations (Naschold, 2013). Threshold points may enter as heteroscedastic and positively auto-correlated errors when there are too few sample observations (Barrett, 2005). Detailed information and a large dataset regarding household income and asset holding—in addition to village characteristics—improve the consistency of our parametric estimation. Because we have a three-wave longitudinal and village level dataset, we can control for time-invariant unobservable heterogeneities and time-invariant village characteristics with fixed effects. The basic regression model (Model 1), which estimates how initial assets, demographic conditions and severity of shock variables explain asset growth, takes the following form:

$$\Delta A_{it} = \kappa_1 f(A_{it-1}) + \kappa_2 H_{it-1} + \kappa_3 S_{it-1} + \theta_i + \theta_{dt} + \sigma_{it} \quad (2.2)$$

where ΔA_{it} refers to growth in assets of household i between period t and $t-1$. Asset growth is a function of initial asset level (A_{it-1}) is included in the growth regression to capture the idea from the conditional convergence hypothesis that poorer households initially grow more rapidly (Carter and Barrett 2006). H_{it-1} is a vector of the initial levels of human capital (age, labor supply and education). To explore the effect of past shocks (S_{it-1}) on asset growth, we include information about income and the asset severity of shocks recorded by each household. Asset severity of shocks is measured as (i) the share of asset loss relative to total assets and (ii) income loss relative to total income. We also measure severity of shocks[3] based on household's qualitatively assessment of shocks for robustness check. Because similar intrinsic household characteristics and shock severities can lead to different asset accumulation patterns, a household fixed effect (θ_i) is included to control for time-invariant unobserved household characteristics. Furthermore, a province-year fixed effect (θ_{dt}) is included to control time-invariant province heterogeneity and an arbitrary time series of annual shocks affecting provinces uniformly in each year. ε_{it} represents the error term. The effect of shock variables depends on the coping strategies of households. To analyze how household coping

[3]Households were asked to assess the severity with which each shock affected them based on an ordinal scale from 1 (no impact) to 4 (high severity)

mechanisms affect observed asset accumulation in the aftermath of shocks, we modify equation 2.2 (Model 2) to capture the effect of coping strategies:

$$\Delta A_{it} = \alpha_1 f(A_{it-1}) + \alpha_2 H_{it-1} + \alpha_3 S_{it-1} + \alpha_4 C_{it-1} + \alpha_5 S_{it-1} * C_{it-1} + \theta_i + \theta_{dt} + \omega_{it} \quad (2.3)$$

where C_{it-1} is a vector of coping strategies, such as consumption reduction, natural resource extraction, diversifying agricultural portfolios, sales of assets or borrowing. Coping strategies are interacted with shocks because presumably these only have an effect when a shock occurs. Our hypothesis is that in the presence of poverty traps, costly coping strategies would push poor households permanently into a low-growth path. Estimating the effect of coping strategies on asset growth using household fixed effects estimates allows us to control for the effect of time-invariant unobservable heterogeneities.

To assess the effect of geographic capital on asset growth, we include a vector of geographic capital variables in equation 2.2 and specify Model 3 as follows:

$$\Delta A_{it} = \delta_1 f(A_{it-1}) + \delta_2 H_{it-1} + \delta_3 S_{it-1} + \delta_4 C_{it-1} + \delta_5 S_{it-1} * C_{it-1} + \delta_5 G_{vt-1} + \delta_6 A_{it-1} * G_{vt-1} + \theta_i + \theta_{pt} + \omega_{it} \quad (2.4)$$

where G_{vt-1} is a vector of village-level geographic capital, including the share of the area under irrigation, village social problem categorization, the share of households with state-supplied electricity and water, transportation facilities, health access in the village, distance to the nearest market and quality of roads. Geographic capital index interacted with initial assets in equation 2.4 to explore the possibility that the effects of the return for assets might vary across households depending on geographic location and the quality of institutions and infrastructure.

We follow Carter et al. (2007) by employing Hansen's (2000) threshold estimator technique[4] to test whether our data can be split into two groups above and below a critical initial asset threshold at which accumulation dynamics diverge. To capture for the effect of time-invariant unobservable heterogeneities and time-invariant village characteristics, we perform a within-transformation (fixed effect-transformation) of our data before estimating the threshold. We test the presence of poverty traps and assess whether the effect of shocks differs between the two groups in equation 2.5:

$$\begin{aligned} \Delta A_{it} &= \lambda_1^u f(A_{it-1}) + \lambda_2^u S_{it-1} + \lambda_3^u H_{it-1} + \lambda_4^u C_{it-1} + \lambda_5^u S_{it-1} * C_{it-1} + \lambda_6^u G_{vt-1} + \lambda_6^u A_{it-1} * G_{vt-1} + \vartheta_{it} \text{ if } T > T^* \\ \Delta A_{it} &= \lambda_1^\ell f(A_{it-1}) + \lambda_2^\ell S_{it-1} + \lambda_3^\ell H_{it-1} + \lambda_4^\ell C_{it-1} + \lambda_5^\ell S_{it-1} * C_{it-1} + \lambda_6^\ell G_{vt-1} + \lambda_6^\ell A_{it-1} * G_{vt-1} + \tau_{it} \text{ if } T \leq T^* \end{aligned} \quad (2.5)$$

[4]A threshold estimation model allows us to scrutinize nonlinearities in the conditional expectation function and to identify threshold effects in multiple equilibria model (Hansen 2000).

where T^* represents a dynamic asset threshold. The superscripts μ and ℓ denote coefficients for the subset of households above and below the estimated threshold, respectively. First, we would expect that households below the estimated threshold are not able to grow and accumulate assets, which implies that λ_1^{ℓ} is negative and significantly different from zero. Second, shocks severity is hypothesized to affect asset growth significantly and negatively for households below the estimated threshold. We would also expect that households below the threshold adopt costly coping strategies because they have less access to formal insurance mechanisms.

2.3.4. Indirect measures of testing the existence of poverty traps

The direct tests of asset dynamics of the poverty traps hypothesis is subject to a number of econometric challenges, such as unobserved heterogeneity and measurement error problems because asset markets in rural Vietnam are imperfect. Therefore, we combine this approach with the indirect testing methods of the poverty traps proposed by Carter and Lybbert (2012). In this approach, we use Hansen's (2000) threshold estimation techniques to test for the presence of the asset threshold that split our data into two distinct behavioral regimes.

$$D_{it} = \begin{cases} \alpha_1^r A_{it} + \alpha_2^r Z_{it} + \alpha_3^r S_{it} + \upsilon_i^r + \rho_{it} & \text{if} \quad \ell > \ell^* \\ \alpha_1^l A_{it} + \alpha_2^l Z_{it} + \alpha_3^l S_{it} + \upsilon_i^l + \theta_{it} & \text{if} \quad \ell \le \ell^* \end{cases} \tag{2.6}$$

where D_{it} represents household i's probability of drawing down assets in response to shocks at time t. The superscripts r and l denote coefficients for the subset of households above and below the estimated threshold, respectively. A_{it} represents household i's asset index at time t. S_{it} denotes a vector of shock variables. Z_{it} are household and village characteristics and γ_i is the household fixed effect. ℓ^* represents asset threshold that splits our data into two distinct behavioral response to shocks. We hypothesize threshold estimation approach split our data into two distinct behavioral regimes. We would expect the coefficient (α_2^r) on asset to be negative and statistically significant for households below the estimated threshold because those households may prefer to retain assets to maintain their subsistence asset levels and future income. While we would expect that households above the estimated threshold may depend on their assets to cope with shocks.

We also explore whether our data split into two distinct behavioral regimes in terms of consumption reduction in response to shocks as specified in equation 2.7:

$$R_{it} = \begin{cases} \beta_1^r A_{it} + \beta_2^r Z_{it} + \beta_3^r S_{it} + \tau_{it}^r + \iota_{it} & \text{if} \quad \ell > \ell^* \\ \beta_1^l A_{it} + \beta_2^l Z_{it} + \beta_3^l S_{it} + \tau_{it}^l + \varpi_{it} & \text{if} \quad \ell \le \ell^* \end{cases} \tag{2.7}$$

where R_{it} represents household i's probability of consumption reduction in response to shocks at time t. We now anticipate the coefficient of the asset index (β_2^r) to be positive for households below the threshold and expect a negative coefficient (β_2^l) for households above the threshold. In other words, households below the threshold are expected to reduce consumption and maintain their assets while households above the threshold will reduce assets and smooth consumption.

2.4. Data description

The data used for this study originate from a panel survey to assess vulnerability to poverty in Asia (the DFG FOR 756 database), which consists of three rounds (2007, 2008 and 2010) of household- and village-level surveys. A three-stage cluster random sampling procedure was used to obtain a sample representative of the rural populations of three provinces, which all belong to the Central Highlands of Vietnam, i.e., Ha Tinh, Thua Thien Hue and Dak Lak provinces (Hardeweg et al., 2013). To reflect differences in population density and in agro ecological conditions, the provinces were stratified into coastal, lowland and highland zones. In the first stage, the sampling of communes was undertaken according to population share at the district level. In the second stage, villages were sampled with probability that was proportional to the population size. Finally, a fixed number of 10 households were sampled with implicit stratification by household size. The fixed number of 10 households per village was based on organizational criteria. The initial size was 2,200 households and 220 villages. Annual attrition rates were low at slightly above 1%. The survey instruments included a detailed household questionnaire and a survey form for the head of the village. The household questionnaire contained information about household characteristics, various sources of income and provided detailed data on household shock experiences and risk expectations, including a qualitative and quantitative assessment of the consequences of shocks. The village-level questionnaire contained information on topography, social problem categorization and the infrastructure and basic public goods that can affect households' livelihoods and the decisions they make to cope with shocks and risks. Table 2.1 offers a description of the variables and summary statistics of the pooled sample characteristics of the panel variables. The household income[5] per capita per day was $US 3.99. The average household consisted of 4.38 persons and more than two-third of the households in the sample were headed by males. On average, the household head was 47.43 years old, and approximately one-third of the samples were from ethnic minorities. The proportion of adult members with elementary school, secondary school and professional training were 0.22, 0.17 and 0.22, respectively. We find that the sample households lost 13% of their assets

[5]Household income and other asset values are measured at purchasing power parity (PPP) in $US adjusted prices, with 2005 as the base period to make real-term comparisons across waves.

and 32% of their income due to various shocks. Nearly two-thirds of the sample households reported that reducing consumption was their most important risk-coping strategies and 23% of the households reported that they drew down on assets in response to shocks.

Table 2.1.Variables & definitions of descriptive statistics in the panel model (N = 6288)

Variable	Description	Mean	St.dev
Income per day	Income per day (measured at PPP in $US)	4.05	6.10
Household and social capital			
HH-size	Total household size	4.38	1.76
Children	Proportion of children in household under 15 years old	0.09	0.22
Elderly	Proportion of elderly in household above 60 years old	0.21	0.22
Age	Age of the household head	47.43	15.65
Gender	Gender of the head (male headed =1, female headed =0)	0.77	0.42
Ethnic	Major ethnic Kinh & Hoa (=1), others(=0)	0.79	0.40
Head: illiterate	Household head with no schooling	0.16	0.37
Head: elementary	Household head with elementary schooling	0.46	0.50
Head: secondary	Household head with secondary schooling	0.33	0.47
Head: professional	Household head with professional training	0.06	0.23
Adult education: elementary	Proportion of adult households with elementary schooling	0.22	0.23
Adult education: secondary	Proportion of adult households with secondary schooling	0.17	0.20
Adult education: professional	Proportion of adult households with professional training	0.22	0.28
Membership	Involved in political or social organizations (yes=1, no=0)	0.87	0.33
Off-farm	Participated in off-farm wage employment (yes=1,no=0)	0.52	0.50
Self emp.	Own small- and medium-scale enterprises (yes=1, no=0)	0.25	0.44
Physical & natural capital (measured at PPP in $US)			
Agric. tools	Value of agricultural tools owned	408	1037
Transp. tools	Value of transportation tools owned	1064	2916
Land	Land size owned in hectares	0.78	1.12
Livestock	Value of livestock owned	814	2595
Own house	Value of house owned	10255	15825
House utilities	Value of household utilities owned	1010	1968
Geographical capital at village level			
Paved road	The village has paved road (yes=1, no=0)	0.55	0.50
Mountainous	The village is located in the mountains (yes=0, no=1)	0.52	0.50
Main transp.	Main transportation is bus or motorcycle (yes=1, no=0)	0.57	0.49
Violence	The village experienced violence (yes=0, no=1)	0.83	0.62
Epidemics	The village experienced epidemics (yes=0, no=1)	0.89	0.69
Water supply	Proportion of households with public water supply	0.23	0.42
Irrigated	Total irrigated land in the village(in hectares)	13	24
HHs elect.	Proportion of households with electricity	0.92	0.23
HHs sanit.	Proportion of households with sanitation	0.18	0.32
Distances market	Distance to nearest market in km	0.13	0.10
Shock severity			
Asset shocks	Asset shocks severity: asset lost share of total asset	0.13	0.28
Income shock	Income shocks severity: income lost share of total income	0.32	0.38
Coping measures in responses to shocks			
Forest extrac.	Depends on forest extraction (yes=1, no=0)	0.14	0.35
Diversify agric.	Diversifying agricultural profile (yes=1, no=0)	0.06	0.23
Drawing assets	Drawing drawn assets (yes=1, no=0)	0.23	0.34
Lending informal	Lent money from informal money lenders (yes=1, no=0)	0.17	0.38
Public transfer	Participated in public transfer (yes=1, no=0)	0.12	0.32
Reduce cons.	Reduced consumption (yes=1, no=0)	0.64	0.47

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: Household income and other asset values are measured in $US purchasing power parity (PPP) adjusted prices, with 2005 as the base period to permit comparisons in real terms across waves.

Table 2.2 shows the changes in poverty[6] and income distribution from 2007 to 2010. Poverty is pronounced in all the sampled provinces. Average income per capita and day increased from $US3.35 in 2007 to $US4.41 in 2010, which indicates an annualized growth rate of 8%. On average, more than one-third of the households experienced poverty each year, but the results show a decreasing trend in all poverty measures. For example, the head count ratio, the poverty gap and poverty severity decreased by 8%, 7% and 6% in 2010, respectively.

Table 2.2. Income per day and poverty trends of sample households

Year	Household income per capita	Poverty Index		
		Poverty headcount	Poverty gap	Poverty severity
2007	3.35(5.37)	0.33	0.16	0.11
2008	4.17(6.33)	0.27	0.13	0.08
2010	4.41(6.43)	0.25	0.09	0.05

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: We calculate poverty indices following the Foster–Greer–Thorbecke class of poverty measures, which include the head-count, poverty gap and severity measures (Foster et al., 1984).

Moreover, Table 2.3 shows that approximately 31% and 21% of households experienced poverty for one year and two years respectively, and approximately 13% of the sampled households consistently had income below the poverty line in all three periods. It is interesting to note that the percentage of chronically poor (in all three periods) households is similar to the three waves of the Vietnam household living standards survey (VHLSS) 2002-2006 panel analyzed by Baulch and Vu (2011). The proportion of households that live below the poverty line differs across provinces. Poverty is pronounced among the sampled households in Thua Thien Hue, which might be because this province is on the coastline and frequently suffer extreme weather shocks and because of the large proportion of ethnic minorities living in remote and mountainous areas. The income poverty measures indicate that poverty is typically a transitory phenomenon, which requires a detailed investigation into what determines welfare dynamics.

Table 2.3. Percentage of households by income poverty dynamics by province

Variable	All sample	Ha Tinh	Thua Thien Hue	Dak Lak
Always poor	12	11	18***	9*
Twice poor	20	22	22	20
Once poor	32	33	27	33
Never poor	35	34	33	38*

Source: DFG Rural Household and Village-level Surveys in Vietnam, 2007, 2008 and 2010.

In the shock module, we obtain information on the estimated total loss of income and assets due to an event in the year of its occurrence. Table 2.4 also reports the consequences of the most commonly reported shocks on the estimated loss of household assets and income loss due to the

[6]Note that Vietnam does not have a single national poverty line. The one the paper used is the income poverty line calculated by GSO for rural areas measured at PPP $US1.73 per capita per day throughout all provinces. Source: GSO (2011).

event. On average, households lost about $US361 income and $US101 asset per capita during 2007-2010 due to various sources of shocks.

Table 2.4. Income and asset loss per capita due to shocks by year

Year	Income loss per capita	Asset Loss per capita
2007	272(1558)	137(475)
2008	449(1040)	92(266)
2010	362(1369)	75(480)
Average	361(1341)	101(420)

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010. Standard deviations in parentheses.

2.5. Estimation results and discussions

2.5.1. Shocks severity and welfare dynamics

Table 2.5 reports the asset and income shock severity by initial asset tercile and provinces. Both asset and income shock severity decline across asset terciles. For the poor, income shock severity accounts for more than 35% of household income, whereas that figure is approximately 26% for those in the top asset tercile. Poorer households also lost a greater percentage of their assets (21%) than did wealthier households, who lost only 6% of their assets. The results indicate that poor households are more vulnerable to shocks than wealthier households. The consequences of shocks are severe among the sampled households in Thua Thien Hue.

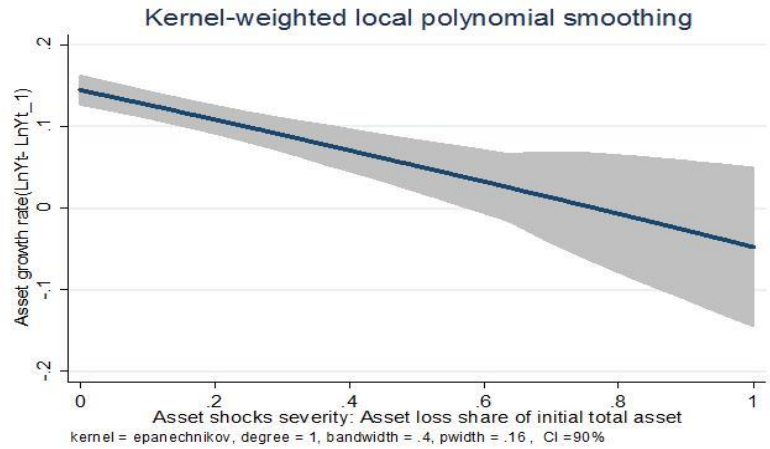
Table 2.5. Share of asset and income loss from total asset and income by asset tercile and province

		Asset tercile			Provinces		
	Pooled	Lowest	Middle	Highest	Ha Tinh	Thua Thien Hue	Dak Lak
Income shock severity	0.31(0.37)	0.37(0.38)	0.29(0.36)	0.26(0.36)	0.25(0.32)	0.31(0.37)	0.36(0.40)
Asset shocks severity	0.12(0.26)	0.21(0.35)	0.08(0.20)	0.06(0.17)	0.10(0.22)	0.16(0.30)	0.09(0.25)

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010. Standard deviations in parentheses.

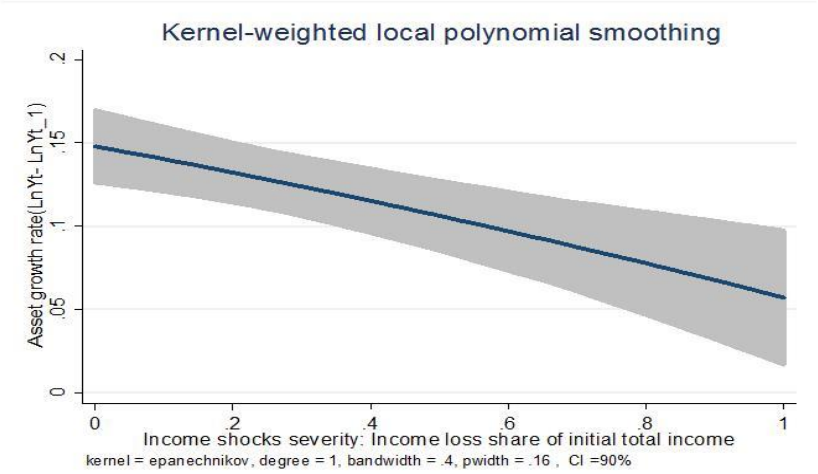
To address the effect of both income and asset shock severities on asset growth, we use nonparametric estimates to regress asset growth on the shock severity over the range [0, 1], as shown in figures 2.1 and 2.2. The Kernel-weighted polynomial regression shows a statistically significant negative relationship between asset growth and shock severity. Households adversely affected by asset and income shocks experience lower asset growth. Severe asset shocks lead to negative growth, which demonstrates that exposure to uninsured adverse shocks can push poor households permanently into a lower growth path and trap them in poverty.

Figure 2.1. Non-parametric regression of asset growth on asset loss initial asset share



Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Figure 2.2. Non-parametric regression of asset growth on income loss share



Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010

2.5.2. Asset growth by wealth group

Following the basic growth model given by equation 2.2, we are now able to explore the pattern of asset growth and identify the effect of initial assets, shocks, coping strategies and geographic capital. We include a third order polynomial in the initial assets to allow for nonlinearities in the center of the distribution (Naschold, 2012). Table 2.6 shows the results of five alternative specifications using household fixed effects estimate that refer to equation 2.2, 2.3, and 2.4, in the methodology section. Basic model (a) and (b) explores the effect of initial assets, income and asset shock severity, and severity of shocks based on household's qualitatively assessment of shocks, respectively on asset

growth pattern. The expanded models that refer to equation 2.3 and 2.4 include additional variables to investigate how coping strategies and geographic capital affect asset growth pattern. All model results indicate asset growth diminishes significantly with the level of assets. Consistent with the results using a non-parametric approach (see Figure 2.1 and 2.2); the results show that shocks income and asset shock severity, and severity of shocks have a significant negative effect on asset growth (Table 2.6, column one and two). When we introduce shocks coping strategies in model 2 (Table 2.6, column three) the effect of shocks further reduce asset growth. We estimate model 3 on various geographic capital variables (model 3a), and aggregate geographic capital index[7] and its interaction with initial assets (model 3b). In line with previous studies (e.g., Jalan and Ravallion 2002), several of the geographic capital variables (distance to market, road quality, transportation, irrigation and sanitation) show a significant effect on asset growth (Table 2.6, column four and five).

[7] We constructed geographic capital index using factor analysis of all relevant geographic variables.

Table 2.6. Fixed effects regression estimates of asset growth

	Model 1				Model 2		Model 3			
	Basic 1		Basic 2		Shock & coping strategies		Geographic capital (a)		Geographic capital interacted with assets (b)	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Asset index	-0.802***	0.13	-0.800***	0.13	-0.805***	0.13	-0.806***	0.13	-0.851***	0.14
Asset index ^2	-0.272***	0.09	-0.272***	0.09	-0.268***	0.09	-0.286***	0.09	-0.283***	0.10
Asset index ^3	-0.050	0.07	-0.050	0.07	-0.049	0.07	-0.040	0.07	-0.045	0.08
Age	0.000	0.01	0.000	0.01	-0.001	0.01	0.002	0.01	-0.004	0.01
Age^2	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
Adult educ.	-0.064	0.05	-0.066	0.05	-0.068	0.05	-0.038	0.05	-0.060	0.05
Gender	-0.076*	0.04	-0.076*	0.04	-0.081*	0.04	-0.110**	0.043	-0.096**	0.04
Membership	0.011	0.07	0.015	0.07	0.012	0.07	-0.021	0.07	-0.008	0.07
Elder	0.070	0.16	0.063	0.16	0.048	0.16	0.158	0.15	0.115	0.16
Child	0.056	0.12	0.047	0.12	0.022	0.13	0.130	0.13	0.122	0.15
Adult labor	0.015	0.01	0.016	0.01	0.016	0.01	0.015	0.01	0.013	0.01
Asset shock	-0.395***	0.11								
Income shock	-0.185***	0.06								
Severity of shocks			-0.314***	0.06	-0.336***	0.08	-0.290***	0.08	-0.304***	0.08
Forest extrac.					-0.262*	0.16	-0.235	0.15	-0.256	0.16
Diversify agric.					0.213	0.24	0.226	0.24	0.251	0.24
Drawing assets					0.193	0.19	0.183	0.19	0.234	0.20
Informal lending					0.177	0.17	0.229	0.17	0.183	0.18
Formal lending					1.334	0.90	1.546*	0.92	1.249	0.85
Public transfer					-0.035	0.16	-0.028	0.15	-0.020	0.16
Reduce cons.					-0.109	0.11	-0.130	0.11	-0.107	0.12
Forest extrac.* shocks					-0.129*	0.07	-0.119*	0.07	-0.128*	0.07
Diversify agric.* shocks					-0.102	0.11	-0.126	0.11	-0.116	0.11
Drawing assets*shocks					-0.087	0.09	-0.102	0.09	-0.103	0.10
Lending informal*shocks					-0.669**	0.34	-0.750**	0.35	-0.649**	0.32
Formal lending*shocks					-0.105	0.08	-0.124	0.08	-0.110	0.08
Reducing cons.*asset shocks					0.080	0.05	0.092*	0.05	0.081	0.05
Public transfer*asset shocks					0.032	0.07	0.035	0.07	0.023	0.08
Paved road							0.160***	0.06		
Mountainous							-0.089*	0.05		
Main transp.							0.224***	0.05		
Violence							-0.027	0.04		
Epidemics							0.071	0.07		
Water supply							0.076	0.08		
Irrigated							0.001*	0.00		
HHs elect.							0.001	0.00		
HHs sanit.							0.001**	0.00		
Distances market							-0.336**	0.14		
Geographic capital index									0.249***	0.09
Geographic capital * Asset									-0.245**	0.10
Cons	1.014***	0.17	0.903***	0.16	0.900***	0.16	1.358***	0.39	0.980***	0.17
R-squared		0.18		0.19		0.21	0.27		0.20	
N	4192		4192		4192		4192		4192	

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: All variables refer to base period value. *** p<0.01. ** p<0.05. * p<0.10.

Although the regression results discussed above show apparently poor households accumulate more quickly than wealthier households, and they are more vulnerable to shocks, they do not establish the long-run welfare dynamics path of poor household. Now, we employ Hansen's threshold

estimator[8] to test whether there exists a critical asset threshold around which asset growth dynamics bifurcates model of equation 2.4. We identify the threshold[9] (L^*) at $US3.92, which is measured in purchasing power parity that splits our sample into two statistically significant different asset growth regimes, where 60% of the households fall into the lower regime.

Table 2.7 illustrates that those below and above the threshold by shocks severity and geographic capital. Those below the threshold tend to lose about 36% of their income and 17% of their assets while those above the threshold tend to lose 26% of their income and 6% of their assets. Those households also tend to report they face sever shocks, use consumption reduction strategy as main coping strategies in case of shock. Additionally, there may be an ethnicity factor because 80% of the households below the threshold are ethnic minorities. Households below the threshold tend to live in risky environments, i.e., in coastal or mountainous areas. Furthermore, they tend to be characterized not only by poor infrastructure conditions but also by security problems and disease epidemics.

[8]We employed a likelihood ratio test for the threshold parameter. The likelihood ratio statistic using a maximum likelihood bootstrap method is statistically significant at 1%, which shows that the model without threshold effects (the model under the null hypothesis) is strongly rejected. Furthermore, the 95% confidence interval for the threshold estimates using bootstrap techniques is rather small ($US3.77 to $US3.97).

[9]Non-parametric local polynomial regressions with Epanechnikov kernel weights were employed as a robustness analysis to test for the existence of thresholds at which asset accumulation diverges. The asset recursion function confirms this. The relative truncation threshold is calculated at $US3.87, which suggests that the estimated threshold is fairly precise.

Table 2.7. Households below and above the threshold by shocks severity and geographic capital

Households with:	Households below the MT	Households above the MT	Difference test
Ethnic minorities (%)	72	28	***
Asset shock severity (%)	17	6	***
Income shock severity (%)	36	26	***
Shock severity (count)	2.45	1.5	***
Drawing down asset (%)	13	25	***
Reduction consumption (%)	70	54	***
Households located in villages with:			
Coastal areas	57	43	**
Mountainous areas	61	39	***
No access to motorized transport	70	30	***
No paved roads	59	41	***
No access to electricity	72	28	***
No access to public water supply	58	42	***
No access to sanitation	61	39	***
Violence	58	42	**
Epidemics	66	34	***

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Based on the threshold, we can now assess the effect of initial asset, shocks coping strategies and geographic capital on asset growth separately for the two wealth groups. We test whether the initial assets, asset and income shock severity, severity of shocks and geographic capital coefficients from the two groups of households are equal to each other. We find statistically significant differences in the coefficients of initial assets, asset and income shock severity, severity of shocks and geographic capital between households below and above the estimated threshold.

Table 2.8 and 2.9 demonstrates that there are several interesting messages that can be extracted from this comparison. First, splitting the sample rejects the convergence hypothesis supported by the results of all three models (Table 2.8 and 2.9). The coefficient of the initial asset level is significant and negative for households below the threshold[10] (in all models in Table 2.8), but this is not the case for households above the threshold (Table 2.9), which indicates that households living on less than $US3.97 per capita per day are unable to accumulate assets simply because their initial level of assets is too small. This condition indicates a poverty trap, which at first glance may be surprising for an emerging market economy such as Vietnam that has an impressive record of poverty reduction in the recent past. However, our analysis provides some answers as to why this is possible and why the decline in poverty is an insufficient indicator for sustainable development.

[10]Consequently, we defined this threshold as Micawber Threshold (MT) at which accumulation dynamics diverge.

Table 2.8. Fixed effects regression estimates of asset growth for households below the MT (L*)

	Households Below the MT									
	Model 1				Model 2		Model 3			
	Basic (a)		Basic (b)		Shock & coping strategies		Geographic capital (a)		Geographic capital interacted with asset (b)	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Asset index	-0.739***	0.21	-0.734***	0.21	-0.753***	0.21	-0.873***	0.23	-0.826***	0.23
Asset index ^2	-0.340***	0.13	-0.347***	0.13	-0.329***	0.13	-0.383***	0.13	-0.323**	0.13
Asset index ^3	-0.101	0.15	-0.108	0.15	-0.080	0.15	-0.030	0.16	-0.053	0.16
Age	-0.012	0.01	-0.012	0.01	-0.014	0.01	-0.011	0.01	-0.014	0.01
Age^2	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
Adult educ.	0.229***	0.08	0.229***	0.08	0.246***	0.08	0.234***	0.08	0.236***	0.07
Gender	-0.055	0.07	-0.056	0.07	-0.074	0.07	-0.145*	0.08	-0.081	0.07
Membership	-0.028	0.11	-0.017	0.11	-0.020	0.12	-0.019	0.12	-0.038	0.12
Elder	1.186***	0.39	1.160***	0.39	1.233***	0.40	1.340***	0.40	1.255***	0.38
Child	0.148	0.18	0.153	0.18	0.149	0.18	-0.105	0.08	-0.122	0.08
Adult labor	1.431***	0.40	1.386***	0.41	1.472***	0.43	1.473***	0.42	1.551***	0.43
Asset shock	-0.479***	0.15								
Income shock	-0.184*	0.10								
Severity of shocks			-0.379***	0.08	-0.433***	0.11	-0.342***	0.11	-0.377***	0.11
Forest extrac.					0.420	0.26	0.342	0.28	0.413	0.28
Diversify agric.					0.655	0.45	0.782*	0.46	0.725	0.45
Drawing assets					0.705	0.49	0.609	0.49	0.664	0.49
Informal lending					0.410	0.31	0.439	0.32	0.459	0.31
Formal lending					1.467	1.67	1.291*	1.72	2.580	1.71
Public transfer					0.219	0.26	0.253	0.25	0.216	0.25
Reduce cons.					-0.407*	0.23	-0.439*	0.23	-0.418*	0.23
Forest extrac.* shocks					-0.201*	0.12	-0.192*	0.11	-0.181*	0.11
Diversify agric.* shocks					-0.293	0.19	-0.360*	0.19	-0.321*	0.19
Drawing assets*shocks					-0.275	0.23	-0.271	0.22	-0.270	0.22
Lending informal*shocks					-0.220*	0.13	-0.238*	0.14	-0.243*	0.13
Formal lending*shocks					-0.247	0.61	-0.565	0.63	-0.294	0.62
Public transfer* shocks					-0.060	0.12	-0.060	0.12	-0.059	0.11
Reducing cons.* shocks					-0.209**	0.09	-0.224**	0.09	-0.203**	0.09
Paved road							0.110	0.11		
Mountainous							-0.230**	0.11		
Main transp.							0.168**	0.08		
Violence							-0.073	0.08		
Epidemics							-0.094*	0.06		
Water supply							0.152	0.13		
Irrigated							0.001	0.00		
HHs elect.							0.002	0.00		
HHs sanit.							0.003***	0.00		
Distances market							-0.368***	0.09		
Geographic capital index									0.331***	0.05
Geographic capital * Asset									-0.318**	0.14
Cons	0.044	0.40	-0.063	0.41	-0.213	0.40	-0.013	1.01	-0.120	0.38
R-squared		0.14		0.14		0.16		0.22		0.21
N	2535		2535		2535		2535		2535	

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: All variables refer to base period value. *** p<0.01. ** p<0.05. * p<0.10.

Second, our results show (Table 2.8, column one and two) that shocks have a much significant effect on households trapped in poverty. Both the asset and income shock coefficients, and shocks severity are significant. The marginal effects of the respective mean values of the shock coefficients indicate that an increase in the asset shocks of 10% decreases asset growth by 4.7%, on average; for income shocks, the reduction in asset growth is 1.8%. However, for households above the MT, shocks do not

seem to matter much (Table 2.9, column one and two). There are two possible reasons; first those households lost only 7% of their assets and about one-fourth of their income, whereas that figure is about 17 % of their assets and 36% of their income and 17 % of their assets for households below the MT. Second, households above the MT are often situated in wealthier areas that tend to adopt high-return strategies for income generation. Third, the model with coping strategies (Table 2.8, column three) shows that coping strategies exacerbate the effect of shocks as shown by the larger magnitude of the shock coefficients for households below the MT. Shocks coping strategies such as labor allocation to forest extraction, borrowing from informal money lenders and reducing consumption have significant negative effects on asset growth. This is quite plausible that households trapped in poverty tend to be those that are forced to adopt costly coping strategies which further suggest that those households generally give up future prospects to maintain current levels of well-being as much as possible.

Fourth, when geographic capital is introduced (Table 2.8 and 2.9, column four), the coefficient of severity of shocks becomes smaller in the magnitude which suggests that geographic capital has a significant role on household resilience in coping with shocks. Living in a mountainous areas and remote areas lowers the asset growth for households below the MT to reduce growth on average by 2% and 4%, respectively which suggest that poverty is increasingly concentrated among ethnic minorities often located in Vietnam's mountainous and remote area. Geographic variables measuring "access to motorized transportation" and "sanitation" and have significant positive impact on household asset growth, whereas epidemics such as avian flu have significant negative impact on asset growth for households below the MT. While access to a paved road, motorized transportation and electricity have significant positive impacts on household asset growth for households above the MT. Aggregate geographic capital index have strong significant effect on household asset growth for both group of households, while the magnitude is significantly higher for households below the MT. We also explore whether the return on assets differs with geographic capital; initial assets are interacted with geographic capital index (Table 2.8 and 2.9, column five). Our results suggest that assets have higher returns in villages with access to quality infrastructure, and public goods and services for both groups of households.

Turning to the effect of household education and demographic characteristics (Table 2.8 and 2.9, column five), we find that level of education; proportion elderly and adult household members have significant positive effect on asset growth for households below the MT. The proportion adult household members have a positive significant effect on asset growth for households above the MT. Female-headed households for that group of households' shows higher asset growth than their male

counterparts. The reason could be that female heads of household receive remittances from their spouses who had migrated to urban areas for non-farm employment.

Table 2.9. Fixed effects regression estimates of asset growth for households above the MT (L*)

	Households Above the Threshold									
	Model 1				Model 2		Model 3		Model 4	
	Basic 1		Basic 2		Shock & coping strategies		Geographic capital		Geographic capital interacted with asset	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Asset index	-0.310	0.20	-0.308	0.20	-0.292	0.20	-0.051	0.20	-0.291	0.19
Asset index ^2	-0.647***	0.25	-0.664**	0.24	-0.686***	0.26	-0.692***	0.25	-0.519**	0.19
Asset index ^3	0.287**	0.13	0.292**	0.13	0.317**	0.13	0.297**	0.13	0.327**	0.13
Age	0.000	0.01	0.000	0.01	-0.001	0.01	0.001	0.01	0.003	0.01
Age^2	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
Adult educ.	0.003	0.04	0.002	0.04	0.003	0.04	0.014	0.05	0.018	0.04
Gender	-0.098**	0.04	-0.097**	0.04	-0.089**	0.04	-0.081*	0.04	-0.100**	0.04
Membership	0.035	0.08	0.037	0.08	0.041	0.08	0.020	0.08	0.031	0.08
Elder	-0.029	0.18	-0.028	0.18	-0.031	0.18	0.110	0.16	-0.074	0.17
Child	-0.413***	0.14	-0.411***	0.14	-0.400***	0.15	-0.232	0.15	-0.423***	0.15
Adult labor	0.013***	0.00	0.014***	0.00	0.013***	0.00	0.013***	0.00	0.013***	0.00
Asset shock	-0.114	0.10								
Income shock	-0.050	0.06								
Severity of shocks			-0.099	0.07	-0.082	0.09	-0.079	0.08	-0.114	0.10
Forest extrac.					0.101	0.15	0.087	0.15	0.066	0.15
Diversify agric.					0.126	0.28	0.170	0.27	0.100	0.29
Drawing assets					-0.011	0.14	0.016	0.14	0.006	0.15
Informal lending					-0.171	0.17	0.17	0.17	-0.183	0.17
Formal lending					0.102	0.61	0.338	0.63	0.141	0.64
Public transfer					-0.192	0.17	-0.190	0.17	-0.287	0.18
Reduce cons.					0.017	0.11	0.002	0.11	-0.008	0.12
Forest extrac.* shocks					-0.071	0.07	0.07	0.07	-0.060	0.07
Diversify agric.* shocks					-0.069	0.12	0.12	0.12	-0.061	0.13
Drawing assets*shocks					-0.019	0.07	0.07	0.07	-0.029	0.07
Lending informal*shocks					0.055	0.07	0.08	0.08	0.054	0.08
Formal lending*shocks					-0.018	0.22	0.22	0.22	-0.028	0.23
Reduce. cons. *asset shocks					-0.004	0.05	0.05	0.05	0.011	0.05
Public transfer*asset shocks					0.042	0.07	0.07	0.08	0.082	0.08
Paved road							0.127**	0.06		
Mountainous							0.036	0.05		
Main transp.							0.152***	0.06		
Violence							-0.052	0.04		
Epidemics							0.047	0.07		
Water supply							0.047	0.09		
Irrigated							0.002*	0.00		
HHs elect.							0.002*	0.00		
HHs sanit.							0.000	0.00		
Distances market							-0.242	0.39		
Geographic capital									0.154**	0.07
Geographic capital*Asset									-0.121	0.09
Cons	0.534***	0.18	0.502***	0.183	0.500***	0.185	1.013***	0.31	0.438**	0.18
R-squared		0.20		0.20		0.22		0.27		0.25
N	1657		1657		1657		1657		1657	

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: All variables refer to base period value. *** p<0.01. ** p<0.05. * p<0.10.

2.5.2. Behavioral differences in shock coping strategies by wealth group

In the previous sections, we assessed the existence of poverty traps using direct tests of asset dynamics. In this section, an indirect test of differentiated behavioral responses to shocks is used to assess the existence of poverty traps that has been recently suggested by Carter and Barrett (2013). Using Hansen's threshold estimator applied to drawing down assets and consumption reduction in response to shocks, we identify the asset threshold (ℓ^*) at about \$US3.01 that splits our sample into two statistically significant behavioral responses to shocks in terms of drawing asset and consumption reduction. The estimated asset threshold allows us to test for differences in shock-coping strategies. We hypothesize that households above the threshold smooth consumption by drawing down on their assets, whereas those below the threshold will reduce consumption to maintain their assets specified in connection with equation 2.6 and 2.7. To capture time-invariant household characteristics, we estimate a fixed effect logit regression model to test these hypotheses.

First, we regress drawing down assets, income and shock severity, as well as other covariates separately for households below and above the threshold. The results presented in Table 2.10 for below and above the threshold are quite striking, for households above the threshold we find a highly significant negative effect of assets level, whereas asset level has a positive and significant effect on drawing down assets for households above the threshold. The results confirm our hypothesis that households above the threshold draw down assets in response to shocks, but this is not the case for households below the threshold. Memberships in local social and political organizations tend to increase drawing down assets in response to shocks for households below the threshold. We also find households with a higher level of education and those having more children are more likely to depend on their assets to cope with shocks for households above the threshold.

Table 2.10. Drawing down assets in response to shocks by estimated asset threshold (ℓ^*)

	Pooled		Below ℓ^*				Above ℓ^*			
	Asset & income shocks		Asset & income shocks		Severity of shocks		Asset & income shocks		Severity of shocks	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Asset index	0.132	0.33	-1.795***	0.69	-1.796***	0.69	1.665*	0.87	1.619*	0.87
Age	0.051***	0.01	0.054**	0.02	0.054**	0.02	0.038	0.02	0.039	0.02
Age^2	-0.000*	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
Adult educ.	0.146	0.09	0.005	0.15	0.001	0.15	0.277**	0.13	0.273**	0.13
Gender	0.237*	0.12	0.073	0.20	0.072	0.20	0.248	0.17	0.253	0.17
Membership	0.149	0.17	0.457*	0.27	0.448	0.27	-0.198	0.23	-0.212	0.23
Elder	-0.472	0.38	-0.693	0.77	-0.657	0.76	-0.038	0.49	0.017	0.49
Child	-0.034	0.31	-0.354	0.62	-0.305	0.60	0.721*	0.43	0.716*	0.43
Adult labor	-0.053	0.04	-0.057	0.08	-0.050	0.07	-0.025	0.05	-0.027	0.05
Asset shock	0.308	0.20	0.225	0.29			0.957***	0.34		
Income shock	-0.117	0.14	0.037	0.22			-0.294	0.20		
Severity of shocks					0.132	0.18			0.162	0.10
N	3,809		1,261		1,261		1,847		1,847	

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: *** p<0.01. ** p<0.05. * p<0.10.

To explore who is more likely to depend on consumption reduction strategies in response to shocks, we estimate a fixed effect logit regression model of reducing consumption in case of shock using asset level, income and asset shock severity as well as other covariates as explanatory variables. Consistent with our hypothesis, we find a highly significant positive effect of assets level on reducing consumption in case of shock for household below the threshold, whereas assets level has a negative effect for households above the threshold, although it is not significant (Table 2.11). The results confirm our hypothesis and are consistent with a study in rural Burkina Faso (Kazianga and Udry, 2006; Carter and Lybbert, 2012). Consumption reduction in case of shock is more likely to increase with age of the head for both households below and above the threshold. Households below the threshold with more adult labor are less likely to reduce consumption in response to shocks. Furthermore, for both groups of households we find that asset and income shock severity is significantly related to consumption.

Table 2.11. Consumption reduction in response to shocks by estimated asset threshold (ℓ^*)

	Pooled		Below ℓ^*				Above ℓ^*			
	Asset & income shocks		Asset & income shocks		Severity of shocks		Asset & income shocks		Severity of shocks	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Asset index	-0.032	0.20	0.700*	0.38	0.733*	0.39	-0.095	0.37	-0.065	0.38
Age	0.028**	0.01	0.032*	0.02	0.029	0.02	0.033**	0.01	0.031**	0.01
Age^2	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
Adult educ.	0.072	0.06	0.247*	0.13	0.255*	0.13	0.070	0.08	0.058	0.08
Gender	0.163*	0.08	0.173	0.17	0.200	0.16	0.130	0.11	0.142	0.11
Membership	-0.009	0.11	0.193	0.21	0.271	0.20	-0.052	0.16	-0.049	0.15
Elder	-0.457*	0.27	-0.893	0.60	-1.205**	0.59	-0.429	0.33	-0.476	0.32
Child	1.115***	0.23	-0.016	0.54	-0.422	0.53	-1.293***	0.31	-1.276***	0.30
Adult labor	0.034	0.02	-0.147**	0.07	-0.199***	0.07	0.073*	0.04	0.077*	0.04
Asset shock	1.495***	0.20	1.399***	0.28			1.952***	0.34		
Income shock	2.621***	0.13	2.174***	0.24			2.731***	0.17		
Severity of shocks					1.991***	0.19			3.036***	0.18
N	3,809		1,261				1,847			

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: *** p<0.01. ** p<0.05. * p<0.10.

2.6. Conclusions and policy implications

This study has examined the link between shocks, geographic capital and poverty traps. The contribution of the paper is two-fold. First, we provide empirical evidence about the conditions of poverty traps in an emerging market economy in Southeast Asia where overall poverty reduction has been successful but in which inequality has increased and "pockets of poverty" remain. Second, we compare direct tests of asset dynamics and indirect tests of differentiated behavioral responses to shocks used to assess the existence of poverty traps.

We find consistent results from the direct tests of asset dynamics as well as the indirect testing methods. Both provide strong evidence for the existence of poverty traps and offer information about the degree and the costs of uninsured risk that rural households in Vietnam are confronted with. In particular, we find that the indirect approach provides better insights about the cost of uninsured risk. There are three major reasons for the existence of poverty traps in rural Vietnam. First, poorer household experience more shock and are much more affected by these shocks when we compared with those of wealthier households. Second, our models show that the ethnic discrimination, the allocation of infrastructure and public goods and services are also responsible factors for the existence of poverty traps. Third, we could say that "to be poor is expensive!" Households trapped in poverty tend to be those that are forced to adopt costly coping strategies which further suggest that those generally give up future prospects to maintain current levels of well-being as much as possible mainly because they have less access to formal insurance mechanisms.

We believe that our empirical results have important policy implications. The income equivalent of our asset threshold equates to approximately twice the poverty line set by the Vietnamese General Statistics Office (GSO) for rural areas. In other words, households that have surpassed the poverty line based on ex post poverty assessment are not necessarily out of poverty because the majority of these do not accumulate assets. At least from a medium term perspective, approximately 60% of the approximately 2,000 households in the three provinces included in our sample can be considered trapped in poverty which is much higher than the 25% to 33% head count ration in our sample over three panel waves. This suggests that poverty reduction in rural Vietnam is still long way to go. While the Vietnamese government may have comprehensive and effective programs to help the poor, particularly in the case of natural disasters and other shocks, it is uncertain to what extent these measures can solve the problem of the poverty trap. As long as these programs are focused on smoothing consumption, they may show quick success in terms of poverty reduction that is measured in terms of head count ratio. However, such interventions will not necessarily put people on a sustainable development path. What seems to be required instead are more integrated intervention in building up productive assets and develop the capacities of the poor including better access to formal credit and insurance, and public service and infrastructure.

Appendix 2.1A: Fixed effects estimates of livelihood regression to construct asset index

	Coef	Se
HH-Size	-0.343***	0.09
Children	-0.486	0.38
Elderly	-1.472***	0.55
Age	-0.065	0.07
Age^2	-0.004	0.01
Gender	-0.012	0.14
Off-Farm	0.309***	0.11
Self Emp	0.729***	0.16
Migrant	0.021	0.09
Agric. tools	0.023*	0.01
Agric. tools^2	-0.007	0.01
Transp. tools	-0.009*	0.01
Transp. tools^2	0.005***	0.00
Land	0.387**	0.17
Land^2	-0.025	0.02
Livestock	0.026***	0.01
Livestock^2	-0.005***	0.00
Own House	0.004***	0.00
Own House^2	-0.000***	0.00
House Utilities	0.023***	0.01
House Utilities^2	-0.005***	0.00
Agric. tools*Land	0.001	0.01
Agric. tools*Transp. tools	0.000	0.00
Agric. tools* Livestock	0.000	0.00
Agric. tools*House	0.000*	0.00
Agric. tools*House utilities	0.000	0.00
Transp. tools*Land	-0.005*	0.00
Transp. tools*House	-0.000***	0.00
Transp. tools*House utilities	0.000	0.00
Transp. tools*Livestock	0.000	0.00
Land*House	0.001***	0.00
Land*House utilities	-0.007**	0.00
Land*Livestock	-0.002	0.00
Livestock*House	0.000	0.00
Livestock*House utilities	0.000	0.00
House*House utilities	0.000	0.00
Distances market	-0.008***	0.00
Main transp	0.597***	0.15
Irrigated	0.323***	0.04
HHs sanit.	0.005***	0.00
HHs elect.	0.009**	0.00
Violence	-0.112	0.14
Epidemics	-0.057	0.18
Paved road	0.204	0.18
Mountainous	-0.060	0.15
Water supply	0.009***	0.00
Province Hue*Time	0.049	0.10
Dak Lak*Time	0.049	0.09
Cons	2.247***	0.51
N	6288	
R^2	0.29	

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: *** p<0.01. ** p<0.05. * p<0.10.

REFERENCES

Adato, M., Carter, M.R., May, J. (2006). Exploring Poverty Traps and Social Exclusion in South Africa Using Qualitative and Quantitative Data. *Journal of Development Studies* 42:226–247.

Alderman, H., Hoddinott, J., Kinsey B. (2006). Long Term Consequences of Early Childhood Malnutrition. *Oxford Economic Papers* 58(3):450–474.

Asian Development Bank (ADB), (2012). Asian Development Outlook 2012: Confronting Rising Inequality in Asia. Asian Development Bank, Philippines, Mandaluyong City.

Banerijee, A., Newman, A. (1993). Occupational Choice and the Process of Development." *Journal of Political Economy* 101(2):274–98.

Banerjee, A., Duflo, E. (2003). Inequality and growth: What can the data say? *Journal of Economic Growth* 8, 267–299.

Barrett, C. B., B. J. Barnett, M. R. Carter, S. Chantarat, J. W. Hansen, A. G. Mude, D. E. Osgood, J. R. Skees, C. Turvey, G., Ward, M. N. (2008). Poverty Traps and Climate Risk: Limitations and Opportunities of Index-Based Risk Financing." IRI Technical Report No. 07-02.

Barrett, C. B., Marenya, P. P., McPeak, J. G., Minten, B., Murithi, F. M., Oluoch Kosura, W., Place, F., Randrianarisoa, J. C., Rasambainarivo, J., Wangila, J. (2006). Welfare Dynamics in Rural Kenya and Madagascar. *The Journal of Development Studies* 42: 248–277.

Barrett, C.B. (2005). Rural Poverty Dynamics: Development Policy Implications. *Agricultural Economics* 32:45–60.

Barrett, C.B., Carter, M.R. (2013). The Economics of Poverty Traps and Persistent Poverty: Policy and Empirical Implications. *The Journal of Development Studies* 49: 976–990.

Basu, K. (1999). Child Labor: Cause, Consequence and Cure with Remarks on International Labor Standards. *Journal of Economic Literature* 37(3), 1083–1119.

Baulch, B., Pham, H.T., Reilly, B. (2011). Decomposing the Ethnic Gap Standards in Rural Vietnam: 1993 To 2004. *Oxford Development Studies* 40: 87–117.

Carter, M. R., Little, P. D., Mogues, T., Negatu, W. (2007). Poverty Traps and Natural Disasters in Ethiopia and Honduras. *World Development* 35:835–856.

Carter, M.R., Barrett, C.B. (2006). The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach. *The Journal of Development Studies* 42:178–199.

Carter, M.R., Lybbert, T.J. (2012). Consumption versus Asset Smoothing: Testing the Implications of Poverty Trap Theory in Burkina Faso. *Journal of Development Economics* 99:255–264.

Deaton, A. (1991). Saving and Liquidity Constraints. *Econometrica* 59: 1221–1248.

Dercon, S. (2002). Income Risk, Coping Strategies and Safety Nets. *World Bank Research Observer* 17:141–166.

Dercon, S., Christiaensen L. (2011). Consumption Risk, Technology Adoption and Poverty Traps: Evidence from Ethiopia. *Journal of Development Economics* 96:159–173.

Emerson, P.M., Portela, A. (2003). Is There a Child Labor Trap? Intergenerational Persistence of Child Labor in Brazil. *Economic Development and Cultural Change* 51(2), 375–398.

Fafchamps, M., Udry, C., Czukas, K. (1998). Drought and Saving in West Africa: Are Livestock a Buffer Stock? *Journal of Development Economics* 55 (2), 273–305.

Foster, J., Greer, J., Thorbecke, E. (1984). A Class of Decomposable Poverty Measures. *Econometrica* 52:761–766.

General Statistics Office (2011). Summary results of the Vietnam household living standard survey 2010. Statistical Publishing House, Hanoi, Vietnam

General Statistics Office of Vietnam (2007). Result of the Vietnam Household Living Standards Survey (VHLSS) 2006. Statistical Publishing House, Hanoi, Vietnam

Giesbert, L., Schindler, K. (2012). Assets, Shocks and Poverty Traps in Rural Mozambique. *World Development* 40:1594–1609.

Hansen, B.E. (2000). Sample Splitting and Threshold Estimation. *Econometrica* 68: 575–603.

Hardeweg, B., Stephan, K., Waibel, H. (2013). Establishing a Database for Vulnerability Assessment. In Stephan, K. and Waibel, H. (Eds.), *Vulnerability to Poverty-Theory, Measurement and Determinants*. Macmillan: Palgrave.

Hoddinott, J. (2006). Shocks and Their Consequences across and Within Households in Rural Zimbabwe. *The Journal of Development Studies* 42: 301–321.

Jalan, J., Ravallion, M. (2002). Geographic Poverty Traps? A Micro Model of Consumption Growth in Rural China. *Journal of Applied Econometrics* 17:329–346.

Jalan, J., Ravallion, M. (2004). Household Dynamics in Rural China. In S. Dercon, (eds.), *In Insurance against Poverty*. Oxford University Press: Oxford

Kazianga, H., Udry, C. (2006). Consumption Smoothing? Livestock, Insurance and Drought in Rural Burkina Faso. *Journal of Development Economics* 79: 413– 446

Lokshin, M., Ravallion, M. (2004). Household Income Dynamics in Two Transition Economies. *Studies in Nonlinear Dynamics and Econometrics* 8:1–31.

Lybbert, T. J., Barrett, C. B., Desta, S., Coppock, D. L. (2004). Stochastic Wealth Dynamics and Risk Management among a Poor Population. *The Economic Journal 114:750*–777.

Naschold, F. (2012). "The Poor Stay Poor" Household Asset Poverty Traps in Rural Semi-Arid India. *World Development* 40: 2033–2043.

Naschold, F. (2013). Welfare Dynamics in Pakistan and Ethiopia – Does the Estimation Method Matter? *The Journal of Development Studies* 49: 936-954

Nguyen Viet, C. (2012). Ethnic Minorities in Northern Mountains of Vietnam: Poverty, Income and Assets. MPRA Paper No. 40769, Munich University, Germany.

Phung, D. P, Hardeweg, B., Praneetvatakul, S., Waibel, H. (forthcoming). Non-Sampling Error and Data Quality: What Can We Learn From Surveys to Collect Data for Vulnerability Measurements? *World Development.*

Quisumbing, A., Baulch, B. (2013). Assets and Poverty Traps in Rural Bangladesh. *The Journal of Development Studies* 49:898–916.

Vu L. Baulch, B. (2011). Assessing Alternative Poverty Proxy Methods in Rural Vietnam. *Oxford Development Studies* 39(3): 339-367.

World Bank, 2012. Well Begun, Not yet Done: Vietnam's Remarkable Progress on Poverty Reduction and the Emerging Challenges. Report Number 74910, Washington DC; World Bank.

Zimmerman, F.J., Carter, M.R., 2003. Asset Smoothing, Consumption Smoothing and the Reproduction of Inequality under Risk and Subsistence Constraints. *Journal of Development Economics* 71: 33–260.

3 POVERTY TRANSITION IN RURAL VIETNAM: THE ROLE OF MIGRATION AND REMITTANCES

With Herman Waibel and Lena Hohfeld

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3.1. Introduction

The movement of rural populations out of agriculture to find jobs in urban centers is a major aspect of the development process, especially in emerging market economies in Asia. Because of the increasing numbers of rural-urban migrants, the influence of migrant remittances on household welfare has come to the fore in policy discussions and related research in recent decades. While the importance of remittances for rural households is undisputed; results regarding their effect on household welfare are ambiguous. Some authors find that migration, particularly migration with remittances, relaxes liquidity constraints, allows poor households to engage in high-return activities, and, in turn, improves asset accumulation (e.g., Adams and Cuecuecha, 2010; Taylor et al., 2003).

By contrast, other research indicates that migration and remittances may not necessarily improve the welfare of rural households for a variety of reasons. First, remittances may influence the behavior of households, which may use remittances for consumption purposes rather than investment (Adams and Cuecuecha, 2010; de Brauw and Rozelle, 2008). Second, migrants from poor rural households are often employed in low-quality urban occupations with poor job security, such as domestic service and informal sector occupations, which results in low and uncertain remittances (Zhang, 2012; Fan and Stark, 2008; Mckenzie and Rapoport, 2007). By contrast, wealthier households tend to have more successful migrants with better paid employment; therefore, migration can increase inequality in the community of origin (Acosta et al., 2008; Nguyen et al., 2007; Amare et al., 2012). The overall impact of migration and remittances on welfare dynamics at the origin thus remains an empirical question.

Several studies in various developing countries have focused on the effects of migration and remittances on poverty and inequality based on retrospective assessments of flow variables, such as income and consumption (e.g., Amare et al., 2012; Adams and Cuecuech, 2010; Nguyen et al., 2011; Acosta et al., 2008). However, a limitation of such variables is that they do not distinguish between structural or stochastic poverty. Households are structural (long-term) poor, if they are poor based on income and asset poverty lines. They are however only stochastically (short-term) poor, if they

own assets above the asset poverty line, but their income is below the poverty line, for example due to shocks (Barrett, 2005). Migration and remittances can lead to structural transitions out of poverty if they increase asset accumulation. However, if migration and remittances increase only current income and consumption and not assets, these transitions may be stochastic, which implies that migrants may fall back into poverty (Barrett, 2005). Moreover, income and consumption data are subject to recall and measurement errors that can inadvertently lead to an overestimation of the impact of migration and remittances on poverty transitions. Measurement of assets does not require recall, and can therefore be expected to be more accurate (Sahan and Stifel, 2000; Barrett, 2005).

The paper uses a three-year rural panel data set that contains information at the village and household level on approximately 2200 households in 220 villages in three Vietnamese provinces. The paper contributes to the literature in several respects. First, from a conceptual perspective, our study links two areas in the economics of poverty, i.e., the dynamic asset-based approach (Carter and Barrett, 2006) and the New Economics of Labor Migration theory (Taylor, 1999; Stark & Bloom, 1985). The combining these two theories allows us to identify whether and under which conditions migration with and without remittances leads to long-term structural growth, based on asset growth, or to stochastic growth, based only on short-term growth of income and consumption, but not on asset growth, which implies a high risk of individuals to fall back into poverty (Lybbert et al., 2004). Second, from an empirical research perspective, our study makes three contributions: (i) it differentiates the impacts of migration from those of remittances, (ii) it provides evidence on whether migration and remittances ultimately reduce the asset growth gap between poor and non-poor households, and (iii) it examines the impact of migration and remittances on the well-being of ethnic minorities who have been lagging relative to individuals who benefited from the very positive overall poverty reduction occurring in Vietnam (World Bank, 2012; Baulch et al., 2011).

From an econometric standpoint, as analysis the welfare implications of migration and remittances may be affected by an endogeneity problem. This paper acknowledges that the differences in welfare outcome variables between migrant and non-migrant households could be due to unobserved heterogeneity. To address the potential endogeneity problem of migration decision and remittances receipts, first we employ household-level fixed-effects (FE). Household FE estimates control for the effect of time-invariant unobservable heterogeneities; however, the estimates may suffer from bias due to time-variant unobservable characteristics. We therefore complement FEs with instrumental variable (IV) estimation. In the choice of instruments, we follow McKenzie and Rapoport (2007) and Antman (2011) and use unemployment rate and GDP per capita in three major

migrant destinations[11] to control for time-variant heterogeneities. We argue that that these variables influence the welfare growth only through their effect on the household's migration decision and remittances receipts.

The remainder of the paper is organized as follows. The next section elaborates the background on migration in Vietnam and the data that are used. In section 3, we propose a model that links the new economics of labor migration theory and welfare dynamics by using the asset-based approach. The empirical and identification strategies that we apply to test our hypotheses are discussed in section 4. Estimation results and discussions are presented and discussed in section 5, which are followed by our conclusions in section 6.

3.2. Background and data description

3.2.1. Background on migration in Vietnam

During the "Doi Moi" in the 1980s, the Vietnamese government initiated a transition from a centralized command economy to a more market-oriented economy. Following the reform, capital inflows and capital good exports and imports showed remarkable growth (Plummer, 1995), and the share of agriculture in GDP declined by half, while the share of manufacturing in GDP nearly doubled between 1990 and 2010, increasing the demand for labor in urban areas (GSO, 2010). Rural migrants satisfied much of this demand. Consequently, the percentage of individuals employed in agriculture declined from 73% in 1990 to 54% in 2007 (GSO, 2010).

Following the Doi Moi reforms, both the strict relocation programs and the "Ho Khau" registration systems that formerly restricted many individuals from legally migrating into cities were relaxed, and farmers were able to transfer or lease their land (Duong et al., 2011). Because of these changes, migration within and across Vietnam's borders has increased dramatically over the last two decades. The 1999 census revealed that approximately 4.5 million persons migrated internally during the period from 1995 to 1999, whereas between 2004 and 2009, the level of migration increased to 6.6 million persons (7.7% of the population). The major receiving destinations are Ho Chi Minh City and its surrounding provinces, Binh Duong, Dong Nai and Hanoi in the northern part of the country.

Ethnic minorities, who represent all ethnic groups other than the ethnic majority population of Kinh, are concentrated in the geographically remote upland areas. Because of their geographic

[11]The information about migration activities contained in the household survey includes information about the migration duration period, the place of destination and the remittances received from the absent household member.

remoteness, lower level of education, and reduced access to information on urban job opportunities, these minority populations are less likely to migrate. According to the 2009 census, the Kinh ethnic majority accounted for more than 90% of migration, whereas ethnic minorities are generally engaged in low-return activities in their natal villages[12].

3.2.2. Data description

The data used for this study originate from a longitudinal survey designed to assess vulnerability to poverty in Asia (DFG FOR 756 database) that comprises three rounds (2007, 2008 and 2010) of household- and village-level surveys. The survey was conducted in three provinces of the North Central Coast and Central Highlands in Vietnam. The provinces were deliberately selected because of their peripheral location along a border with their neighbors Laos or Cambodia and because of the certain degree of variation in agro-ecological conditions between these provinces. A three-stage cluster random sampling procedure was used to obtain a sample representative of the rural populations of the three selected provinces. In the first stage, the communes were sampled according to population share at the district level. Next, the villages were sampled with a probability proportional to their size based on their population. Finally, a systematic random sample with equal probability from household lists ordered by household size was used, resulting in a total sample size of 2200 households and 220 villages (Hardeweg et al., 2013). The data include detailed information on household characteristics such as the education level, demographic characteristics, migration experience, assets, income, and consumption of the household and the household members. The village head questionnaire contains information on the infrastructure and basic public goods that could affect the livelihoods of the households.

As this study aims to explore the impact of migration and remittances on asset accumulation, we defined a migrant is a household member who has lived outside the district for at least one month during the survey year period. We distinguish migrant households[13] into households with remittances and households without remittances. Not all households that include a migrant receive remittances, which may be due to high living costs and occasionally low-quality employment (UNFPA, 2010). Migrant households without remittances are migrant households that did not receive remittances during the survey year period. As remittances, we consider in-kind and cash

[12]More than two-thirds of ethnic minorities, primarily those living in mountainous and remote villages, remained poor in 2010, whereas only 13% of the Kinh majority remained poor. In addition, the income gap between the two groups increased by 14.6% between 1995 and 2004, despite long periods of economic growth (Baulch et al., 2011).

[13]Since the proportion of international migrant households in the sample was only about 3%, we did not differentiate the impact of international migration from the impact of internal migration.

remittances from migrants. Table 3.1 provides a description of the variables and summary statistics of the pooled sample. On average, the household size was 4.38 members, and adult members had 7.86 years of schooling. More than three-fourths of the sampled household heads were male. More than 85% of the households participated in political or social organizations, and more than 75% of the sampled households participated in non-farm activities.

Table 3.1. Description and summary statistics of panel variables (N = 6318)

Variable		
Household and social capital		
HH size	Total household size	4.38(1.76)
Children	Proportion of children in household under 15 years of age	0.24(0.22)
Elderly	Proportion of elderly in household over 60 years of age	0.10(0.23)
Age	Age of the household head	47.40(15.64)
Mean edu.	Average years of schooling of adult members	7.86(3.42)
Gender	Gender of the household head (Male headed=1, female headed=0)	0.77
Ethnic	Any household member involved in a political or social organization (yes=1, no=0)	0.79
Membership	Participated in off-farm activities (yes=1, no=0)	0.87
Off-farm	Own small- or medium-scale enterprise (yes=1, no=0)	0.52
Self emp.	Total household size	0.25
Physical and natural capital measured in PPP $US at 2005 prices		
Agric. tools	Value of agricultural tools owned	408(10.37)
Transp. tools	Value of transportation tools owned	1070(29.54)
Land	Land size owned, in hectares	0.78(1.12)
Livestock	Value of livestock owned	811(25.88)
Own house	Value of house owned	10222(1580.17)
House utilities	Value of house utilities owned	1008(190.66)
Village characteristics		
Paved road	The village has a paved road (yes=1, no=0)	0.55
Mountainous	Main transportation is by bus or motorcycle (yes=1, no=0)	0.48
Violence	The village experienced violence (yes=1, no=0)	0.17
Epidemics	The village experienced epidemics (yes=1, no=0)	0.11
Irrigated	Proportion of households with public water supply	13.01(24.21)
No. enterp.	Total irrigated land in the village	0.17(1.64)
HHs elect.	Number of enterprises with more than 9 employees	82.31(32.65)
HHs pub. water	Proportion of households with electricity	23.12(22.65)
HHs sanit.	Proportion of households with sanitation	18.20(31.53)
Time to a market	Time to reach nearest market in minutes	22.57(24.37)
Intensity of shocks		
Asset loss	Share of assets loss to total assets	0.13(0.77)
Income loss	Share of income loss to total income	0.32(0.38)
No. observations	Number of observation	6318

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.
Note: Standard deviations are presented in parentheses.

The average annual income[14] per capita, the share of income from remittances, and the proportion of migrant households for the three years are reported in Table 3.2. The annual income[15] per capita

[14]Household income and other asset values are measured in $US PPP-adjusted prices, with 2005 as the base period to permit comparisons in real terms across waves.

increased from $US1212 in 2007 to $US1596 in 2010, yielding an annual growth rate of 8%. Approximately 41% of the sample households were migrant households, with an average of 1.24 migrants per household. The percentage of households receiving remittances increased from 19% to 30% between 2007 and 2010. Over all households, average remittances increased from $US312 per year in 2007 to $US567 in 2010. For those households receiving remittances, remittances represented approximately 27% of total household income.

Table 3.2. Average income, migration and remittances

Year	2007	2008	2010	Average
Annual income per cap.	1212(161)	1500(190)	1596 (193)	1426(182)
Migrant HHs (%)	0.37	0.41	0.45	0.41
Migrant HHs with remit. (of total HHs, %)	0.19	0.28	0.30	0.25
Number of migrants per HH (of migrant HHs)	1.32(2.16)	1.14(1.93)	1.26(2.05)	1.24(2.05)
Annual income from remit. (total HHs)	312(562)	481(629)	567(963)	453(732)
Income share of remittances for recipient HHs (%)	0.29(0.37)	0.28(0.32)	0.24(0.26)	0.27(0.31)
No. Observations	2106	2106	2106	

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.
Note: Standard deviations are presented in parentheses.

3.3. Conceptual framework and selected evidence

In this section, we propose a model that links the New Economics of Labor Migration theory and the asset-based approach to welfare dynamics. Our welfare dynamics model builds on that of Barrett (2005). We express the income of the household as the product of the household's productive asset endowments and the returns to capital:

$$Y_{it} = K_{it}^{'}[r_{it} + \mu_{it}] + \varepsilon_{it} \quad (3.1)$$

where Y_{it} is the measured income of household i at time t, K_{it} refers to a vector of human and physical assets, and r is the corresponding vector of expected returns per unit of the asset held. The variable μ refers to exogenous shocks, such as production and market shocks; ε represents measurement error. We assume that the exogenous stochastic income and measurement error (μ_{it} and ε_{it}, respectively) have a mean of zero, have constant variance, and are serially independent. Structural income ($E[Y_{it}] = A_{it}$) what Carter and Barrett (2006) refer to as "*asset index*", is specified as follows:

$$E[Y_{it}] = A_{it} = K_{it}^{'}(r_{it}) \quad (3.2)$$

[15]Household income and other asset values are measured in $US purchasing power parity (PPP) adjusted prices, with 2005 as the base period to permit comparisons in real terms across waves.

Structural income (asset index) can be interpreted to measure the underlying structural well-being of a household. The total differentiation of the income equation 3.1 yields an expression for a change in income as a function of the change in the asset stock, the change in expected returns on assets, and various sources of shocks:

$$dY_{it} = dK'_{it}[r_{it} + \mu_{it}] + K'_{it}[(dr_{it} + d\mu_{it})] + d\varepsilon_{it} \quad (3.3)$$

The expectation of equation 3.3 determines the structural income changes of the household:

$$E[dY_{it}] = \Delta A_{it} = dK'_{it} r_{it} + K'_{it} dr_{it} \quad (3.4)$$

Equation 3.4 highlights that a household's structural income (asset index) changes depend on the changes in the household's productive asset holdings and the changes in the rates of return on assets. The new economics of labor migration theory states that remittances (I) can improve asset growth and can offer rural households pathways for structural transitions by enabling them to overcome liquidity and risk constraints (Taylor, 1999; Stark & Bloom, 1985). Thus, the first channel through which remittances can increase asset growth is by improving the factor productivity of endowments; we specify a return function of the following form:

$$r_{it} = f(I, K_{it}, G_{vt}, \mu_{it}, \varepsilon_{it}) \quad (3.5)$$

The factor productivity of endowments is a function of income from remittances, human and physical assets (K), village endowment (G) and shocks (μ). ε is an error term. The inclusion of K_{it} allows for variable returns to scale depending on asset type. G_{vt} refers to a vector of exogenous variables on village level, such as infrastructure facilities and topography of the village, which may lead to the different rates of return across time or space for a given level of assets and remittances.

The second channel through which remittances can improve rural households' standard of living is through changes in the asset stocks (dK). Thus, structural income growth can be expressed as a reduced-form function of the initial human and physical asset endowments (K), remittance income (I), initial exogenous conditions at village level (G), and changes in these three factors:

$$dA_{it} = f(K_{it}.dK_{it}, I_{it,}, dI_{it}, G_{vt}, dG_{vt}) \quad (3.6)$$

However, considerable evidence suggests that receiving remittances can also influence natal households' consumption and working behavior such that they use the remittances for consumption purposes and increase the reservation wage at which members of migrants' households are willing

to engage in non-farm activities (Adams and Cuecuecha, 2010). Additionally, because of the costs and risks associated with migration, better-off households are able to obtain higher quality urban employment, whereas migrants from poorer households tend to engage in low-return activities with less job security (Mckenzie and Rapoport, 2007; Admas, 2007). Hence, migration can lead to greater inequality in the community of origin (Amare et al., 2012; Admas, 2011).

We test the following hypotheses based on the conceptual framework and literature review: (1) migration with remittances accelerates households' asset growth in rural areas, (2) remittances facilitate structurally poor households' efforts to exit poverty and to catch-up with their better-off neighbors, (3) remittances increase asset growth by improving factor productivity, and (4) ethnic minorities in Vietnam are less likely to benefit from migration.

3.4. Empirical estimations and identification strategies

3.4.1. Asset index and welfare dynamics

We measure household welfare using asset index for three reasons. First, the asset index is scaled in poverty line units, which allow us to distinguish between structural and chronic poverty. Second, the index also captures the income variability of the stochastic returns on assets, caused by shocks, and the volatility in unearned transitory income, for example gifts. Third, the index controls for measurement errors and recall bias and therefore provides more reliable measures of long-run welfare than observed income measures. The main objective of our paper is to estimate the impact of migration on asset accumulation. To construct our main variable, asset index, which equals the structural income from equation 3.2, we apply the livelihood regression model developed by Adato et al. (2006).

$$L_{it} = \alpha + \sum_{j=1} \beta_j (A_{ijt}) + \sum_{j,k} \beta_{jk} (A_{ijt})(A_{ikt}) + \beta_g G_{vt} + \lambda_{pt} + \gamma_i + \pi_{it} \quad (3.7)$$

Let L_{it} is defined as household i's monthly income per capita divided by the rural poverty line (P). The poverty line[16] employed in the paper is the income poverty line calculated by the GSO for rural areas measured at PPP $US1.73 per capita per day throughout all provinces (GSO, 2011). A value of L_i below one denotes households with income below the poverty line, and a value above one identifies non-poor households. In this model, a bundle of assets likely to shape a household's future

[16]As a robustness check, we also estimate the livelihood regression by using a two-dollar per day poverty line. The relative magnitudes are comparable, and the significance level for all variables remains unchanged; thus, the discussion of the results henceforth focuses on the livelihood regression based on the national poverty line.

well-being is utilized. A_{ijt} is a vector of asset items j including the human, social, physical, and natural assets owned by household (i) at time t. All items j are interacted with each other (k) to allow the marginal return of assets to vary with the levels of other assets. β represents vectors of the coefficients of current household assets. G_{vt} refers to a vector of assets at the village (v) level. γ_i denotes household FEs, which control for a variety of fixed factors that shape a household's well-being. Province-year FEs (λ_{pt}) are added to control time-invariant province heterogeneity and an arbitrary time series of annual shocks affecting provinces uniformly in each year. The brackets indicate that the marginal contribution of assets depend on all of household i's assets and characteristics at time t.

The literature suggests that a wide range of human, social, physical, natural, and geographic capital factors likely shape a household's future well-being (Naschold, 2012; Radeny et al., 2012). Accordingly, we include various proxies for human capital, such as the average number of years of schooling of household members, the proportions of adults and dependents in the household, and the gender and age of the household head. As proxies for social capital, we use memberships in local social and political organizations and the migration status of the household. Asset (e.g., agricultural and transportation equipment, household utilities, and livestock) values are measured in $US (PPP) adjusted prices, with 2005 as the base period to permit comparisons in real terms across waves. Land is measured in hectares. To capture geographic location and natural topographic conditions, social problem categories, infrastructure, and basic public goods are included. The squared terms of several variables are included to account for potential diminishing returns on assets. We also include interaction effects between all basic assets to allow the marginal return on assets to vary with the levels of other assets. A complete list of the variables and their definitions are provided in Table 3.1.

We estimate livelihood regression model in equation 3.7 using both household-level fixed-effects. The purpose of the livelihood regression model is to reliably predict the asset index (structural income), as an input for the asset growth equation and subsequent models, which are described in the next sections[17]. We derive the asset index using a fixed effects model because our test indicated that endogeneity problems due to unobserved characteristics did not support the random effects model. The full estimation results using household fixed effects are reported in Appendix 3.1A.

Thus, the asset indices, which by definition equal the structural income of the household, are constructed from the fitted values of livelihood regression equation 3.7. We then use the asset

[17]The results are not included here because we are interested in not the coefficients but the robustness of the prediction. However, the results are available on request.

index (A_{it}) to distinguish between structural poor and non-poor households. A household is *structurally poor* if its asset-based income and its observed income are below the poverty line. A household is identified as *structurally non-poor* if both incomes are above the poverty line.

3.4.2. Asset growth equation

Following our conceptual framework in section 3 and using the data set described above, we estimate three models to examine the impact of migration and remittances on household asset growth. The dependent variable is the asset index constructed with livelihood regression as described in the previous section. First, we estimate the impact of migration with and without remittances on asset growth by using a function of the following form:

$$\Delta A_{it} = \gamma_1 Z_{it-1} + \gamma_2 A_{it-1} + \gamma_3 W_{it-1} + \gamma_4 M_{it-1} + \gamma_5 \mu_{it} + \gamma_6 G_{vt-1} + \eta_{it} \quad (3.8)$$

where ΔA_{it} refers to the growth in an asset between t and $t-1$. Z_{it-1} represents a vector of levels of household characteristics for the lagged period. Village mean of initial household asset index (A_{it-1}) is included in the growth regression to capture to control for initial level asset in the community. The effect of interest is captured by the coefficients on W_{it-1}, which is an indicator equal to one if the migrant household received remittances and zero otherwise, and M_{it-1} variable which is an indicator equal to one if the migrant household did not receive remittances during the case period and zero otherwise. To explore the impact of shocks (μ_{it}) on asset growth, we include information on the severity of shocks on income and assets recorded by each household. The severity of shocks on income and assets is measured as the share of assets and income lost from total initial assets and income, respectively. We also include village-level assets (G_{vt-1}) such as topography, social problem categories, infrastructure and basic public goods, for in the case period to address the heterogeneities across villages in explaining household asset growth.

As a second model we estimate the impact of the level of remittances on rural household asset growth by using of the following a regression function:

$$\Delta A_{it} = \alpha_1 I_{it-1} + \alpha_2 A_{it-1} + \alpha_3 Z_{it-1} + \alpha_4 \mu_{it} + \alpha_5 G_{vt-1} + \omega_{it} \quad (3.9)$$

where I_{it-1} refers to level of remittances[18] measured as a natural logarithm in the case period. Finally, we separately estimate the asset growth model (equation 3.9) by welfare status and ethnicity to control for heterogeneity in the impact of migration and remittances. In particular, we

[18]Because some households have zero remittances, we use remittances plus one (log (remittances +1)) during the logarithmic transformation.

examine whether migration and remittances affect structurally poor households differently than structurally non-poor households and whether ethnic minorities are less likely to benefit from migration than the Kinh ethnic majority.

Migration decisions and remittance receipt could be endogenous elements of the rural household asset growth equation because a household typically makes a migration decision based on its level of information, level of human and physical capital and other characteristics. Therefore, migrant and non-migrant households may be systematically different. We use household-level FEs by employing a unique panel data set containing detailed information on household- and village-level characteristics to correct for this type of endogeneity. Household FE estimates control for the effect of time-invariant unobservable heterogeneities; however, the estimates may suffer from bias due to time-variant unobservable characteristics. We therefore complement the household FE estimates with an IV regression. To control for time-variant heterogeneities, we require a set of instruments that influence welfare growth only through their effect on the household's migration decision and remittance receipt for this regression.

Since we have two endogenous variables (migration and remittances), we employ two different instruments, which are based on economic conditions in the main migrant destination. In our approach we follow (McKenzie and Rapoport, 2007; Antman, 2011). In detail, we use employment and per capita income[19] in the three main migrant receiving destinations for our three provinces in a year prior to the survey. To construct the instruments, we match our panel household data with longitudinal yearly unemployment rate and per capita income of three migrant destinations provinces with data from the General Statistics Office (GSO, 2006-2010) of Vietnam. We match each of our sample provinces with data from the main destination of migrants from this province. Main destination from our sample provinces are Ho Chi Minh City for migrants from Dak Lak (84%), Binh Doung and Dong Nai for migrants from Hue (67%) and Hanoi for migrants from Ha Tinh (75 %).

Our justification for using these instruments is that employment and economic conditions in the recent past in destination provinces influence households' migration decision and flow of remittances without directly influencing the welfare growth in the village. A potential concern with regard to the validity of the instrument is that the employment and economic conditions of the destination provinces may be correlated with the village's economic activities. Thus, destinations' employment and economic conditions may directly affect households' welfare growth outcomes. To

[19]To construct the instruments, we match our panel household data with the longitudinal yearly unemployment rate and per capita income of three migrant destination provinces collected from different issues of the Statistical Year Book published by the General Statistics Office (GSO) of Vietnam.

circumvent this problem, first, we include the employment and economic conditions of the three origin provinces and a wide range of village-level characteristics in the identification strategies. Second, instead of using observed income, we use asset index as an outcome variable, which controls for measurement and stochastic errors. To further mitigate the concern, we use lagged migration status and remittance levels to help ensure that migration and remittances are affected by subsequent changes in asset growth.

3.4.3. Oaxaca decomposition

After identifying the drivers of asset growth, we employ Blinder–Oaxaca decomposition analysis (Blinder, 1973; Oaxaca, 1973) to explore the channel through which remittances affect household asset growth. To do so, we identify the difference in asset growth between remittance receipts and remittances non-receipts that is due to differences in asset the productivity (productivity effect), and/or asset endowment (endowment effect). We rewrite the asset growth equation separately for remittance receipts and remittances non-receipts and compute the growth differential. The asset growth equation for remittances receipts: $\Delta A_i^W = \alpha_o^W + \sum_{i=1}^{W} \alpha_j^W X_{ji}^W + \mu_i^W$. The asset growth equation for remittances non-receipts: $\Delta A_i^M = \alpha_o^M + \sum_{i=1}^{M} \alpha_j^M X_{ji}^M + \mu_i^M$. Thus, the asset growth gap between remittance receipts and remittances non-receipts is given by:

$$\Delta\bar{A}^W - \Delta\bar{A}^M = \underbrace{\sum \alpha_j^W (\bar{X}_j^W - \bar{X}_j^M)}_{E} + \underbrace{\sum \bar{X}_j^N (\alpha_j^W - \alpha_j^M)}_{P} + \underbrace{(\alpha_o^W - \alpha_o^M)}_{U} \quad (3.10)$$

where E refers to growth differences due to remittance receipts having larger endowments (endowment effect), and P refers to growth differences due to remittance receipts having higher productivity (productivity effect). U refers to any unexplained effect.

3.5. Results and discussions

3.5.1. Welfare dynamics and migration

In this section we derive an asset index (the structural income) and distinguish between structurally poor and non-poor households[20] by using the livelihood regression model. We use both household-level FEs to derive the asset index. The purpose of the livelihood regression model is to reliably

[20]As a robustness check, we also estimate the livelihood regression by using a two-dollar per day poverty line. The relative magnitudes are comparable, and the significance level for all variables remains unchanged; thus, the discussion of the results henceforth focuses on the livelihood regression based on the national poverty line.

predict the realized level of structural income as an input for the asset growth equation and subsequent models[21]. We find that the random-effects model generates better predictions, explaining 44% of the variation in the livelihood measure, compared to 22% for the FEs model.

Table 3.3. Descriptive statistics of households by migration status

	Migrant (41%)	Non-migrant (59%)	Difference test
Asset index per capita	1524 (366)	1380 (484)	***
HH size	4.46(1.76)	4.33(1.76)	***
Children	0.19(0.19)	0.28(0.22)	***
Elderly	0.07(0.17)	0.12(0.25)	***
Mean edu.	8.81(3.04)	7.27(3.51)	***
Gender	0.78	0.76	*
Ethnic	0.86	0.75	***
Membership	0.91	0.85	***
Village characteristics			
Paved road	0.57	0.54	**
Mountainous	0.45	0.49	***
Violence	0.16	0.18	*
Epidemics	0.09	0.13	***
Public water supply	0.22	0.23	
Irrigated	12.51(23.45)	13.32 (24.66)	*
No. of enterp.	0.18(1.67)	0.16(1.63)	
HHs elect.	93.22(21.53)	91.75(23.30)	**
HHs sanit.	20.07(32.93)	17.06(30.59)	***
Time to a market	21.87(23.48)	22.99(24.90)	
Time to a bank	35.28(30.30)	35.94(31.73)	*
Intensity of shocks			
Asset loss	0.12 (0.25)	0.14(0.29)	
Income loss	0.31 (0.37)	0.33(0.39)	
No. Observations	2590	3723	

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.

Note: The significance tests between migrant and non-migrant households are the t-test for continuous variables and the Pearson chi^2 test for categorical variables. *** p<0.01. ** p<0.05. * p<0.10.

Table 3.3 presents summary statistics for the households in our sample by migration status. Migrant households have higher wealth and significantly higher asset levels than non-migrant households. Migrant households also tend to be better educated, to have significantly greater labor endowments, and to have a lower dependency ratio than non-migrant households. For example, adults in migrant households have on average 8.81 years of schooling, whereas non-migrant households have approximately 1.5 years fewer years of schooling. We also find that belonging to the Kinh ethnic majority and having a household member who participates in social networks are

[21]The results are not included here because we are interested in not the coefficients but the robustness of the prediction. However, the results are available on request.

positively correlated with migration. Migrant households come from villages with better public infrastructure, lower levels of violence and epidemics, and locations in the plains.

Table 3.4. Aggregate structural income and asset poverty by year and migration status

Year	2007	2008	2010	Average	2007-10 t-test
Asset index per capita	1284	1440	1560	1428	276***
Structurally poor (%)	22	14	13	16	-9***
No. Observations	2106	2106	2106		

	Migrant				**Non-migrant**			
	2007	2008	2010	2007-10 t-test	2007	2008	2010	2007-10 t-test
Asset index per capita	1332	1560	1692	360***	1248	1368	1476	228***
Structurally poor (%)	19	12	9	-10***	24	15	15	-9***
No. Observations	779	863	948		1327	1243	1158	

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.
Note: Standard errors are given in parentheses. *** p<0.01. ** p<0.05. * p<0.10.

Table 3.4 reports the asset poverty and asset level in total and by migration status for three years. In total, the asset level per capita increased from $US1284 in 2007 to $US1560 in 2010. Asset growth is reflected by a change in asset poverty status. For example, the results reveal a significant decline in structural poverty of 9%. The asset growth rate was 5% over the 2007–2010 period for migrant and non-migrant households. In the same period, a significant decline in structural poverty for both migrant and non-migrant households occurred, with structural poverty decreasing by 10% and 9% in 2010, respectively. A rigorous analytical model is required to verify whether these differences in our key variables of interest remain unchanged after we control for all confounding factors.

3.5.2. Asset growth impact of migration and remittances

In the previous section, we provided a general overview of the asset levels, poverty dynamics, and summary statistics of migrant and non-migrant households. In this section of the paper, we explore the impact of migration and remittances on asset growth. Table 3.5 presents the results of the first equation that is used in the later IV analysis to explain asset growth. Both instruments (employment and income status) are individually and jointly significant at the 5% level in the first-stage regression, suggesting that migrant destinations' employment and economic conditions are crucial factors driving migration decisions and remittance receipt.

Table 3.5. First Stage Regressions for Migration and Remittances Status

Variables	Migration decision		Receive remittances	
	1		2	
Household characteristics	**Coef**	**Se**	**Coef**	**Se**
HH size	0.189***	0.023	0.194***	0.017
Dep ratio	-0.276***	0.035	-0.265***	0.027
Mean edu.	0.008***	0.003	-0.003	0.002
Asset index	0.055***	0.015	0.053***	0.011
Membership	0.148***	0.055	0.046	0.041
Gender	-0.026	0.021	-0.039***	0.016
Village characteristics				
Paved road	-0.005	0.035	0.043*	0.026
Violence	0.049**	0.028	-0.018	0.021
Epidemics	0.031	0.034	0.013	0.026
Public water supply	-0.028	0.039	0.000	0.030
Irrigated land	-0.001	0.001	0.000	0.001
No. Enterp.	0.000	0.000	0.000	0.000
HHs electricity	-0.019***	0.010	0.008	0.008
HHs sanitation	-0.001	0.000	0.000	0.000
Time to a market	0.001	0.001	0.000	0.000
Province employment and income status				
Employment org	0.545***	0.176	0.660***	0.134
Income level org	0.000	0.000	0.000	0.000
Shock severity				
Asset loss	-0.001	0.023	-0.006	0.017
Income loss	0.000	0.001	0.000	0.000
Selection controls: province employment and income status				
Income level des	0.001**	0.000	0.001***	0.000
Employment des	-0.075**	0.039	-0.037**	0.022
F stat on excluded instruments		13.82***	13.25***	
No. Observations		4212		4212
No. FEs		2106		2016

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.

Note: The regression included a dummy for provinces. Robust standard errors are presented in brackets. *** p<0.01. ** p<0.05. * p<0.10.

We estimate the model for asset growth[22] with both FE and IV-FE models; the results are reported in Table 3.6. In general, the FE and IV-FE estimates for migration and remittances are similar in sign and magnitude; the results obtained from both models confirm that migration without remittances has no significant impact on asset growth, whereas remittances receipts and the level of remittances have significant, positive effects on asset growth. However, the IV-FE estimates for the key variables of interest are much larger than the FE estimates, implying that correcting for sample selection

[22]We also estimate asset growth with pooled OLS and pooled IV-OLS models. The models estimated for our variables of interest (migration and remittances) are similar in sign. However, the estimates for our variables of interest in both models are smaller than the IV-FE estimates, implying that correcting for unobserved heterogeneity affects the results. The results are available on request.

affects the results. We use Hansen-J statistics to test for over-identification in both regressions; the correct exclusion of instruments cannot be rejected. The last two rows of Table 3.6 report the results of these tests. Therefore, our subsequent discussion primarily focuses on the two-stage IV-FE model estimates.

Table 3.6. Estimates of asset growth: impact of migration and remittances

	Migration with & without remittances				**Level of remittances**			
	FE		FE-IV		FE		FE-IV	
	1		**2**		**3**		**4**	
	Coef	**Se**	**Coef**	**Se**	**Coef**	**Se**	**Coef**	**Se**
Migration & remittances								
With remittances	0.192**	0.021	2.741***	0.656				
Without remittances	-0.001	0.016	-0.475	1.729				
Log-remittances					0.029***	0.006	0.645***	0.106
Household characteristics								
HH size	-0.292***	0.026	-0.688***	0.173	-0.292***	0.026	-0.372**	0.171
Dep. ratio	-0.246***	0.032	0.284	0.224	-0.251***	0.032	-0.300*	0.171
Gender	0.030***	0.003	0.038***	0.006	0.030***	0.003	0.009	0.010
Membership	0.042	0.027	0.055	0.043	0.043	0.026	0.052	0.050
Initial asset index	-0.619***	0.023	-0.696***	0.051	-0.620***	0.023	-1.302***	0.045
Village characteristics								
Paved road	0.099**	0.049	0.167**	0.077	0.097**	0.049	0.125***	0.048
Violence	0.023	0.047	-0.048	0.050	0.025	0.047	0.032	0.035
Epidemics	0.003	0.057	-0.027	0.057	0.003	0.057	0.016	0.046
Public water supply	0.003***	0.000	0.002**	0.001	0.003***	0.000	0.002***	0.000
Irrigated land	0.072	0.061	0.095	0.060	0.072	0.060	0.066	0.048
No. Enterp.	0.001	0.001	0.002**	0.001	0.001	0.001	0.000	0.001
HHs electricity	0.067***	0.013	0.051***	0.011	0.066***	0.013	0.055***	0.010
HHs sanitation	0.004***	0.001	0.004***	0.001	0.004***	0.001	0.004***	0.001
Time to a market	0.001	0.001	0.000	0.001	0.000	0.001	0.002**	0.001
Shock severity								
Asset loss	-0.211***	0.012	-0.212***	0.012	-0.237***	0.012	-0.311***	0.112
Income loss	-0.113***	0.016	-0.125***	0.017	-0.130***	0.015	-0.123***	0.017
Province employment & income status								
Employment des.			0.000	0.000			0.000**	0.000
Income level des			0.089	0.067			-0.025	0.038
No. observations	4212		4212		4212		4212	
No. FEs	2106		2106		2106		2106	
Over identification test p value			0.413				0.176	
First Stage F Stat on Excluded IVs			9.131				26.612	

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.

Note: All variables, except the severity of shocks, refer to the base period value. The regression included a dummy for provinces. Robust standard errors are presented in brackets. *** p<0.01. ** p<0.05. * p<0.10.

The results for the IV-FE estimations aiming to differentiate the impact of migration from that of remittances are reported in column (2) of Table 3.6. The results reveal that having a household

member who has migrated to an urban area has no significant impact on household's asset growth. Migration with remittances increases the asset growth of natal households[23]; these households have 2.7% greater asset growth than households that do not receive remittances. The results of the IV-FE estimation aiming to examine the impact of remittances on household asset growth are reported in column (4) of Table 3.6. The results reveal that remittances have a positive, significant impact on asset growth. Controlling for other factors, we find that a 10% increase in the level of remittances in the previous year tends to increase asset growth by 6.5%, on average. This result supports the hypothesis that remittances can facilitate asset growth by enabling households to overcome liquidity constraints and therefore by stimulating productivity-enhancing investments in higher-return activities. This finding is in line with the findings of Adams and Cuecuecha (2010) for Guatemala and McCarthy et al. (2009) for Albania, who show that migrant households tend to spend remittances on investments, including human and physical capital investments.

Household size, household head gender, and social and political network membership also have statistically significant effects on asset growth. Households with large family sizes experience lower asset growth. Controlling for other factors, we find that female-headed households exhibit higher asset growth than their male-headed counterparts. The results show that membership in local social and political networks have a strong, significant and positive effect on asset growth. More important, we find that access to public infrastructure, such as a public water supply, sanitation, and electricity, plays a significant role in improving asset growth. These results indicate that asset growth rates at the household level are significantly higher in generally accessible areas. For example, the effect of road quality is particularly strong; asset growth differs by 12% between households in villages with a paved road and households in villages with a dirt road. A high level of violence and epidemics in villages has a significant negative impact on asset growth rates. Additionally, households in villages with good market access and favorable agro-ecological endowments are more likely to accumulate assets at the household level. We also find that asset and income shocks have a negative, statistically significant impact on asset growth. The marginal effects of the respective mean values of the shock coefficients indicate that a 10% increase in the severity of asset shocks decreases asset growth by 3.1%, on average; for income shocks, the corresponding reduction in asset growth is 1.2%.

[23]As a robustness check, we also estimate the asset growth model while excluding international migrant households, but the results remain unchanged. The results are available on request.

3.5.3. Heterogeneous impact of migration and remittances

We examine whether the magnitude of the coefficient of migration with remittances and level of remittances varies by initial asset holdings by estimating the growth model separately for structurally poor and non-poor households. The results (Table 3.7) indicate that remittances have a significant impact on asset growth for both structurally poor and structurally non-poor households. However, when we compare structurally non-poor with structurally poor households, the coefficient for remittances is approximately four times higher for the latter. The fourth column in Table 3.7, controlling for other factors, we find that a 10% increase in remittances increases asset growth by 4.4%, on average, for structurally poor households. This finding is in line with the findings of Garip (2014) for Thailand, who show that poor households with a remitting migrant tend to accumulate assets. This result supports the new economics of labor migration hypothesis that remittances facilitate structural poverty transitions by rural households by allowing them to overcome liquidity constraints and by enabling them to engage in higher-return activities (Taylor and Lopez-Feldman, 2010).

Table 3.7. Asset Growth, Migration and Remittances: IV-FE Regression by Welfare Status

	Structurally poor				**Structurally non-poor**			
	Migration with & without remittances		Level of remittances		Migration with & without remittances		Level of remittances	
	1		**2**		**3**		**4**	
	Coef	**Se**	**Coef**	**Se**	**Coef**	**Se**	**Coef**	**Se**
With remittances	1.337**	0.677			0.312**	0.131		
Without remittances	-1.444	4.535			0.124	0.595		
Log-remittances			0.443**	0.216			0.092**	0.039
No. observations		848		848		3,364		3,364
No. FEs		424		242		1682		1682
Over identification test p value	0.606		0.678		0.837		0.683	
First Stage F Stat on Excluded IVs	8.581		10.521		39.762		43.781	

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.

Note: The regression, omitted from the table, controls for household characteristics, village characteristics, and shocks severity. Robust standard errors are presented in brackets. *** p<0.01. ** p<0.05. * p<0.10.

We further allow for heterogeneity in the impact of remittances by ethnicity. In first and second column of Table 3.8, the results show that remittances have no significant impact on asset growth for ethnic minorities, whereas remittances improve asset growth for the Kinh ethnic majority as seen in the third and fourth column of Table 3.8. There are two possible explanations for this result. First, the relationship between remittances and welfare growth may not be significant for ethnic minorities because minorities are concentrated in geographically remote upland areas and are generally less informed about urban labor conditions; hence, they are less likely to migrate. In our sample of approximately 2000 households, 39% of all households include migrants, but only 14% of

those are ethnic minority households during the 2007-2010 period. Additionally, migrants from ethnic minority households may have limited initial human capital and social accessibility, may face difficulties in obtaining documents for resident registration in major cities, or may have limited access to social services such as affordable health care, education, and housing; thus, they may become poor migrants in urban areas, which in turn would affect the well-being of household members left behind. For example, during the period of 2007-2010, while 25% of all migrant households received remittances, only 6% of ethnic minority households with migrants received remittances.

Table 3.8. Asset Growth, Migration and Remittances: IV-FE Regression by Ethnicity

	Ethnic minority				**Ethnic majorities**			
	Migration with & without remittances		Level of remittances		Migration with & without remittances		Level of remittances	
	1		**2**		**3**		**4**	
	Coef	**Se**	**Coef**	**Se**	**Coef**	**Se**	**Coef**	**Se**
With remittances	0.876	1.016			3.612**	1.639		
Without remittances	1.419	1.519			-0.021	0.109		
Log-remittances			1.078	0.681			0.510***	0.090
No. observations	868		868		3,344		3,344	
No. FEs	434		434		1672		1672	
Over identification test p value	0.840		0.362		0.685		0.131	
First Stage F Stat on Excluded IVs	5.09		4.47		6.84		28.63	

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.

Note: The regression, omitted from the table, controls for household characteristics, village characteristics, and shocks severity. Robust standard errors are presented in brackets. *** p<0.01. ** p<0.05. * p<0.10.

3.5.4. Decomposition analysis

The regression results discussed above confirm the significant impact of remittances on asset growth. Now, we use the Blinder-Oaxaca decomposition to identify the channels through which remittances affect rural welfare growth. More important, the decomposition analysis allows us to determine the share of the observed difference in asset growth that is attributable to households' endowments and/or asset productivity between households that received remittances and households that did not receive remittances. We also identify the contribution of covariates to these effects. The results of the decomposition analysis are reported in Table 3.9.

Households that received remittances enjoy a 9.2% higher total growth in assets than households that did not receive remittances. We decompose this growth into the endowment and productivity effects, and the results reveal that 2% of this growth is attributable to differences in endowments, whereas 59% is due to differences in asset productivity. In other words, the explained difference in growth is approximately 96%, and this result is primarily due to higher estimated returns on resources owned by households that received remittances. These results are in line with previous

empirical results (e.g., Skoufias and Olivieri, 2007). The results thus indicate that the main channel through which remittances affect asset growth is by increasing the productivity of household assets, for example, through investment in new technology and previously inaccessible opportunities. Households that received remittances have 22% and 41% higher productivity from human and social capital and from physical and natural capital, respectively, than households that did not receive remittances. Specifically, households that received remittances have higher returns to education and a higher dependency ratio, indicating that remittances allow these households to pay for their children's education and thereby to increase their accumulation of human capital. Moreover, households that received remittances enjoy higher returns on social capital, specifically those from the age of the household head and membership in social and political organizations. A potential explanation for this finding is that seniority and participation in social and political networks in the natal village may help migrants to reduce job search costs and living expenses and thereby to increase the flow of remittances. Households that received remittances also have higher returns on their agricultural tools, livestock, and transport equipment. The higher returns on physical capital in farming might arise because remittances may protect assets during shocks and may relax households' liquidity constraints. Remittances may thus allow them to purchase complementary inputs and thereby to improve the productivity of their assets.

Table 3.9. Blinder–Oaxaca decomposition of growth difference by remittance status (%)

	Endowments effect(E)	Productivity effect(P)	Total explained (E+P)
Human & social capital	**-0.5**	**21.6**	**21.1**
Mean education.	0.1	15.3	15.35
Dependency ratio	-0.1	11.0	10.9
Age of the household head	0.1	0.2	0.3
Membership	-0.1	3.0	2.9
Ethnicity	-0.5	-7.9	-8.4
Natural & physical capital	**0.7**	**40.9**	**41.6**
Land	-0.2	-5.1	-5.3
Agricultural tools	0.8	47.5	48.3
Livestock	0.4	6.2	6.6
Own house	0.1	-7.3	-7.2
House utilities	-0.3	-2.7	-3
Transportation equipment	-0.1	2.3	2.2
Geographic & locational variables	**1.9**	**-7.3**	**-5.4**
Total	**2.1**	**55.2**	**57.3**
Summary of decomposition results			
Total growth differential (E+ P+ U)			9.2
Endowment & productivity effect (E + P)			57.3
Unexplained effect (U)			-48
Productivity effect as % of total explained difference [E/(E+ P)]			96

Source: DFG Rural Household and Village Level Surveys 2007, 2008, and 2010 in Vietnam.
Note: Positive values indicate a difference in favor of recipient households.

3.6. Conclusions and policy implications

This study combines insights of the New Economics of Labor Migration with the asset-based approach to welfare dynamics. The contribution of the paper is threefold. First, from a conceptual perspective, our study links the New Economics of Labor Migration theory and the asset-based approach of welfare dynamics. Combining these two theories allows us to differentiate whether poverty transitions induced by migration are actually structural, based on long-term asset growth, or stochastic, based only on short-term increases in income or consumption, which implies a risk of individuals falling back into poverty. Second, we provide empirical evidences on the impact of migration without and with remittances on household asset growth. The analysis is based on a unique panel data set over a period of four years from three provinces in rural Vietnam. Third, we provide evidence of the heterogeneous impact of migration and remittances on welfare dynamics due to initial welfare status and ethnicity. In particular, we analyze whether remittances facilitate structural poverty transitions for rural households in Vietnam and investigate whether ethnic minorities are less likely than the Kinh ethnic majority to benefit from migration.

The results support our hypotheses and confirm empirical findings for other developing countries. To control for the endogeneity of migration and remittances, we use household FE and FE-IV models. First, we find that only one-third of households with migrants actually receive remittances.

This small percentage might be due to the high costs of living, the difficult document requirements for resident registration in major cities or the low quality of employment. Second, the results indicate that migration that leads to remittances has a positive effect on poverty transitions, which confirms our first hypothesis. Third, we find that structurally poor migrant households that received remittances experienced greater asset growth than non-poor households, indicating that remittances allow poor households to escape poverty and to catch-up with their better-off neighbors. This result corroborates our second hypothesis and previous empirical results (e.g., de Brauw and Harigaya, 2007; Taylor and Fletcher, 2007; McCarthy et al., 2009; Adams and Cuecuecha, 2010).

Fourth, remittances improve the asset growth of ethnic majorities, but they have no impact on the asset growth of ethnic minorities, who are the poorest of the poor in rural Vietnam. This finding suggests that the enormous welfare gap that exists between ethnic minorities and the Kinh majority in Vietnam cannot be overcome by rural-urban migration. There are two possible reasons for this result: First, ethnic minorities are concentrated in the geographically remote upland areas and are therefore less likely to migrate. Second, ethnic minority households that have migrants typically find it more difficult to obtain stable and decent employment, and they ultimately accept low-return, risky urban employment. Finally, the Blinder–Oaxaca decomposition confirms our third hypothesis that remittances accelerate asset growth and that remittances offer rural households pathways for structural transitions by increasing the returns on poor households' resources. In an imperfect credit and insurance market setting such as that in rural Vietnam, many poor rural households are unable to optimize their investments in physical and human capital, owing to liquidity constraints. Remittances foster long-term welfare by enabling liquidity-constrained households to exploit previously inaccessible opportunities that improve the factor productivity of their assets (Taylor, 1999; Rozelle, Taylor and de Brauw, 1999; Taylor and Lopez-Feldman, 2010).

From a policy perspective, our results suggest that existing public support schemes for ethnic minorities should be reconsidered. Consumption support in case of shocks does not solve the basic problem of ethnic minorities—a lack of infrastructure and a low level of human capital. We also suggest that policy makers review migration policies and regulations. For example, measures that reduce long registration procedures for migrants in urban areas and that provide better social protection will enhance the welfare of migrants and natal households and will strengthen rural-urban integration.

Appendix 3.1A: Fixed effects estimates of livelihood regression to construct asset index

	Coef	Se
HH-Size	-0.343***	0.09
Children	-0.486	0.38
Elderly	-1.472***	0.55
Age	-0.065	0.07
Age^2	-0.004	0.01
Gender	-0.012	0.14
Off-Farm	0.309***	0.11
Self Emp	0.729***	0.16
Migrant	0.021	0.09
Agric. tools	0.023*	0.01
Agric. tools^2	-0.007	0.01
Transp. tools	-0.009*	0.01
Transp. tools^2	0.005***	0.00
Land	0.387**	0.17
Land^2	-0.025	0.02
Livestock	0.026***	0.01
Livestock^2	-0.005***	0.00
Own House	0.004***	0.00
Own House^2	-0.000***	0.00
House Utilities	0.023***	0.01
House Utilities^2	-0.005***	0.00
Agric. tools*Land	0.001	0.01
Agric. tools*Transp. tools	0.000	0.00
Agric. tools* Livestock	0.000	0.00
Agric. tools*House	0.000*	0.00
Agric. tools*House utilities	0.000	0.00
Transp. tools*Land	-0.005*	0.00
Transp. tools*House	-0.000***	0.00
Transp. tools*House utilities	0.000	0.00
Transp. tools*Livestock	0.000	0.00
Land*House	0.001***	0.00
Land*House utilities	-0.007**	0.00
Land*Livestock	-0.002	0.00
Livestock*House	0.000	0.00
Livestock*House utilities	0.000	0.00
House*House utilities	0.000	0.00
Distances market	-0.008***	0.00
Main transp	0.597***	0.15
Irrigated	0.323***	0.04
HHs sanit.	0.005***	0.00
HHs elect.	0.009**	0.00
Violence	-0.112	0.14
Epidemics	-0.057	0.18
Paved road	0.204	0.18
Mountainous	-0.060	0.15
Water supply	0.009***	0.00
Province Hue*Time	0.049	0.10
Dak Lak*Time	0.049	0.09
Cons	2.247***	0.51
N	6288	
R^2	0.29	

Source: DFG rural household-and village-level surveys in Vietnam, 2007, 2008 and 2010.

Note: *** p<0.01. ** p<0.05. * p<0.10.

REFERENCES

Acosta, P., Calderon, C., Fajnzylber, P, & Humberto L. (2008). "What is the Impact of International Remittances on Poverty and Inequality in Latin America?" *World Development* 36:1, 89-114.

Adams Jr., Richard H. & Cuecuecha, A. (2010). "Remittances, Household Expenditure and Investment in Guatemala." *World Development* 38:11, 1626-1641.

Amare, M., Hohfeld, L., Jitsuchon S. & Waibel H. (2012). "Rural–Urban Migration and Employment Quality: A Case Study from Thailand." *Asian Development Review* 29:1, 57-79.

Amuedo-Dorantes, C. & Pozo S. (2006). "Remittance Receipt and Business Ownership in the Dominican Republic." *World Economy* 29:7, 939-956.

Antman, FM. (2011). "The Intergenerational Effects of Paternal Migration on Schooling and Work: What Can We Learn from Children's Time Allocations?" *Journal of Development Economics* 96(2):200–208.

Barrett, C.B. (2005). "Rural Poverty Dynamics: Development Policy Implications." *Agricultural Economics* 32, 45–60.

Baulch, B., Pham H.T. & Reilly B. (2011). "Decomposing the Ethnic Gap Standards in Rural Vietnam: 1993 To 2004." *Oxford Development Studies* 40:1, 87-117.

Bayudan-Dacuycuy, C. & Lim J.A. (2013). "Family Size, Household Shocks and Chronic and Transient Poverty in the Philippines." *Journal of Asian Economics* 29, 101–112

Carter, M. & Barrett, C. (2006). "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach." *Journal of Development Studies* 42, 178–199.

de Brauw, A. & Harigaya, T. (2007). "Seasonal Migration and Improving Living Standards in Vietnam." *American Journal of Agricultural Economics* 89:2, 430–447.

de Brauw, A. & Rozelle S. (2008). "Household Investment through Migration in Rural China." *China Economic Review* 19, 320–335.

Duong, L.B., Linh, T.G. & Thao, N.T.P. (2011). "Social Protection for Rural-Urban Migrants in Vietnam: Current Situation, Challenges and Opportunities". CSP Research Report 08.

Garip, F. (2014). "The Impact of Migration and Remittances on Wealth Accumulation and Distribution in Rural Thailand" *Demography* 51:673–698

General Statistics Office of Vietnam (2010). Result of the Vietnam Household Living Standards Survey (VHLSS). Statistical Publishing House, Hanoi, Vietnam.

Hardeweg B., Klasen S. & Waibel H. (2013). "Establishing a Database for Vulnerability Assessment." In: S. Klasen and H. Waibel, Eds., *Vulnerability to Poverty-Theory, Measurement, and Determinants*. Palgrave Macmillan.

Jalan, J. & Ravallion, M. (2002). “Geographic Poverty Traps? A Micro Model of Consumption Growth in Rural China.” *Journal of Applied Econometrics* 17, 329–346.

Lybbert, T. J., Barrett, C. B., Desta, S., Coppock, D. L (2004). “Stochastic Wealth Dynamics and Risk Management among a Poor Population.” *The Economic Journal 114:750*–777.

Mccarthy N., Carletto C., Davis B., & Kilic, T. (2009) “Assessing the Impact of Massive Out-Migration on Albanian Agriculture.” *European Journal of Development Research* 21:3, 448-470.

Mckenzie D. & Rapoport H. (2007) “Network Effects and the Dynamics of Migration and Inequality: Theory and Evidence from Mexico.” *Journal of Development Economics* 84:1, 1-24.

Naschold, F. (2012). ““The Poor Stay Poor” Household Asset Poverty Traps in Rural Semi-Arid India.” *World Development* 40: 2033–2043

Nguyen, V. C., Van Der Berg M. & Lensink R. (2011). “The Impact of Work and Non-Work Migration on Household Welfare, Poverty and Inequality: New Evidence from Vietnam.” *Economics of Transition* 19:4, 771-799.

Plummer, M. G. (1995). “An Analytical Survey of Vietnam's External Policy Challenges.” *Journal of Asian Economics*, 6:3, 327-349.

Radeny, M., Van Den Berg, M. & Schipper, R. (2012). “Rural Poverty Dynamics in Kenya: Structural Declines and Stochastic Escapes.” *World Development* 40, 1577–1593.

Rozelle S., Taylor, J.E. & de Brauw A. (1999). “Migration, Remittances and Agricultural Productivity in China.” *American Economics Review* 89:2, 287–291.

Skoufias E. & Olivieri S. (2013). “Sources of Spatial Welfare Disparities in Indonesia: Household Endowments or Returns?” *Journal of Asian Economics* 29, 62–79

Stark, O. & Bloom, D. E. (1985). “The New Economics of Labor Migration.” *American Economic Review*, 75:2, 173–178.

Stark, O. & Fan, C.S (2008). “Rural-To-Urban Migration, Human Capital and Agglomeration.” *Journal of Economic Behavior & Organization* 68:1, 234-247

Taylor, E. (1999). “The New Economics of Labor Migration and the Role of Remittances in the Migration Process”. *International Migration*, 37(1), 63–88.

Taylor, J. & Lopez-Feldman A. (2010). “Does Migration Make Rural Households More Productive? Evidence from Mexico.” *Journal of Development Studies* 46:1, 68–90.

Taylor, J., Rozelle, S., & De Brauw, A. (2003). “Migration and Incomes in Source Communities: A New Economics of Migration Perspective from China”. *Economic Development & Cultural Change* 52:1, 75–101.

Wooldridge, J.M. (2002). Econometric Analysis of Cross Section and Panel Data. The MIT Press, Cambridge, Massachusetts London, England

World Bank. (2012). “Well Begun, Not Yet Done: Vietnam’s Remarkable Progress on Poverty Reduction and the Emerging Challenges”. Hanoi, Vietnam.

Yang, D. (2008). “International Migration, Remittances and Household Investment: Evidence from Philippine Migrants’ Exchange Rate Shocks”. *Economic Journal* 118:528, 1–40.

Zhang, L. (2012). “Economic Migration and Urban Citizenship in China: The Role of Points Systems”. *Population & Development Review* 38(3): 503–533.

4 RURAL–URBAN MIGRATION AND EMPLOYMENT QUALITY: A CASE STUDY FROM THAILAND

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5 RAINFALL VARIABILITY, SHOCKS AND NON-FARM EMPLOYMENT: EVIDENCE FROM RURAL HOUSEHOLDS IN NORTHEAST THAILAND

With Herman Waibel

Paper will be published at German Association of Agricultural Economists (GEWISOLA) 54th conference proceedings.

5.1. Introduction and research objectives

Climate variability and shocks can put various sectors at risk, threaten households' livelihoods and undermine attempts to reduce poverty. The implications of rainfall variability and various source of shock are especially important for people in Southeast Asian regions who rely on agricultural and natural resources for their primary income and for heavily populated coastlines and large sections of the population who live on less than $2 a day (ADB, 2009). The negative effects of rainfall variability and shocks in non-farm activities can be compounded by incomplete insurance and credit markets, which affect the behavior of households with regard to their adaptation strategies and responses to shocks. Even in emerging market economies such as Thailand, where the rapid and broad-based economic development and reduction of chronic poverty have been realized, and rural households are still vulnerable to climate change and extreme events in agriculture remains (Luo and Lin, 1999; IPCC, 2007). More than two-thirds of agricultural production in rural Thailand is rain fed and largely dependent on monsoon rains for cultivation (ADB, 2009). Thus, climate change, including higher surface temperatures, floods, droughts, severe storms and rising sea levels, are more likely to increase the vulnerability of the agricultural systems (Iglesias et al., 2011).

Rural households in developing countries attempt to reduce their overall vulnerability to climate shocks and manage the impacts of these climate shocks ex-post by changing their farm portfolios of crops and livestock (e.g., Howden et al., 2007; Di Falco and Chavas, 2009; Smale et al., 2001), using the non-farm activities (e.g., Bandyopadhyay and Skoufias, 2013; Ellis and Allison, 2004; Barrett et al., 2001; Ito and Kurosaki, 2009), and employing a wide range of agriculture-based practices and technologies such as new cultivars, fertilizer and soil and water management (e.g., McCarthy et al., 2011, Dercon and Christiaensen, 2011). The non-farm activities have been used as a useful adaptation and coping strategy in some developing societies to withstand rainfall variability and cope with shocks (Ellis and Allison, 2004; Barrett et al., 2001; Rose, 2001; Ito and Kurosaki, 2009). Thus, the rural non-farm sector plays a critical role in promoting growth and welfare by providing alternative employment. Consequently, the share of non-farm income to total household income is significant and growing in many developing countries (Barrett et al., 2005). For example, Davis et al.

(2010) reported that the non-farm income share has grown to 40–60% of rural incomes in Africa, Latin America and Asia.

However, there are three possible challenges in using the non-farm activities as an adaptation strategy for rainfall variability and coping with shocks. First, because the share of non-farm income to total household income is growing in many developing countries as they increasingly rely on non-farm income, agricultural production shocks are no longer the only source of risks: demographic shocks and shocks in the non-farm activities, such as job loss or income reduction, can limit the effectiveness of the non-farm activities as a means of adapting to rainfall variability. Studies (e.g., Fallon and Lucas, 2002; Huang et al., 2010; Bowen et al., 2012) have indicated that financial crises have led to a substantial reduction in non-farm employment. Huang et al. (2010) found that rural households that diversified into non-farm employment lost their jobs because of the 2007-09 global financial crises in China. Tongruksawattana et al. (2013) found that demographic shocks, particularly the illness of a household member, represent the second most common shock type experienced by households in rural Thailand. They also found that demographic shocks cause higher asset losses than agricultural shocks.

Second, the non-farm activities as an adaptation and coping strategy against rainfall variability can be limited when the non-farm activities is also affected by the same types of shocks that make the returns from the non-farm activities to be correlated with on-farm returns (Barrett et al., 2001; Ito and Kurosaki, 2009). Additionally, households in developing countries face imperfect capital markets that influence a household's liquidity constraint, which influences a household's decision to engage in the non-farm activities (Beegle et al., 2006; Barrett et al., 2005; Demeke et al., 2011). In particular, because poor households in developing countries are constrained in terms of liquidity and more risk averse, they have a greater incentive to use the non-farm activities as an adaptation strategy and to cope with shocks (Bezu et al., 2012). However, they face entry barriers in using the non-farm activities because of the lack of necessary resources, such as skill and capital, thus allowing wealthier farm households to dominate the most remunerative non-farm employment (Barrett et al., 2005; Lanjouw and Lanjouw, 2001). This situation applies to rural Thailand, where income inequality is particularly high (Warr, 2011).

In this regard, the contributions of this paper to the existing literature are three-fold. First, this study aims to contribute to the expanding literature (Green and Weatherhead, 2014; Di Falco et al., 2012; Di Falco et al., 2014; Bandyopadhyay and Skoufias, 2012) on the impact of rainfall variability on household non-farm employment by including demographic shocks and shocks in the non-farm activities, such as job loss or income reduction. The emphasis on using demographic shocks and

shocks in the non-farm activities distinguishes this study from others that consider the impacts of rainfall variability on non-farm employment. Second, this paper examines how rural households use non-farm employment to adapt rainfall variability, agricultural shocks and other sources of shocks on non-farm employment by distinguishing among different types of non-farm labor, such as agricultural wage[24], non-agricultural wage[25] and non-farm self-employment[26], to address the possible heterogeneity of the non-farm activities as a means of adapting to rainfall variability and coping with shocks in terms of their returns and accessibilities. Third, most of the past studies have used cross-sectional data, which limits the conclusions with regard to the long-term impact of climate variability and various sources of shocks. This paper utilizes a large panel data set that includes detailed information on retrospective information about shock experience and twenty-year historical rainfall patterns, such as coefficients of variation and intensity in village level rainfall, respectively which allows us to examine how rural households cope with long-term changes in climatic parameters and other sources of shocks.

The study is organized as follows. The next section presents the conceptual framework underlying the model which explains non-farm strategies in the presence of risk and incomplete credit and insurance markets. Empirical strategies to test our hypotheses are presented in section 3. Section 4 describes the data; including information on the incidence and consequences of shocks and non-farm employment and in section 5, the study discusses the econometric results. In section 6, the study concludes and forwards policy implications.

5.2. Conceptual framework

The study framed the analysis using the standard unitary agricultural household model in the presence of risk. The risk-averse farm household chooses climate variability adaptation and shock coping strategies that will yield the highest net income given the production function and land, labor, and other resource constraints as well as climate (Green and Weatherhead, 2014; Di Falco et al., 2012; Di Falco et al., 2014; Bowen et al., 2012). The study considers the role of asset endowments in explaining non-farm activities as means of adapting rainfall variability and coping with shocks. Because the poor have a low level of initial human and physical capital, are more

[24]Agricultural wage employment refers to activities outside the own farm, such as agricultural wage laborer, logger or fisher.

[25]Non-agricultural wage employment includes jobs in the services sector, construction and production industries.

[26]We define non-farm self-employment as employment of households that have an own-account worker (e.g., handicraftsman, petty-trader) or households with an own business that employs family workers or other employees (e.g., restaurant, convenience shop, hair salon, transport business).

liquidity constrained and are more risk averse, they may be less able to exploit non-farm employment opportunities and thereby adapt to rainfall variability (Beegle et al., 2006; Barrett et al., 2005; Demeke et al, 2011).

As shown in studies conducted in developing countries (e.g.; Amare et al., 2012; Barrett et al., 2005), skilled wage employment and relatively high-investment businesses yield higher average and marginal returns compared with farming or other non-farm activities but are not accessible to poorer households. Conversely, initially wealthier households often have access to credit and insurance markets and are situated in wealthier areas that tend to engage in high-return non-farm employment, with the result that non-farm employment ultimately has a tendency to increase inequality (Lanjouw and Lanjouw, 2001). Furthermore, it is observed that the livelihoods of rural households in developing countries increasingly rely on non-farm income (Davis et al., 2010). Hence, rainfall variability is no longer the only source of risks, and shocks related to economic slowdown in the industrial or services sectors and idiosyncratic shocks, such as demographic shocks, may also negatively affect rural households. Considering the findings from the literature, it can be deduces that it is important to incorporate not only rainfall variability but also multiple sources of uncertainties stemming from non-farm employment and the asset endowments of rural households when examining the role of non-farm activities in a household's ability to adapt to rainfall variability and cope with shocks.

Adaptation measures for rainfall variability and coping strategies for various sources of shocks by a farmer over a given period of time are assumed to be derived from the maximization of a discounted expected utility function of farm profit subject to rainfall variability, various sources of shocks that can influence the non-agriculture sector and liquidity constraints. Assuming that each farmer makes his non-farm employment participation decision to maximize profit, the reduced form non-farm employment decision is given by:

$$A_{jit} = A(x_{it}, c_{it}, s_{it}, z_{it}, v_{it}; \beta) + \mu_{it} \quad (5.1)$$

where A_{itj} is the labor allocated[27] to different sectors (j) such as agricultural wage, non-agricultural wage and non-farm self-employment of household i in time t. x_{it} is a vector of household characteristics, c_{it} is a vector to capture climatic variables and s_{it} is a vector with various sources of

[27]Log hour allocated is used because the error terms become less heteroscedastic after the logarithmic transformation.

shocks[28]: (i) demographic shocks and (ii) economic shocks. z_{it} represents a vector of wealth indicators. v_{it} represents a vectors of village-level characteristics. β is the vector of coefficients, and μ_{it} is the household-specific random error term. Similar to the previous studies (Rose, 2001; Ito and Kurosaki, 2009) and because more than two-thirds of agricultural production in rural Thailand is rain fed and largely dependent on monsoon rains for cultivation (ADB, 2009), the study employs monsoon rainfall variability (sum of monthly rainfalls from June to September) in the calculation of rainfall variables as the proxy for climate variability variable.

Following agricultural household theory and situation analysis, we establish the following hypotheses regarding how households use the non-farm activities to adapt to rainfall variability and cope with various sources of shocks. First, the study hypothesizes that farmers use the non-farm activities to adapt to rainfall variability by allocating more labor to non-agricultural wage and self-employment and less to agricultural wage employment, meaning that non-farm activities are heterogeneous in terms of adapting climate variability and coping with shocks adaptation strategies. Second, using non-farm activities to adapt to rainfall variability is a limited strategy in the presence of economic and idiosyncratic shocks, such as demographic shocks. Third, the study hypothesizes that poorer households are less able to exploit non-farm employment opportunities to adapt to rainfall variability because of a lack of start-up human and physical capital and incomplete insurance and credit markets.

5.3. Estimation techniques

To test our hypotheses developed above, the study first aims to examine how rural households use non-farm activities to adapt rainfall variability and agricultural shocks. Rainfall variability, rainfall abundance at the village level as well as self-reported agricultural shocks is included as proxies for rainfall variability and agricultural shocks. The basic regression model, which estimates how rural household use the non-farm activities to adapt to rainfall variability and cope with agricultural shocks, takes the following form:

$$A_{jit} = \beta_c c_{it} + \mu_{it} \quad (5.2)$$

[28]The question asked during the survey was as follows: considering the time during the year preceding the survey, did any event cause a shock that affected the household and subsequent welfare loss due to shocks?

where c_{it} is a vector to capture climatic variables such as the coefficient of variation[29], lagged monsoon rainfall and shocks related to agricultural production such as flood, drought, bad weather, pests and diseases. The study includes quadratic terms of lagged monsoon rainfall levels and the coefficient of variation to allow for nonlinear relationships between rainfall patterns and non-farm activities. Second, the study investigates how rural households use non-farm activities to adapt rainfall variability and agricultural shocks in the presence of shocks in the labor market and demographic shocks on non-farm employment. The following specification is estimated:

$$A_{jit} = \beta_c c_{it} + \beta_s s_{it} + \mu_{it} \quad (5.3)$$

where s_{it} is a vector of various sources of shocks, e.g., demographic shocks such as health and death shocks and economic shocks such as losing jobs, business failures and price changes.

Additionally, to examine whether the risk-bearing capacities of households differ with the level of assets and whether shocks have a smaller effect on households with a greater level of assets, the study includes non-land assets and their interaction with rainfall variability and shock variables. In this model, a wide range of household- and village-level characteristics are also included. The study investigates this empirically as follows:

$$A_{jit} = \beta_x x_{it} + \beta_c c_{it} + \beta_v v_{it} + \beta_s s_{it} + \beta_{cz}(c_{it} * z_{it}) + \beta_{sz}(s_{it} * z_{it}) + \beta_z z_{it} + \mu_{it} \quad (5.4)$$

where x_{it} is a vector of household characteristics such as education, age, gender of the household head, and household size. z_{it} is a vector of wealth indicators that include land size, irrigated land size, the value of livestock and the value of non-land assets. The study also includes initial village-level characteristics (v_{it}), such as the proportion of households with public electricity, public water supply, quality of the roads, time to market and number of enterprises in the village, to address the heterogeneity across villages in explaining non-farm employment. The asset holdings are expected to enhance weather risk bearing capacity and buffer against various sources of shock. Estimating the equations using OLS could cause bias if household-omitted characteristics that affect the non-farm activities are also correlated with rainfall variability and other sources of shocks. Intrinsically similar households and sources of shocks can also lead to different non-farm employments. The study therefore also employs a household fixed-effects version of the equations to control for household unobservable, such as nonlinearities in wealth indicators, and to reduce the potential for biased

[29]The coefficient of variation (CV of rainfall) is calculated based on rain season (sum of rainfalls from June to October) on 20-years (1991–2010) rainfall data at village-level (200 villages). The data set includes the amount of rainfall (in millimeters) per month and total days. The straight-line distance method between each village in the sample is used.

estimates on rainfall viability and other sources of shocks. The study also employs a fixed-effects Tobit estimator to account for both the censoring in the dependent variable and the panel nature of the data and provide a robust basis to compare the results all equations will be estimated using both the fixed effects and fixed-effects Tobit estimator.

5.4. Study area and data description

The data used for this study originate from a longitudinal survey DFGFOR756[30] database that comprises two rounds (2008 and 2010) of household- and village-level surveys that were conducted in rural Northeast Thailand. The surveys were conducted in three deliberately selected provinces, i.e., Buriram, Nakhon Phanom and Ubon Ratchathani, based on the high importance of agriculture for household income despite a low agricultural potential, remoteness in some areas and a high potential in other economic sectors. The sample was designed in such a way that it is representative of the rural population and would allow conclusions to be drawn for the vulnerability of households in rural areas in Northeast Thailand and other areas with similar conditions (Hardeweg et al., 2013). Within the provinces, a three-stage random cluster sampling procedure was used to obtain a sample that was representative of the rural populations of the three selected provinces. In the first stage, the sub-district was sampled with approximately proportional allocation. Next, the villages were sampled with a probability proportional to their size based on their population. Finally, a systematic random sample with equal probability from household lists ordered by household size was used, resulting in a total sample size of 2200 households and 220 villages (Hardeweg et al., 2013). The survey instrument included modules on household characteristics, assets, income, consumption and hours worked in various types of non-farm employment. A comprehensive shocks and risks section to collect retrospective information about shock experience and current risk perception was also included. The study matches this data set with longitudinal monthly rainfall data collected from local meteorological stations by the Thailand Meteorological Agency from 1991 to 2010. The data set includes the amount of rainfall (in millimeters per day) for 52 weather stations in the three provinces. The study uses a straight-line distance between each village (200 villages) to link the survey data with the closest weather station.

Following the literature (Ito and Kurosaki, 2009; Rose, 2001; Bandyopadhyay and Skoufias, 2013; Di Falco et al., 2009), the study focuses on rainfall variability, represented by the coefficient of variation

[30]It has been implemented by a consortium of economic research institutes of four German universities, including those in Hannover, Goettingen, Giessen, and Frankfurt. http://www.vulnerability-asia.uni-hannover.de/

of rainfall, rainfall abundance and self-reported agricultural shocks, such as drought, flood, crop pests and diseases, to address how rural households use the non-farm activities to adapt to rainfall variability. The coefficient of variation (CV of rainfall) is measured as the standard deviation divided by the mean of the monsoon season (sum of rainfalls from June to October) for twenty years' worth (1991–2010) of rainfall data at the village level (200 villages), and rainfall abundance is measured as the lagged average monsoon rainfall. The study uses a dummy variable for positive welfare losses[31] due to drought, flood, bad weather, crop pests and diseases as an indicator of agricultural shocks during the year preceding the survey. Similarly, a dummy variable for positive welfare loss due to illness and death is used as an indicator of demographic shocks and a dummy variable for positive welfare loss due to job loss, price changes and market regulation during the year preceding the survey.

Table 5.1 provides a description of the variables and summary statistics of the pooled sample used in the ensuing analysis. On average, the households supply 248, 45 and 125 labor hours per month to non-agricultural wage, agricultural wage and non-farm self-employment. On average, the household size was 4.04 members, and average age of adult members had 38.24 years. The number of household members with below primary, primarily school, secondary school and professional training were 1.33, 1.76, 0.66 and 0.27, respectively. Our key variables of interest are lagged rainfall, coefficient of variation of rainfall, agricultural shocks, demographic shocks and economic shocks. The average lagged rainfall over the period of analysis was around 1,370 mm, and the coefficient of variation (CV of rainfall) was 0.53. Nearly half of the sample households reported experience agricultural shocks, 34% and 29% of the sampled households reported demographic and economic shocks respectively.

[31]The question asked during the survey was as follows: considering the time during the year preceding the survey, has any event caused a shock that affected the household and subsequent welfare loss due to shocks?

Table 5.1. Description of variables and descriptive statistics

Variable	Description	N=4134
Dependent variables		**Mean**
Non-agric wage	Hours supplied to non-agricultural wage per month	248 (257)
Agric. wage	Hours supplied to agricultural wage per month	45(148)
Non-farm self-empl.	Hours supplied to non-farm self-employment per month	125 (398)
Household characteristics		
HH size	Total household size	4.04(1.75)
Below primary	Number of household members with below primary education	1.33(1.21)
Age adult	Average age of adult members in the household	39.24(9.80)
Dep. ratio	The dependency ratio is the number of dependents relative to the total number of household members	0.29(0.17)
Primary	Number of household members who have completed primary education	1.76(1.41)
Secondary	Number of household members who have completed secondary education	0.62(1.06)
Prof. Training	Number of household members who have completed professional education	0.27(0.63)
Wealth indicators		
Land	Land size, in hectares	2.45(3.03)
Livestock	Value of livestock (measured in PPP $US at 2005 prices)	1180(2012)
Non-land asset	Value of non-land assets (measured in PPP $US at 2005 prices)	6998(14049)
Lowest asset	Households that are asset poor are in the lowest tercile	0.33(0.47
Asset medium	Households that have medium assets are in the medium tercile	0.33(0.47
Asset non-poor	Households that are asset rich are in the top tercile	0.33(0.47
Village characteristics		
HHs Water supply	Households with access to public water supply in the village (%)	0.91(0.29)
HHs electricity	Households with access to electricity in the village (%)	96.54(15.73)
Paved road	The village has paved road (yes=1, no=0)	0.86(0.35)
No. enter.	Number of enterprises that have more than 9 employees	0.15(0.66)
Time to market	Time to reach the market in minutes	17.10(12.84)
Rainfall variability		
Rainfall variability	The coefficient of variation (CV of rainfall): Measured as the standard deviation divided by the mean of the monsoon seasons (sum of rainfalls from June to October) in the 20 years (1991–2010)	0.53(0.10)
Lagged rainfall	Lagged average monsoon rainfall levels/1,000, in mm	1.37(0.41)
Agric. shocks	A dummy variable for positive welfare losses because of drought, flood, bad weather, crop pests and diseases	0.46(0.50)
Other sources of shocks		
Demo. shocks	A dummy variable for positive welfare loss because of illness and death	0.34(0.48)
Econ. shocks	A dummy variable for positive welfare loss because of job loss, price changes and market regulation	0.29(0.45)

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand. Figures in brackets are standard deviations.

As revealed by the household surveys, in all three provinces, the most frequently experienced shocks are related to agriculture (Table 5.2). However, demographic and economic shocks also play a role. In the shock module, information on the estimated total loss of income and assets and the extra expenditures due to an event in the year of its occurrence is obtained. Table 5.2 also reports the consequences of the most commonly reported shocks on the estimated loss of household assets and income, extra expenditures and total welfare loss due to the event. In 2008, agricultural shocks were the main source of welfare loss, followed by demographic and economic shocks, whereas in 2010, demographic shocks were dominant, followed by agricultural and economic shocks. More than 85% of the sample households participated in non-farm employment during the survey periods. Approximately 72% participated in non-agricultural wage activities, and 31% participated in non-

farm self-employment (Table 5.3). The higher proportion of non-agricultural wage employment may reflect the accessibility of non-agricultural wage activities in rural Thailand.

Table 5.2. Incidence and welfare consequences of shocks by year

	Year	Agric. Shocks	Demo. Shocks	Econ. Shocks
Incidence of shocks (%)				
	2008	43	30	25
	2010	48	38	31
Welfare consequences of shocks (PPP $US in 2005)				
Loss of income	2008	1125(1455)	400(528)	865(369)
	2010	749(1156)	163(228)	285(169)
Extra expenditure	2008	223(512)	774(1322)	133(281)
	2010	115(412)	864(921)	518(381)
Loss of assets	2008	165(1180)	169(779)	140(666)
	2010	128(680)	258(779)	211(666)

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand. Figures in brackets are standard deviations.

Figures in brackets are standard deviations.

Approximately 72% participated in non-agricultural wage activities, and 31% participated in non-farm self-employment (Table 5.3). The higher proportion of non-agricultural wage employment may reflect the accessibility of non-agricultural wage activities in rural Thailand. Table 5.3 also presents the intensity of non-farm employment participation and returns to family labor. Although the proportion of households participated in nonagricultural and agricultural wage employment seems to have declined, the hours supplied in nonagricultural and agricultural wage increased by 10% and 11%, respectively. Non-farm self-employment has the highest return to family labor among all of the activities undertaken by farmers. The average return to labor for self-employment[32] is more than $US5.02 per hour, which is approximately six and twelve times higher than that observed for non-agricultural wage and agricultural wage labor, respectively. The results may suggest that non-farm employment is heterogeneous in terms of their returns.

[32]For non-farm self-employment, return is defined as the net income (profit) from non-farm self-employment divided by the number of hours supplied for non-farm self-employment per year.

Table 5.3. Proportion of participants (%), labor supply and return to non-farm employment

	Year	Non-agric. wage	Agric. wage	Non-farm self-empl.
Participants (%)	2008	80	18	31
	2010	71	17	34
	Change t- test	*	***	**
Labor supply per month (Hour)	2008	315.29(246.16)	265.15(277.46)	393.58(323.15)
	2010	353.54(248.68)	294.29(253.46)	426.68(425.42)
	Change t-test	***	**	
Individual components	2008	1.34(1.31)	0.33(0.94)	0.39(0.66)
	2010	1.39(1.26)	0.28(0.79)	0.43(0.70)
	Change t-test	**	***	*
Return per hour	2008	0.64(4.04)	0.24 (0.80)	5.49(5.58)
	2010	0.78(3.30)	0.48(0.72)	4.60(4.59)
	Change t-test	***	**	

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand. Figures in brackets are standard deviations.

Figures in brackets are standard deviations.

Table 5.4 presents the household characteristics, assets and various sources of shocks by non-farm employment participation. The results show that approximately 54% of the top tercile of households based on assets participate in non-farm self-employment activities, whereas approximately half of the lowest tercile group of households based on assets are engaged in agricultural wage employment. Table 5.4 also presents the reported shocks, and the incidence of shocks differs by non-farm employment participation. Households that are mainly dependent on low-return non-farm employment and have lower initial asset holdings were more likely to report being adversely affected by various sources of shocks.

Table 5.4. Descriptive statistics variables used in the model by non-farm participation status

Variable	All sample	Non-participant (13%)	Participant		
			Non-agric. wage (75%)	Agric. wage (17%)	Non-farm Self-empl.(32&)
Household characteristics					
Below primary	1.03(1.21)	1.36(1.16)	1.03(1.23)	1.40(1.14)	0.82(1.22)
Primary	2.06(1.41)	2.06(1.15)	2.11(1.50)	2.11(1.40)	1.80(1.45)
Secondary	0.90(1.05)	0.51(0.81)	1.03(1.04)	0.63(1.01)	1.12(1.08)
Professional training	0.27(0.63)	0.08(0.35)	0.23(0.71)	0.12(0.41)	0.36(0.69)
Dep. ratio	1.58(0.78)	1.42(0.94)	1.59(0.74)	1.60(0.69)	1.59(0.74)
Average age of adult	36.24(11.89)	43.36(16.35)	35.21(10.50)	34.76(10.80)	35.38(11.03)
Wealth indicator					
Livestock	3.44(67.52)	3.33(10.10)	2.30(4.50)	2.10(4.90)	5.50(118.30)
Land size	2.46(3.11)	2.90(3.30)	2.50(2.70)	1.60(1.80)	2.70(3.80)
Irrigation	0.15(0.75)	0.24(1.01)	0.12(0.60)	0.11(0.50)	0.18(0.85)
Non-land assets	68.31(130.97)	40.80(78.60)	52.70(87.90)	30.70(66.50)	114.30(188.40)
Non-land asset tercile (%)					
Bottom asset		47	32	49	21
Medium asset		30	35	32	25
Top asset		22	33	19	54
Village characteristics					
Paved road	86	80	90	80	90
HHs electricity	97	92	95	94	96
HHs water supply	91	90	89	88	92
HHs sanitation					
Time to market	17.23(12.88)	15.90(12.10)	17.80(13.40)	18.70(12.80)	16.30(12.50)
No. Enter.	0.14(0.64)	0.20(0.80)	0.20(0.70)	0.10(0.30)	0.10(0.50)
Climate variability					
CV of rainfall	0.48(0.08)	0.48(0.08)	0.49(0.08)	0.48(0.08)	0.49(0.08)
Lagged monsoon	1.18(0.42)		1.16(0.42)	1.08(0.39)	1.16(0.41)
Agric. shocks (%)	45	46	45	47	43
Other sources of shocks					
Demo. Shocks (%)	34	34	34	37	33
Econ. Shocks (%)	29	29	29	30	30
Buriram	38	30	73	22	30
Ubon	44	54	68	14	32
Nakhon Phanom	18	17	74	14	31

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand. Figures in brackets are standard deviations. Figures in brackets are standard deviations.

5.5. Econometric results and discussions

5.5.1. Rainfall Variability, Shocks and Non-farm Activities

Following our conceptual framework in section 3, we first examine how households use the non-farm activities to adapt to rainfall variability and cope with agricultural shocks (Table 5.5) followed by how rural households use the non-farm activities to adapt rainfall variability and other sources of shocks (Table 5.6). We estimated all models (Equation 5.2-4) using both fixed effects[33] and the semi-parametric fixed effects Tobit[34] estimator to address the link of rainfall variability, shocks[35] and non-

[33]This test is based on both the Hausman and robust Hausman test using cluster-robust standard errors (Wooldridge, 2002), which is equivalent to testing the joint significance of the means of various explanatory variables added to the POLS model. The test rejects the null hypothesis that individual effects are random.

[34]Honoré (1992) proposed for a trimming mechanism to restore the symmetry of the error distribution in censored regressions

farm activities. The results indicate that most of the interest variables are similar in sign and significance level in both models, implying that censoring problems might not be severe in our data set given that more than 85% of the households participate in non-farm activities.

Table 5.5. The Rainfall Variability, Agricultural Shocks and Non-Farm Activities as Adaptation Strategies

	Fixed Effects Estimates						Honoré Fixed Effects Tobit Estimates					
	Non-agric. wage		Non-farm self-empl.		Agric. wage		Non-agric. wage		Non-farm self-empl.		Agric.wage	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Rainfall variability												
CV rainfall	0.217***	0.07	0.191**	0.08	-0.026	0.07	0.613**	0.25	0.440***	0.14	-0.418	0.39
CV rainfall sqr.	-0.002**	0.00	-0.002*	0.00	0.000	0.00	-0.003**	0.00	-0.009***	0.00	0.005	0.00
Lagged rainfall	-0.452	0.54	0.302	0.94	-1.025	0.64	-0.514	1.19	1.971	0.92	0.518	5.06
Lagged rainfall sqr	0.088	0.18	-0.112	0.42	0.217	0.20	0.080	0.49	0.645	0.80	-0.240	2.11
Agric. shocks	0.067	0.12	0.180	0.13	0.217**	0.09	0.116	0.17	0.301	0.38	0.250*	0.14
Cons	1.341	2.04	-2.753*	1.55	2.916	1.96						
N	4,128		4,128		4,128		4,128		4,128		4,128	
R^2	0.11		0.10		0.08							

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand.

Note: *** represents p<0.01. ** represents p<0.05. * represents p<0.10.

The main interest of the study is to interpret the magnitude of the coefficients and the economic significance of the effect of rainfall variability and other sources of shocks and because it is not easy to calculate the marginal magnitude of the coefficients from Tobit fixed effects model, hence the decision to base the subsequent discussions on the linear fixed effects model. The direction and magnitude of the effect of rainfall variability and other sources of shocks are compared across three types of non-farm employment.

[35]Self-reported shocks may suffer reporting bias when responses are correlated with wealth and education; we test for significant differences for households with and without shock experience. Results confirm our assumption that shock incidence is largely independent of wealth indicators and household characteristics. The p-value for the chi statistic testing the null hypothesis that the estimated coefficients on the household characteristics and wealth indicators are jointly zero are not rejected for all three models. These results lend some confidence to the validity and independence of the self-reported shocks information. The full estimation results using household fixed effects are available on request.

Table 5.6. The Rainfall Variability, Agricultural Shocks and Other Sources of Shocks and Non-farm Activities

	Fixed Effects Estimates						Honoré Fixed Effects Tobit Estimates					
	Non-agric. Wage		Non-farm self-empl.		Agric. Wage		Non-agric. Wage		Non-farm self-empl.		Agric. Wage	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Rainfall variability												
CV rainfall	0.267*	0.14	0.217***	0.07	-0.026	0.06	0.572**	0.26	0.713***	0.17	-0.445**	0.21
CV rainfall sqr.	-0.002*	0.00	-0.002*	0.00	0.000	0.00	-0.005*	0.00	-0.008***	0.00	0.005	0.00
Lagged rainfall	-0.839	0.72	0.320	0.95	-0.756	0.54	-1.078	0.88	3.694*	1.91	0.921	4.79
Lagged rainfall sqr	0.272	0.28	-0.121	0.42	0.224	0.18	0.355	0.34	0.670	0.80	-0.484	2.00
Agric. shocks	0.198	0.14	0.164	0.14	0.222**	0.10	0.248	0.19	-0.381	0.38	1.169**	0.51
Other Sources of shocks												
Demo. Shocks	-0.293**	0.14	0.118	0.16	0.206**	0.10	-0.313*	0.18	-0.436	0.44	0.332*	0.20
Econ. shocks	-0.409**	0.19	0.063	0.19	-0.096	0.12	-0.502**	0.24	0.702	0.45	0.299	0.61
Cons	-1.009	3.38	-2.797*	1.55	2.889*	1.67						
N		4,128		4,128		4,128	4,128		4,128		4,128	
R^2		0.17		0.16		0.14						

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand.

Note: *** represents p<0.01. ** represents p<0.05. * represents p<0.10.

The primary objective of this study was to analyze the link between rainfall variability, shocks and non-farm activities as means adaptation strategies, with a particular focus on how rural households use of non-farm employment to adapt climate variability and cope with various source of shock. The results and discussions are based results reported in Table 5.7. The study finds a concave relationship between rainfall variability and non-agricultural wage and non-farm self-employment participation. This finding suggests that there is a threshold of rainfall variability after which the use of the non-farm activities as a means of adapting to rainfall variability starts to decrease. The results are in line with previous studies and our hypothesis that rural household use non-agricultural wage and non-farm self-employment as a means of adapting to rainfall variability but with limited extent. This may be because higher rainfall variability not only influences own-agricultural activities but also displaces labor and reduces the demand for labor outside the farm. Given that the average coefficient of variation is approximately 0.53, a 0.1 increase in CV of rainfall from 0.53 to 0.63 implies that households' hours supplied to non-farm agricultural wage activities increase by 21% for certain threshold. Rainfall variability increasing by one-tenth of the coefficient of variation implies that rural households' hours supplied to self-employment increase by 15% for certain threshold. This finding is in line with previous studies in developing countries and Southeast Asia (Rose, 2001; Ito and Kurosaki, 2009).

Furthermore, it is found that rural households in the study area use agricultural wage employment to cope with agricultural shocks and demographic shocks. Households experiencing agricultural shocks increase their agricultural wage labor by 43%. The overall results on how rural household use non-farm activities to adapt rainfall variability and agricultural shocks give strong support for our first hypothesis that the use of non-farm activities is heterogeneous in adapting to rainfall variability and coping with agricultural shocks.

Turning to how rural household use non-farm activities to cope with other sources of shocks mainly shocks in the non-farm activities and demographic shocks, it is found a positive and significant effect of demographic shocks on agricultural wage, which indicates that households in our study area use agricultural wage to cope with demographic shocks. Controlling other factors, households experiencing demographic shocks increase their agricultural wage labor by 31%. Our empirical results are consistent with the findings of Ward and Shively (2011), who found that households in rural China that experienced demographic shock due to the death of a household member are less likely to participate in migration as an ex-ante income smoothing response to risk.

Also, a negative and significant effect of demographic and economic shocks was found on non-agricultural wage employment. Controlling other factors, households experiencing demographic shocks decrease their non-agricultural wage labor by 48%. Similarly, economic shocks lead to a substantial non-agricultural wage employment reduction of approximately 44%. This is in line with previous studies (e.g., Fallon and Lucas, 2002 in Thailand; Huang et al., 2010 in China), which found that rural households who diversified into non-farm employment lost their jobs because of economic shocks. Both demographic and economic shocks have led to substantial non-agricultural wage employment reduction (48% and 44% reduction in hours, respectively) compared to with percentage of hours (21%) allocated to non–agricultural wage employment as an adaptation strategy for rainfall variability. The finding supports our second hypothesis that using non-farm activities to adapt to rainfall variability is limited in the presence of economic and idiosyncratic shocks such as demographic shocks.

Table 5.7. The Effect Rainfall Variability, Shocks and Assets in Explaining Non-Farm Employment

	FE Estimates						Honoré Fixed Effects Tobit Estimates					
	Non-agric. Wage		Non-farm self-empl.		Agric. Wage		Non-agric. Wage		Non-farm self-empl.		Agric. Wage	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	coef	Se	Coef	Se
Rainfall variability												
CV rainfall	0.209**	0.10	0.150**	0.05	-0.098	0.09	0.550**	0.26	0.653***	0.22	-0.432	0.29
CV rainfall sqr.	-0.002**	0.00	-0.002**	0.00	0.001	0.00	-0.005*	0.00	-0.006**	0.00	0.005	0.01
Lagged rainfall	-0.944	0.87	0.440	0.98	-0.620	1.01	-1.163	0.91	2.398	1.73	0.855	3.44
Lagged rainfall sqr	0.322	0.31	-0.119	0.44	0.402	0.42	0.412	0.35	-0.921	0.69	-0.445	1.23
Agric. shocks	0.289	0.19	0.088	0.14	0.436***	0.15	0.351*	0.21	-0.436	0.33	0.117	0.41
Other sources of shock												
Demo. shocks	-0.482***	0.17	0.046	0.17	0.305**	0.15	-0.570***	0.20	-0.110	0.40	1.361***	0.45
Econ. shocks	-0.444**	0.21	-0.177	0.20	-0.328	0.22	-0.555**	0.26	0.015	0.42	-0.046	0.50
Wealth indicators												
Non-land asset	0.147*	0.09	0.439***	0.09	-0.044	0.11	0.281*	0.13	1.516***	0.15	-0.815***	0.23
Land	-0.034	0.03	0.040	0.03	-0.004	0.02	-0.054	0.06	-0.031	0.04	-0.478***	0.09
Livestock	0.056*	0.03	0.037	0.30	0.034	0.03	0.068*	0.04	-0.150***	0.05	0.005	0.07
Irrigation	0.055	0.08	0.012	0.08	0.026	0.06	0.020	0.15	0.220	0.14	-0.052	0.33
Non-land assets and interactions with shocks												
CV rainfall * assets	-0.004*	0.00	0.000	0.00	-0.001	0.00	-0.006**	0.00	0.000	0.00	-0.007	0.01
Agric. shocks* assets	-0.002	0.00	0.000	0.00	0.000	0.00	-0.002	0.00	-0.001	0.00	0.005	0.00
Demo. shocks* assets	0.002*	0.00	0.000	0.00	-0.001	0.00	0.003*	0.00	0.000	0.00	-0.014**	0.01
Econ. shocks* assets	0.000	0.00	0.003*	0.00	0.001	0.00	0.000	0.00	0.002*	0.00	0.005	0.01
Household characteristics												
Dep. ratio	0.111	0.13	0.098	0.10	0.178*	0.09	0.145	0.18	-0.092	0.22	0.443	0.33
Below primary	0.039	0.12	0.185	0.14	-0.077	0.11	0.036	0.15	0.337**	0.14	-0.385*	0.21
Primary	0.398**	0.18	0.421***	0.16	-0.006	0.15	0.480**	0.17	0.186*	0.11	0.699***	0.15
Second	0.526***	0.15	0.182*	0.10	-0.119	0.14	0.625***	0.17	0.134	0.16	0.314	0.21
Prof. train	0.765***	0.22	0.254	0.29	-0.219*	0.12	0.852***	0.24	0.245	0.28	-0.493	0.43
Age adult	-0.007	0.01	-0.022	0.01	-0.016	0.01	-0.009	0.02	0.022	0.02	-0.118***	0.02
Village level characteristics												
Paved road	0.119	0.10	0.110***	0.03	-0.086	0.11	0.150	0.15	0.260	0.20	0.409	0.40
Water supply	0.112**	0.04	0.004	0.01	-0.003	0.01	0.014	0.02	0.009	0.03	0.037	0.05
Time market	0.000	0.00	-0.001	0.00	-0.003	0.00	0.000	0.00	-0.002	0.01	-0.014	0.01
HHs electricity	0.000	0.00	0.005***	0.00	-0.002	0.00	0.000	0.00	0.009***	0.00	-0.009	0.01
No. Enter.	0.153*	0.04	0.122**	0.04	-0.035	0.03	0.049	0.05	0.000	0.13	-0.248	0.28
Ubon* time	0.061	0.07	0.033	0.06	-0.067	0.06	0.062	0.09	0.067	0.14	-0.139	0.29
Buriram* time	0.049	0.07	0.002	0.07	-0.056	0.06	0.065	0.08	0.011	0.16	-0.117	0.21
cons	-1.738	2.76	-4.685*	2.60	4.105*	2.40						
N		4,128		4,128		4,128	4,128		4,128		4,128	
R^2		0.28		0.24		0.22						

Source: DFG Rural Household- and Village-Level Panel Surveys in Thailand.

Note: *** represents p<0.01. ** represents p<0.05. * represents p<0.10.

5.5.2. The role of assets in explaining non-farm Employment

To test the hypotheses that assets may help in adapting to the effects of rainfall variability and whether shocks have a smaller effect on households with a greater level of assets, we include non-land assets and their interactions with rainfall variability and shock variables. We show the results of the fixed effects model that refer to the extended model (equation 4) in Table 5.7. A Wald test for the equality of the interaction terms is rejected in all models. We find that wealth indicators have the expected signs in all non-farm employment equations. There is a positive and significant

relationship between the level of household assets, and non-agricultural wage and non-farm self-employment activities, whereas there is a negative relationship between the level of assets and agricultural wage activities, although it is not significant. This finding may suggest that households with relatively low start-up capital find it hard to engage in higher return activities, while the richer households are able to take part in these activities. A one standard deviation increase in log per capita of non-assets leads to a 15% and 44% increase in non-agricultural wage and non-farm self-employment hours, respectively.

Considering the effect of interaction effects and other covariates, we find that the impact of rainfall variability on non-agricultural wage activities becomes smaller in magnitude and that the impact of rainfall variability becomes insignificant for non-farm self-employment activities when interacting with non-land assets. The results indicate that adaptation to rainfall variability varies with a household's level of assets. Furthermore, the effects of demographic and economic shocks on non-agricultural wage hours become positive when they are interacted with non-land assets. The results may suggest that households with a low level of non-land assets are more likely to be affected by economic shocks and demographic shocks. This finding confirms our third hypothesis that poor households are less able to exploit non-farm employment opportunities and thereby adapt to rainfall variability and shocks.

Turning to the effect of other covariates, we find evidence of a significant negative effect of the level of education on non-agricultural wage labor supply and non-farm self-employment labor supply. This effect could indicate the unwavering role of qualified skills as a necessity for high-return non-farm activities. The significant contribution of the role of education in shaping employment outcomes, obtained from our empirical evidence, is a finding that is consistent with previous empirical studies such as those of Jonasson and Helfand (2010) in Brazil and Matsumoto et al (2006) in Ethiopia, Kenya, and Uganda. Analyzing the demand-side factors[36] provides additional insights. Villages with better access to public facilities, such as paved roads, the availability of enterprises and electricity, play an important role in the expansion of high-return activities such as non-farm self-employment. Similarly, villages with access to a public water supply and enterprises offer opportunities to households to engage in non-agricultural wage employment. This result also supports previous studies assessing the relationship between demand factors and the non-farm labor supply. Jonasson and Helfand (2010) showed that the local availability of geographic variables in the village, such as

[36]Because we use a fixed effects model, the within-village variation over time is small, which is why some of the coefficients are insignificant. In our random effects model, most of the geographic capital variables were highly significant.

quality (paved) roadways and a number of enterprises increases the labor hours of non-agricultural wage employment.

5.6. Conclusions and policy implications

This study explores the link between rainfall variability, shocks and non-farm activities as adaptation strategies with a particular focus on how rural households use of non-farm employment to adapt climate variability and cope with various sources of shocks. The study employ a comprehensive set of household- and village-level panel data from Northeast Thailand and a corresponding twenty-year historical rainfall data set. Using the standard unitary agricultural household model in the presence of risk, we are able to test three hypotheses: (1) household use different types of labor markets as a means of adapting to climate variability and other sources of shocks, and the labor market is heterogeneous in terms of adapting to climate variability and coping with shock; (2) dealing with the labor market as a means of adapting to climate variability is less effective in the presence of severe climate variability, economic shocks and idiosyncratic shocks; and (3) the risk-bearing capacity of households differs with the level of assets. Two models are used to explore the three hypotheses. First, a household fixed-effect is used to control for household unobservable, such as nonlinearities in wealth indicators, and to reduce the potential for biased estimates on rainfall viability and other sources of shocks. Second, a fixed-effects Tobit estimator is used to account for both the censoring in the dependent variable and provide a robust basis to compare the results all equations.

The results support our hypotheses and confirm the empirical findings from other developing countries (e.g., Ito and Kurosaki 2009; Rose 2001; Bandyopadhyay and Skoufias, 2012; Di Falco et al. 2009). Our results support the first hypothesis: rural households use non-farm agricultural wages and non-farm self-employment as a means of adapting to rainfall variability, and labor market are heterogeneous in terms of their returns and risk coping strategies. Also, the second hypothesis on labor market as a means of adapting to climate variability is less effective in the presence of severe climate variability, economic shocks and idiosyncratic shocks cannot be rejected. The paper shows that a concave relationship between rainfall variability and labor hours supplied to non-agricultural wage and non-farm self-employment exists which suggests that there is a threshold of rainfall variability after which the use of the non-farm activities as a means of adapting to rainfall variability starts to decrease. Similarly, in line with previous studies (e.g., Ward and Shively 2011; Fallon and Lucas 2002; Huang et al. 2010), we find that both demographic and economic shocks lead to substantial reductions in non-agricultural wage hours, while households in our study area use agricultural wage employment to cope with demographic shocks. For the last hypothesis, risk-bearing capacity of households differs with the level of assets. It is found that non-land assets play a

very important role in deriving non-farm employment opportunities: households with lower levels of non-assets find it difficult to engage in labor markets, particularly in high-return activities such as non-agricultural wage and non-farm self-employment. Poor households are more likely to be affected by climate variability and other sources of shocks, which suggests that climate variability and other sources of shocks can push certain households into chronic poverty.

Our findings can provide some insight into the link of climate variability and shocks, and non-farm employment and into the possible policy options that are available to reduce the impact of climate variability and other sources of shock. First, the findings suggest the importance of simultaneously analyzing the impact of climate variability and both demographic and economic shocks on non-farm employment. Second, the labor market can be less effective as a means for adaption strategy in the presence of sever rainfall variability, economic and demographic shocks. Third, because labor markets are heterogeneous in terms of adapting climate variability and coping with shocks which indicates it is important distinguish different types of labor market in terms of their returns and adaptation strategies. Fourth, the study identifies a need for complementary intervention in building private asset accumulation, education investments and efforts to stimulate small- and medium-scale enterprises; and investment in infrastructure and public services which could play a vital role in addressing the challenges of climate variability and other sources of shocks.

REFERENCES

Amare, M., Hohfeld, L., Jitsuchon, S., & Waibel, H. (2012). Rural–Urban Migration and Employment Quality: A Case Study from Thailand. *Asian Development Review* 29(1), 57-79.

Asian Development Bank (ADB). (2009). The Economics of Climate Change in Southeast Asia: A Regional Review. Asian Development Bank, Manila, Philippines.

Bandyopadhyay, S., & Skoufias, E. (2012). Rainfall Variability, Occupational Choice, and Welfare in Rural Bangladesh. *Review Economic of the Household.*

Barrett, C. B., Bezuneh, M., Clay, D. C., & Reardon, T. (2005). Heterogeneous Constraints, Incentives and Income Diversification Strategies in Rural Africa. *Quarterly Journal of International Agriculture* 44: 37-61.

Barrett, C. B., Reardon, T., & Webb, P. (2001). Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics and Policy Implications. *Food Policy* 26(4):315-331.

Beegle, K., Deheija, R., & Gatti, R. (2006). Child Labor and Agricultural Shocks. *Journal of Development Economics* 81:80–96.

Bezu, S., Barrett, C.B. & Holden, S.T. (2012) Does the nonfarm economy offer pathways for upward mobility? Evidence from a panel data study in Ethiopia. *World Development* 40, 1634–1646.

Bowen, A., Cochrane, S., & Fankhauser, S. (2012). Climate Change, Adaptation and Economic Growth. *Climatic Change* 113(12); 95-106

Davis, B. Winters, P., Carletto, G., Covarrubias, K., Quiñones, E. J., Zezza, A., Stamoulis, K., Bonomi, G., & DiGiuseppe, S. (2010). A Cross-Country Comparison of Rural Income Generating Activities. *World Development* 38(1): 48-63.

Demeke, A. B., Keil, A., & Zeller, M. (2011). Using Panel Data to Estimate the Effect of Rainfall Shocks on Smallholders Food Security and Vulnerability in Rural Ethiopia. *Climatic Change* 108(1-2); 185-206.

Dercon, S., & Christiaensen, L. (2011). Consumption Risk, Technology Adoption and Poverty Traps: Evidence from Ethiopia. *Journal of Development Economics* 96 (2):159-173.

Di Falco, S., Adinolfi, F., Bozzola, M., & Capitanio, F. (2014). Crop Insurance as a Strategy for Adapting to Climate Change. *Journal of Agricultural Economics*, 65:2, 485–504

Di Falco, S., Bezabih, M., & Yesuf, M. (2010). Seeds for livelihood: Crop Biodiversity and Food Production in Ethiopia. *Ecological Economics*, 69:8, 1695–1702.

Di Falco, S., & Chavas, J-P. (2009). On Crop Biodiversity, Risk Exposure and Food Security in the Highlands of Ethiopia. *American Journal of Agricultural Economics* 91(3): 599–611.

Di Falco, S., Yesuf, M., Kohlin, G., & Ringler, C. (2012). Estimating the Impact of Climate Change on Agriculture in Low-Income Countries: Household Level Evidence from the Nile Basin, Ethiopia. *Environmental and Resource Economics*, 52 (4): 457-478.

Ellis, F., & Allison, E. H. (2004). Livelihood Diversification and Natural Resource Access. *Livelihood Support Program Working Paper No.9, FAO: Rome*.

Fallon P., & Lucas, R. (2002). The Impact of Financial Crises on Labor Markets, Household Incomes, and Poverty: A Review of Evidence. *The World Bank Research Observer,* 17(1), 21-45.

Green, M., & Weatherhead, E. K. (2014). Coping with Climate Change Uncertainty for Adaptation Planning: An Improved Criterion for Decision Making Under Uncertainty Using UKCP09. *Climate Risk Management* 1: 63–75.

Hardeweg, B., Stephan, K., & Waibel, H. (2013). Establishing a Database for Vulnerability Assessment. In Stephan, K. and Waibel, H. (Eds.), *Vulnerability to Poverty-Theory, Measurement and Determinants* (pp. 50–79). Macmillan: Palgrave.

Honoré, B. (1992). Trimmed LAD and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects, *Econometrica,* 60: 533-565.

Howden, S. M., Soussana, J. F., Tubiello, F. N., Chhetri, N., Dunlop, M., & Meinke, H. (2007). Adapting Agriculture to Climate Change. *Proc. Natl Acad. Sci*, 104, 19691–19696.

Huang, J., Zhi H., Huang, Z., Rozelle, S., & Giles, J. (2010). The Impact of the Global Financial Crisis on Non-farm Employment and Earnings in Rural China. *Policy Research Working Paper No. 5439, Washington, DC: The World Bank*.

Iglesias, A., Quiroga, S., & Diz, A. (2011). Looking Into the Future of Agriculture in A Changing Climate. *European Review of Agricultural Economics*, 38:3, 427–447.

Intergovernmental Panel on Climate Change (IPCC) (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Cambridge University Press, Cambridge.

Ito, T., &Kurosaki, T. (2009). Weather Risk, Wages in Kind, and the Non-farm Labor Supply of Agricultural Households in a Developing Country. *American Journal of Agricultural Economics,* 91(3):697–710.

Jonasson, E., & Helfand, S. M. (2010). How Important Are Locational Characteristics for Rural Non-Agricultural Employment? Lessons from Brazil. *World Development*, 38(5): 727- 741.

Lanjouw, Jean O., & Lanjouw, P. (2001).The Rural Non-Farm Sector: Issues and Evidence from Developing Countries. *Agricultural Economics* 26 (1):1-23.

Luo, Q., & Lin, E. (1999). Agricultural Vulnerability and Adaptation in Developing Countries: The Asia-Pacific Region. *Climatic Change* 43(4): 729-743

Matsumoto, T., Kijima, Y., & Yamano, T. (2006). The Role of Local Nonfarm Activities and Migration in Reducing Poverty: Evidence from Ethiopia, Kenya, and Uganda. *Agricultural Economics*, 35: 449-458.

McCarthy, N., Lipper, L., & Branca, G. (2011). Climate-Smart Agriculture: Smallholder Adoption and Implications for Climate Change Adaptation and Mitigation. *Mitigation of Climate Change in Agriculture (MICCA) Working Paper FAO: Rome.*

Rose, E. (2001). Ex-Ante and Ex-Post Labor Supply Response to Risk in a Low-Income Area. *Journal of Development Economics* 64(2):371–88.

Smale, M., Bellon, M., &Aguirre, A. (2001). Maize Diversity, Variety Attributes, and Farmers' Choices in Southeastern Guanajuato, Mexico. *Economic Development and Cultural Change* 50(1): 201–225.

Tongruksawattana, S., Junge, V., Waibel, H., Diez J. R., & Schmidt, E. (2013). Ex-post Coping Strategies of Rural households in Thailand & Vietnam. In Stephan, K. and Waibel, H. (Eds.), *Vulnerability to Poverty-Theory, Measurement and Determinants* (pp. 216–57). Macmillan: Palgrave.

Ward, P. S., & Shively, G. E. (2011). Migration and Land Rental as Risk Response in Rural China. Paper presented at the 2011 AAEA & NAREA Joint Annual Meeting, Pittsburgh, USA.

Warr, P. (2011). Thailand's Development Strategy and Growth Performance. *United Nations University World Institute for Development Economics Research (UNU-WIDER) Working Paper No. 02 Helsinki: United Nations.*

Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Boston.

6 SYNTHESIS

6.1. Conclusions and implications

Although the chapters sketched above provide a deeper picture of how climate variability, shocks, migration and remittances influence welfare dynamics in Vietnam and Thailand, it is possible to draw some general lessons and policy messages from the contribution. They can be grouped into (1) methodological lessons, (2) lessons on the causes of inequality and poverty traps in South-East Asia, (3) specific lessons on ongoing rural-urban migration in Vietnam and Thailand and possible policy response, and (4) suggestions for future research.

From a methodological standpoint, identifying the existence of poverty traps and cause of poverty traps; and analyzing the impact of migration and remittances on rural household welfare left behind are subject to a number of econometric challenges, such as unobserved heterogeneity, sample selection and measurement error. This thesis tackles the methodological issues involved; first it uses a large household- and village-level panel data set covering 4,000 households in six provinces of the two countries. The panel data include detailed information on household characteristics, income, consumption and retrospective information about shock experience and historical rainfall which are able to mitigate the problem of omitted variable bias and time invariant unobserved heterogeneity problems. Second, the thesis employs different estimation techniques to overcome many of the econometric challenges: (1) it applies a dynamic asset-based poverty concept which involves less recall bias and measurement error and provides richer understanding of long-term welfare growth; (2) it combines direct tests of asset dynamics and indirect tests of differentiated behavioral responses to shocks to assess the existence of poverty traps and to mitigate the unobserved heterogeneities and measurement error problems owned to imperfect market settings; and (3) it controls for sample selection and endogeneity problems by employing difference-in-difference propensity score matching and fixed effects as well as an instrumental variable estimation model, whereby the implication of migration and remittances for welfare dynamics is investigated.

As regards the existence of poverty traps; cause of poverty traps; and risk-mitigating and -coping strategies, this study provides deeper insights into how shocks, coping strategies and geographic capital shape long-term welfare paths in Vietnam and how rural households use non-farm employment to mitigate weather risk and cope with shocks in rural Thailand. The thesis shows that households in rural Vietnam become trapped in poverty mainly because of shocks that cause asset and income loss, ethnic discrimination, and limited access to infrastructure and public goods and services. In both countries, many households report that they are losing large amounts of income

and assets because of various types of shock. Households attempt to reduce their risk exposure by using different adaptation and coping strategies like non-farm employment. However, there are three main concerns about how rural households attempt to reduce income risk and cope with shocks. First, poor households adopt costly coping strategies and choose to retain assets to maintain their subsistence asset levels and future income, but such households must reduce their consumption levels to cope with shocks which may mean reducing health-related expenditures and removing children from school. Second, rural households in Thailand often use non-farm employment as rainfall adaptation and shock coping strategies. However, poor households face entry barriers to the non-farm employment because of the lack of necessary resources such as skills and capital, thus allowing wealthier farm households to dominate the most remunerative non-farm employment and further increase the existing inequality. Third, because the ratio of non-farm income to total household income is growing, agricultural production shocks are no longer the only source of income risk: demographic shocks and shocks in the labor market, can limit the effectiveness of the non-farm activities as a means of adapting to climate variability. Although both countries have comprehensive and effective policy programs to help the poor, particularly in the case of natural disasters and other shocks, it remains uncertain to what extent these measures can solve the problem of the growing inequality and rural structural poverty.

With regard to migration, remittances and welfare dynamics this thesis makes three important points. First, disparities in both economic and social status among the urban and rural areas, poor access to social and physical infrastructure in rural areas, and desire for education are considered to be the factors responsible for rural-urban migration. Second, the thesis shows that not all migration decisions lead to the expected outcome. The thesis reveals that only a few households with migrants actually receive remittances and this could be mainly because of the high cost of living, the difficulty of obtaining documentation for resident registration in major cities and occasionally low-quality employment. Third, the impact of migration and remittances is heterogeneous. The thesis shows that migrants from poor households in Thailand tend to engage in low-return activities, whereas the relatively wealthier rural households make better migrants and benefit more from migration, which can lead to growing inequality. Migration and remittances have no significant role in improving ethnic minorities' wellbeing in rural Vietnam which suggests that the enormous welfare gap that exists between ethnic minorities and the Kinh majority cannot be overcome by rural-urban migration.

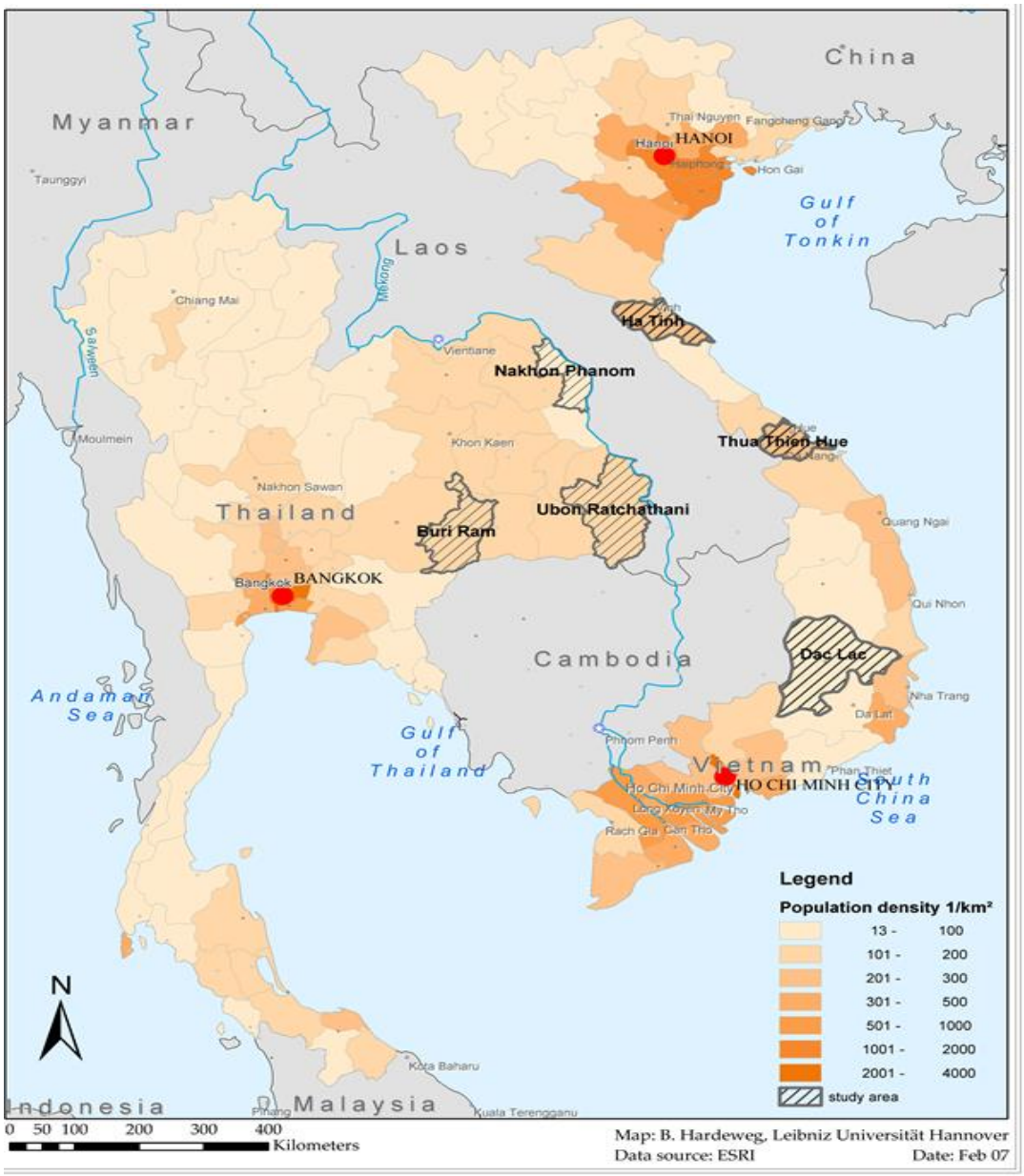
The findings from this thesis provide a number of important lessons for researchers and policy makers concerned with reducing the impact of shocks and promoting sustainable poverty reduction. The overall results support the need for policy to strengthen and leverage a more balanced

investment in terms of allocating infrastructure and public goods and services, building up productive assets, developing the capacities of the poor, and improving access to formal credit and insurance. Second, climate variability and agricultural shocks are not the only sources of shocks that affect rural livelihoods in developing countries. Shocks related to economic slowdown in the industrial or service sectors, and idiosyncratic shocks like health shocks also strongly influence the conditions of rural livelihoods. Enhancing the capacity of adaptation measures of the agricultural sector and complementary efforts to promote public health and to shore up the economy and create jobs can play important roles in improving rural livelihoods. Third, the analysis of Vietnam and Thailand suggests that not all migration decisions may lead to the expected outcome. Measures that reduce long registration procedures for migrants in urban areas, better social protection and more investment in education quality, infrastructure, and public services in rural areas will enhance the welfare of migrants and natal households and strengthen rural-urban integration.

A number of areas for future research are suggested. First, to fully understand and provide more information on whether rural welfare growth patterns in both countries remains the same in the longer-term, it is advisable to maintain the data base and collect data for the same households for a longer time span. Second, the data set contains detailed information on retrospective information about shocks experience, and it is important to match this rich data set with objective climate indicators such as rainfall and temperature to address the link between objective information and subjective assessment about shocks and their implications on for welfare growth patterns. Third, future researches that address the impact of risk and rural household risk behavior on welfare growth patterns are important because household shock experiences underestimate the impact of shocks and rural households use different ex-ante coping strategies. Fourth, it is recommended to match this panel data set with meso-macroeconomic indicators like inflation, income and employment rates at province level to understand the dynamics of provinces. Fifth, adult migration from rural to urban areas is common and massive in both countries; this may affect the rural age structure and agricultural productivity of rural households. It can also encourage child labor and reduce adult educational guidance, and can have strong implications for the development of children left behind and long-term consequences for rural well-being. It is important to address the multi-dimensional aspects of poverty such as agricultural productivity, child health and educational impact of migration and remittances.

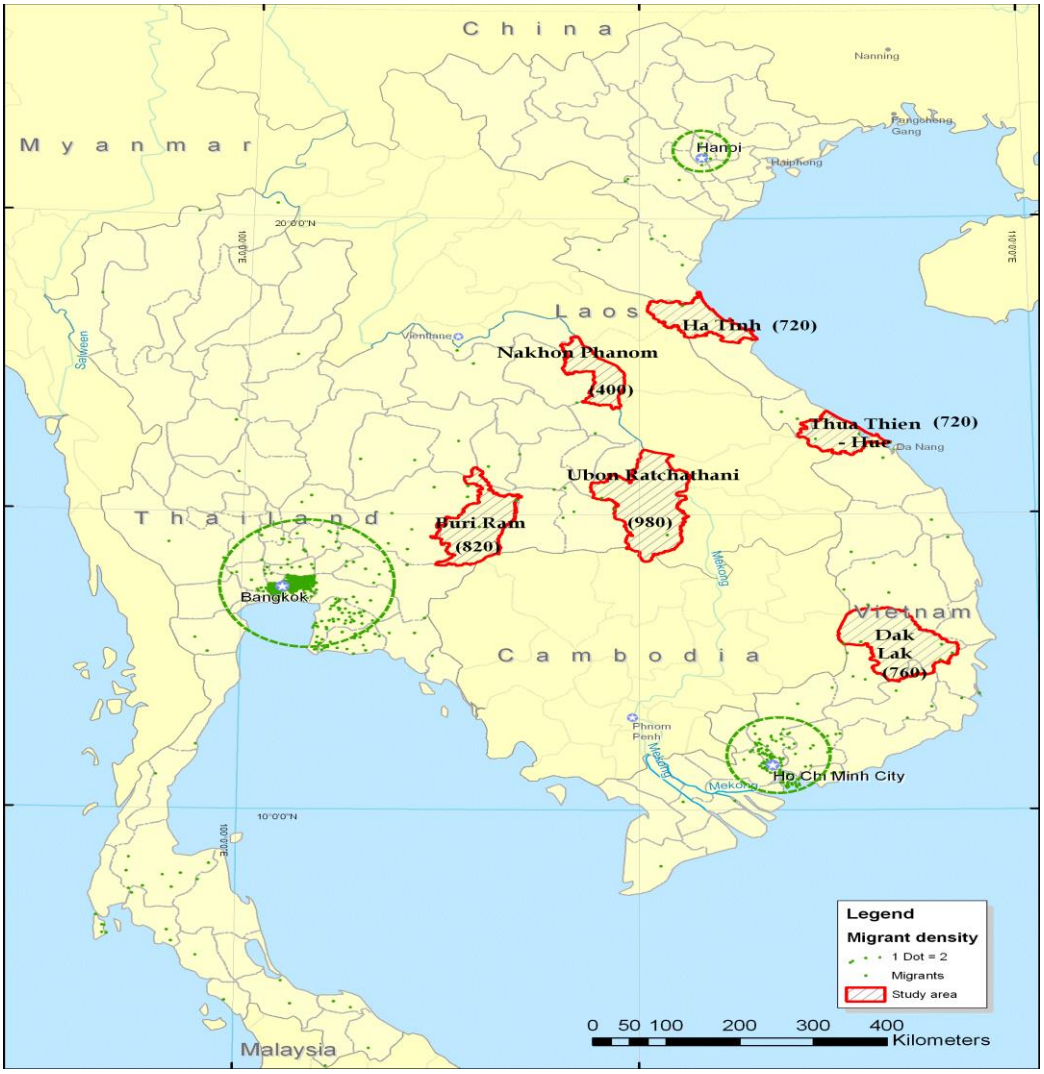
APPENDIX

Appendix 1: DFG Research Unit FOR 756 - Study sites



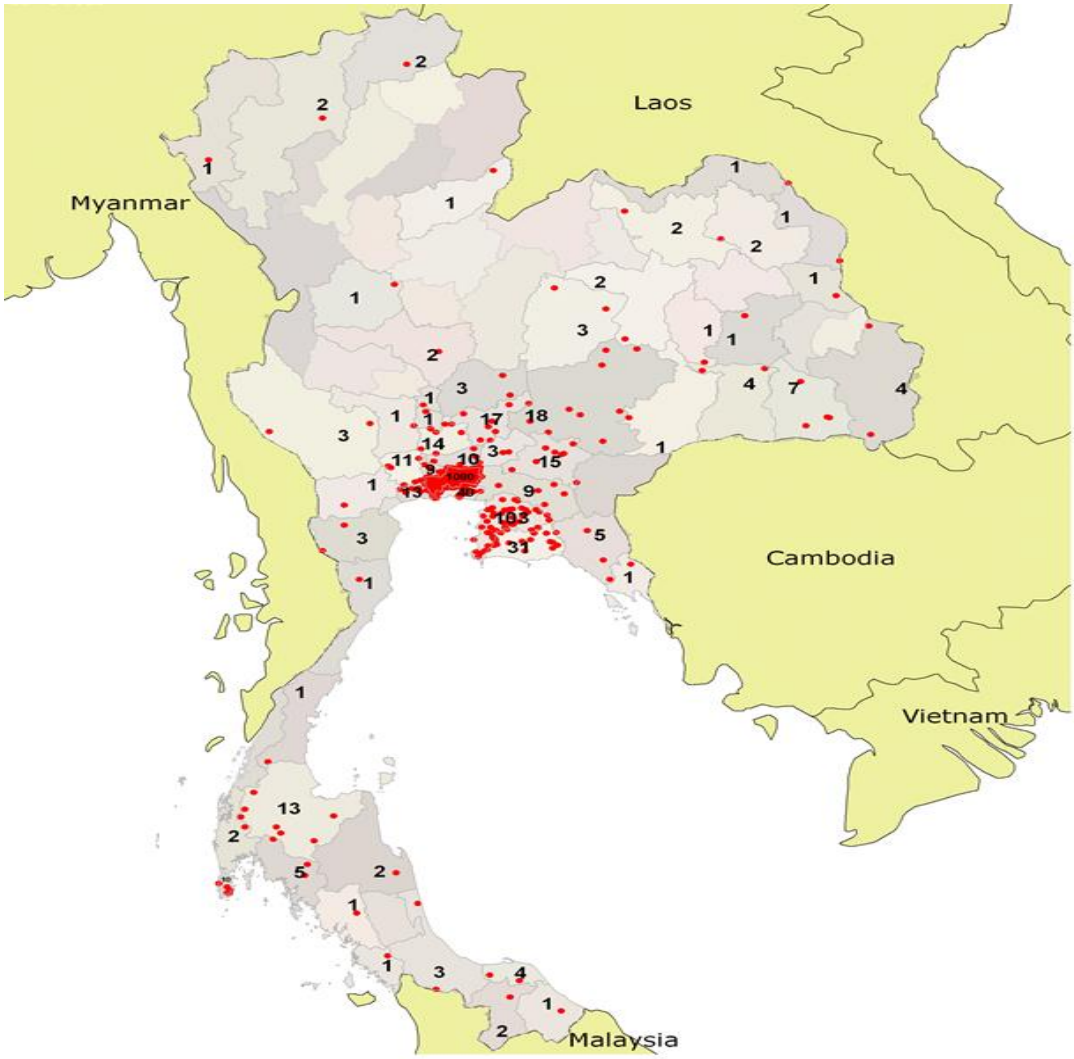
APPENDIX

Appendix 2: Main Migrant Destination Cities: Migrant Density



APPENDIX

Appendix 3: Estimated Number of Migrant Interviews, Thailand



APPENDIX

Appendix 4: Rainfall Stations in Thailand and Annual Rainfall (Interpolated by Distance Method)