Natural resource extraction and rural livelihoods in Southeast Asia

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Zusammenfassung

Klimawandel, Zerstörung natürlicher Ressourcen und Armut sind noch immer drängende Probleme, die nur gleichzeitig gelöst werden können. In den letzten Jahrzehnten erlebte Südostasien ein rasantes Wirtschaftswachstum, das zu einem starken Rückgang der Armut beitrug. Allerdings sind die Verbesserungen ungleich zwischen ländlichen und städtischen Gebieten verteilt. Während die Menschen in städtischen Gebieten an Globalisierung und Wirtschaftswachstum teilhaben können, sind viele ländliche Gebiete noch immer strukturschwach. Schocks – einschließlich klimabezogener Schocks – wirken wie ein Teufelskreis und führen dazu, dass arme ländliche Haushalte, die stark von natürlichen Ressourcen abhängig sind, noch angreifbarer werden. Der Klimawandel und die damit verbundenen extremen Wetterereignisse verursachen Schäden an Eigentum, Ernten, Produktionsanlagen und Infrastruktur, wodurch Armut und Ungleichheit verstärkt werden. Die Zerstörung natürlicher Ressourcen gefährdet die Bereitstellung wichtiger Ökosystemdienstleistungen. Beispielsweise nutzt die Landbevölkerung natürliche Produkte wie Holz, Fisch und Wildfrüchte für den eigenen Lebensunterhalt und zum Verkauf. Die Gewinnung natürlicher Ressourcen dient als Sicherheitsnetz in Krisenzeiten, sichert den täglichen Bedarf und reduziert Einkommensungleichheit. Dies ist wichtig, da die ländliche Bevölkerung nicht homogen ist und ethnische Minderheiten, z.B. in Vietnam, ärmer sind als die ethnische Mehrheit. Obwohl Landwirtschaft und die Gewinnung natürlicher Ressourcen die wichtigsten Strategien zur Sicherung des Lebensunterhalts sind, streben ländliche Haushalte die weitere Diversifizierung ihres Lebensunterhalts an: Sie gehen einer außerlandwirtschaftlichen oder selbstständigen Tätigkeit nach, und einige suchen nach Erwerbsmöglichkeiten in den Städten, um Geld zurück nach Hause zu schicken.

Dennoch sind ländliche Haushalte nach wie vor abhängig von der Nutzung natürlicher Ressourcen, um ihren Lebensunterhalt zu bestreiten. Darüber hinaus trägt ihr Nutzungsverhalten zum Erhalt oder zur Zerstörung dieser Ressourcen bei, was wiederum Auswirkungen auf das Klima hat, da ein intaktes Ökosystem Kohlenstoff speichert. Daher ist es die Zielsetzung dieser Arbeit, die Gewinnung natürlicher Ressourcen als wichtige Strategie zur Sicherung der Lebensgrundlage von ländlichen Haushalten in Südostasien besser zu verstehen. Die konkreteren Ziele sind die Untersuchung (i.) der Auswirkungen von Rücküberweisungen von Arbeitsmigrant*innen auf das Umwelteinkommen, (ii.) des Zusammenhangs zwischen landwirtschaftlicher Effizienz und der Abhängigkeit von

Umweltressourcen, (iii.) der Bedeutung der Gewinnung natürlicher Ressourcen für ethnische Ungleichheit und (iv) der Rolle der Gewinnung natürlicher Ressourcen im Kontext von Covid-19. Um diese Fragen zu beantworten, stellt diese Arbeit vier Forschungsbeiträge vor, die jeweils einen spezifischen Aspekt näher beleuchten.

Alle Beiträge verwenden Daten aus dem Thailand Vietnam Socio Economic Panel (TVSEP). Die Befragung von Haushalten und Dorfvorsteher*innen umfasst ländliche Gebiete der drei Provinzen Nakhon Phanom, Buriram und Ubon Ratchathani in Thailand sowie der drei Provinzen Ha Tinh, Thua Thien Hue und Dak Lak in Vietnam. Diese Provinzen liegen nahe der Grenze zu Laos bzw. Kambodscha und zeichnen sich durch ein niedriges durchschnittliches Pro-Kopf-Einkommen, eine hohe Abhängigkeit von der Landwirtschaft und eine schlechte Infrastruktur aus. Der übergreifende konzeptionelle Bezugsrahmen für diese Arbeit basiert auf dem Sustainable Livelihoods Framework. Mit diesem Ansatz kann untersucht werden, wie ländliche Haushalte ihre Strategien zur Sicherung des Lebensunterhalts wählen und wie diese Entscheidungen miteinander verknüpft sind. Dem Bezugsrahmen zufolge ist die Kapitalausstattung der Haushalte – auch als Plattformen des Lebensunterhalts bezeichnet – entscheidend für diesen komplexen und dynamischen Entscheidungsprozess. Das Kombinieren von Plattformen ermöglicht verschiedene Strategien zur Sicherung des Lebensunterhalts, was wiederum zu unterschiedlichen Auswirkungen führt, wie z.B. die nachhaltige Nutzung von natürlichen Ressourcen oder eine Verringerung der Armut.

Kapitel 1 motiviert das allgemeine Forschungsziel der Arbeit und gibt einen Überblick über die folgenden Kapitel. Kapitel 2 präsentiert einen Beitrag über die Wechselbeziehung zwischen der Gewinnung natürlicher Ressourcen und Migration. Haushaltsmitglieder migrieren in städtische Gebiete, um zu arbeiten und Geld nach Hause zu schicken. Obwohl sich durch Arbeitsmigration die verfügbare Arbeitskapazität innerhalb des Kernhaushalts reduziert, wird zusätzliches Einkommen generiert. Auch die Nutzung natürlicher Ressourcen ist von dieser Arbeits-migration betroffen. Die Analyse des vietnamesischen Datensatzes aus den Jahren 2013, 2016 und 2017 zeigt, dass vermögensärmere Haushalte ihr Umwelteinkommen reduzieren, wenn sie Arbeitsmigrant*innen haben, während vermögendere Haushalte ihr Umwelteinkommen erhöhen. Der Grund dafür ist, dass ärmere Haushalte stärker auf arbeitsintensive Methoden zur Gewinnung natürlicher Ressourcen angewiesen sind. Aufgrund der geringeren Arbeitskapazität entnehmen sie weniger Ressourcen. Insbesondere für die Ärmeren ist deshalb ein verbesserter Zugang zu alternativen Einkommensquellen mit höheren Erträgen wichtig. Vermögendere

Haushalte hingegen sind stärker auf kapitalintensive Methoden zur Gewinnung natürlicher Ressourcen angewiesen, sodass zusätzliches Einkommen als weitere Investition genutzt wird. Daher sind ein gutes Management von natürlichen Ressourcen und die Durchsetzung von Zugangsregelungen erforderlich.

Kapitel 3 enthält einen Forschungsbeitrag, der die Auswirkungen der landwirtschaftlichen Effizienz auf die Abhängigkeit von natürlichen Ressourcen analysiert. Landwirtschaft und die Gewinnung natürlicher Ressourcen gehören zu den wichtigsten Strategien zur Sicherung des Lebensunterhalts ländlicher Haushalte. Da sie z.B. in Bezug auf Geräte ähnliche Inputfaktoren benötigen, ist es wahrscheinlich, dass sie sich gegenseitig beeinflussen. Der Forschungsbeitrag nutzt für die Analyse die Abhängigkeit von natürlichen Ressourcen anstelle des Umwelt-einkommens, da gezeigt werden konnte, dass insbesondere ärmere Menschen von natürlichen Ressourcen abhängig sind. Hierbei wird der Environmental Resource Dependence Index (ERDI) als multidimensionaler Ansatz zur besseren Messung von Abhängigkeit vorgeschlagen. Der Forschungsbeitrag verwendet Daten aller drei vietnamesischen Provinzen aus den Jahren 2013, 2016 und 2017. Die Ergebnisse der ökonometrischen Analysen zeigen, dass eine höhere landwirtschaftliche Effizienz die Abhängigkeit von natürlichen Ressourcen und damit auch den Druck auf die Ressourcengrundlage reduziert. Somit ist es notwendig, Landwirt*innen bei der Verbesserung ihrer landwirtschaftlichen Effizienz zu unterstützen, um die Abhängigkeit und die Entnahme von natürlichen Ressourcen zu verringern.

Kapitel 4 beinhaltet einen Forschungsbeitrag, der sich mit den Auswirkungen der Gewinnung natürlicher Ressourcen auf die ethnische Ungleichheit in der Provinz Dak Lak befasst. Aufgrund sprachlicher und kultureller Barrieren, einem traditionellen Leben in geographisch abgelegenen Regionen und (früherer) Diskriminierung sind ethnische Minderheiten in Bezug auf Bildung, Arbeit, Gesundheitsversorgung und Zugang zu Kapitalmärkten noch immer benachteiligt. Sie sind somit stärker auf natürliche Ressourcen angewiesen, da ihr Zugang zu alternativen und profitableren Strategien zur Sicherung des Lebensunterhalts begrenzt ist. Die Analyse der Daten aus den Jahren 2010, 2013 und 2016 deutet jedoch darauf hin, dass Umwelteinkommen die Einkommensungleichheit insbesondere zwischen ethnischen Minderheiten verringert. Darüber hinaus stellt der Forschungsbeitrag fest, dass die Unterschiede bei der Nutzung von natürlichen Ressourcen auf unterschiedliche Gruppen-merkmale und auf unterschiedliche Erträge aus diesen Merkmalen zurückzuführen sind, was auf eine strukturelle Komponente schließen lässt, die zur ethnischen Ungleichheit beiträgt.

Zudem unterstützt die Gewinnung natürlicher Ressourcen den Konsum ethnischer Minderheiten, da der Konsum von Minderheitshaushalten, die natürliche Ressourcen entnehmen, sinken würde, wenn sie die Gewinnung einstellen würden. Dies deutet auf die geringere Kapazität von Minderheiten hin, Schocks zu bewältigen. Diese Kapazität gilt es zu verbessern. Der Erhalt und die Verbesserung der Ressourcengrundlage ist notwendig, um zu einer Verringerung der ethnischen Einkommensungleichheit sowie zum Wohlstand der Haushalte – insbesondere von ethnischen Minderheiten – beizutragen.

Kapitel 5 befasst sich mit einem Forschungsbeitrag über die Bedeutung verschiedener Strategien zur Sicherung des Lebensunterhalts während der Covid-19 Pandemie. Mit dem Ausbruch der Pandemie wurde die Hypothese aufgestellt, dass mehr natürliche Ressourcen entnommen werden, da die Unterbrechung globaler Wertschöpfungsketten sogar ländliche Gebiete in Ländern mit niedrigem und mittlerem Einkommen erreichen würde, z.B. aufgrund von nicht verfügbaren landwirtschaftlichen Inputfaktoren. Die Analyse des thailändischen Datensatzes von 2020 und 2022 stützt diese Vermutung nur teilweise. Der Forschungsbeitrag zeigt, dass die wirtschaftlichen Auswirkungen der Pandemie im Allgemeinen kurzfristig sind. Außerdem sind Haushalte, die Strategien zur Sicherung des Lebensunterhalts verfolgen, die stärker in globale Wertschöpfungsketten eingebunden sind, wie z.B. eine (selbstständige) Tätigkeit außerhalb der Landwirtschaft, auch stärker betroffen. Dagegen sind Haushalte, die hauptsächlich in der Subsistenzlandwirtschaft tätig sind, weniger beeinträchtigt. Da die letztgenannten Haushalte auch diejenigen sind, die in Krisenzeiten auf die Gewinnung natürlicher Ressourcen zurückgreifen, hatte Covid-19 nur geringe Auswirkungen auf die Nutzung dieser Ressourcen. Dennoch bleibt die Diversifizierung des Lebensunterhalts für alle ländlichen Haushalte wichtig, da verschiedene Arten von Schocks je nach Haushaltsmerkmalen und Strategien zur Sicherung des Lebensunterhalts unterschiedliche Auswirkungen haben. Zusätzlich ist die richtige Identifizierung von denjenigen, die Hilfe benötigen, für gezielte und nachhaltige politische Interventionen während künftiger Krisen unerlässlich.

Insgesamt ist die Gewinnung natürlicher Ressourcen nach wie vor ein wichtiger Bestandteil ländlicher Lebensgrundlagen, der eng mit anderen Strategien zur Sicherung des Lebensunterhalts sowie dem sozioökonomischen Hintergrund der Landbevölkerung in Südostasien zusammenhängt. Die Ergebnisse dieser Arbeit tragen zu einem besseren Verständnis bei, wie der Schutz natürlicher Ressourcen und die ländliche Entwicklung gleichzeitig bewältigt werden können. Vor allem ärmere Menschen sind von natürlichen

Ressourcen abhängig, da ihre Möglichkeiten im Hinblick auf profitablere Alternativen begrenzt sind. Daher muss der Zugang zu ländlichen Arbeitsmärkten und zu Bildung insbesondere für die am meisten benachteiligten Menschen verbessert werden. Zusätzlich ist ein kollektives und nachhaltiges Management natürlicher Ressourcen mit klaren und durchgesetzten Zugangsrechten erforderlich.

Stichworte: Gewinnung natürlicher Ressourcen; Migration; Landwirtschaft; Nachhaltige ländliche Lebensgrundlagen; Ethnische Ungleichheit; Covid-19; Südostasien

Abstract

Climate change, natural resource degradation, and poverty remain pressing issues that have to be solved simultaneously. In the last decades, Southeast Asia experienced rapid economic growth which contributed to strong poverty reduction. However, the improvements are unequally distributed between rural and urban areas. While people in urban areas can participate in globalization and economic growth, many rural areas are still left behind. Shocks – including climate-related shocks – act like a vicious cycle and make poor rural households who heavily depend on natural resources even more vulnerable. Climate change and the associated extreme weather events cause damage to property, crops, production facilities, and infrastructure which increases poverty and inequality. The degradation of natural resources jeopardizes the provision of important ecosystem services. For instance, rural people extract natural products such as timber, fish, and wild fruits for subsistence and for sale. Natural resource extraction functions as a safety net in times of crisis, maintains current consumption of rural households, and reduces income inequality. This might be important as the rural population is not homogenous, and ethnic minorities, e.g. in Vietnam, are even poorer than the ethnic majority. Although farming and natural resource extraction are main livelihood strategies, rural households aim at further diversifying their livelihoods: They engage in off-farm employment or self-employment, and some even seek for opportunities in the cities in order to send money back home.

Nevertheless, rural households still depend on natural resource extraction for their livelihoods. Additionally, their extraction behavior contributes to the conservation or degradation of resources which in turn has an impact on climate since an intact ecosystem stores carbon. Therefore, the aim of this thesis is to deepen the understanding of natural resource extraction as an important livelihood strategy for rural households in Southeast Asia. The more concrete objectives are to investigate (i.) the impact of remittances on environmental income, (ii.) the interrelationship between farming efficiency and environmental resource dependence, (iii.) the importance of natural resource extraction for ethnic inequality, and (iv.) the role of extraction in the context of Covid-19. To answer these questions, the thesis presents four research papers with each of them taking a closer look at a specific aspect of extraction.

All papers use data from the Thailand Vietnam Socio Economic Panel (TVSEP). The household and village head surveys include rural parts of the three provinces Nakhon Phanom, Buriram, and Ubon Ratchathani in Thailand as well as the three provinces Ha Tinh, Thua Thien Hue, and

Dak Lak in Vietnam. These provinces are close to the border with Laos or Cambodia and they are characterized by low average per capita income, high agricultural dependence, and poor infrastructure. The overarching conceptual approach for the thesis is based on the Sustainable Livelihoods Framework which allows to examine how rural households choose their livelihood strategies and how these choices are interconnected. According to the framework, the capital endowment – also referred to as livelihood platforms – of households is crucial for this complex and dynamic decision-making process. The combination of livelihood platforms enables different livelihood strategies which further result in various livelihood outcomes, such as sustainable use of natural resources or reduced poverty.

Chapter 1 establishes the overall research objective of the thesis and provides an overview of the following chapters. Chapter 2 presents a paper about the interrelationship between natural resource extraction and migration. Household members migrate to urban areas in order to work and send remittances back home. Although labor migration shifts the available labor capacity out of the household, it generates additional income. Natural resources extraction is also affected by this labor migration: By looking at the Vietnamese dataset from 2013, 2016, and 2017, the paper suggests that asset-poor households reduce their environmental income if they have working migrants, while asset-rich households increase their environmental income. The reason is that poorer households rely more on labor-intensive extraction activities. Due to the reduced labor capacity, they extract fewer natural resources. Particularly for the poor, it is important to improve the access to alternative income sources that provide higher returns. Richer households, on the contrary, depend more on capital-intensive extraction activities, implying that additional income is used as an investment to further increase extraction. Hence, good management of natural resources and enforcement of access regulations are necessary.

Chapter 3 analyzes the impact of farming efficiency on environmental resource dependence. Farming and natural resource extraction belong to the most important livelihood strategies of rural households. Since they need similar input factors with respect to e.g. equipment, it is likely that they influence each other. For the analysis, the paper refers to environmental resource dependence instead of environmental income because it has been shown that especially poor people are environmentally dependent. In this regard, the Environmental Resource Dependence Index (ERDI) is proposed as a multidimensional approach to better measure dependence. The paper uses data from the three Vietnamese provinces for 2013, 2016, and 2017. The results from the econometric analysis show that higher farming efficiency reduces the dependence on

environmental resources and thus, also the pressure on the natural resource base. Therefore, supporting farmers to improve their efficiency is necessary to reduce dependence and extraction concerning natural resources.

Chapter 4 contains a paper that tackles the impact of natural resource extraction on ethnic inequality in the Vietnamese province of Dak Lak. Because of language and cultural barriers, traditional life in geographically remote regions, and (past) discrimination, ethnic minorities are still disadvantaged with respect to education, employment, health care, and access to capital markets. Hence, they are more reliant on natural resources as their access to alternative and more profitable livelihood strategies is limited. However, the analysis of data from 2010, 2013, and 2016 suggests that environmental income reduces income inequality especially among ethnic minorities. Furthermore, the paper finds that differences in extraction are due to distinct group characteristics and returns to these characteristics, implying a structural component that contributes to ethnic differences. Additionally, natural resource extraction sustains the consumption of ethnic minorities since the consumption of extracting minority households would decrease if they would stop to extract. This points at the lower shock-coping capacity of minorities that has to be enhanced. Preserving and improving the natural resource base is needed to contribute to a reduction in ethnic income inequality as well as to household welfare – especially of ethnic minorities.

Chapter 5 presents a paper about the importance of different livelihood strategies during the Covid-19 pandemic. With the onset of the pandemic, it was hypothesized that more extraction will take place because the interruption of global value chains reaches even rural areas of low- and middle-income countries, e.g. because agricultural input factors are not available. However, the analysis of the Thai dataset from 2020 and 2022 does not completely support this presumption. The paper finds that the economic impact of the pandemic is generally short-term. In addition, households that pursue livelihood strategies that are more involved in global value chains such as off-farm employment or non-farm self-employment are more exposed. On the contrary, households that mainly engage in small-scale and subsistence farming are less affected. Since the latter households are also those that draw on extraction in times of crises, Covid-19 had only a small impact on extraction. Nevertheless, livelihood diversification remains essential for all rural households as different types of shocks have varying consequences depending on household characteristics and livelihood strategies. In addition, the

proper identification of those in need is essential for targeted and sustained policy interventions during future crises.

Overall, natural resource extraction is still an important component of rural livelihoods that is closely interrelated with other livelihood strategies and the socio-economic background of rural people in Southeast Asia. The findings of this thesis contribute to a better understanding of how natural resource conservation and rural development can be tackled simultaneously. Especially poor people are dependent on natural resources since their access to more profitable alternatives is limited. Thus, the access to rural labor markets and education has to be improved especially for the most disadvantaged people. Additionally, a collective and sustainable natural resource management with clear and enforced access rights is needed.

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List of Abbreviations

ADB	Asian Development Bank
Covid-19	Corona Virus Disease 19
CO_2	Carbon dioxide
ERDI	Environmental Resource Dependence Index
FAO	Food and Agriculture Organization
IPCC	Intergovernmental Panel on Climate Change
Log	Natural logarithm
mRNA	Messenger ribonucleic acid
No.	Number of observations
SE	Standard errors
THB	Thai Baht
TVSEP	Thailand Vietnam Socio Economic Panel
UN	United Nations
USA	United States of America
VIF	Variance inflation factor

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Chapter 1

Introduction

1.1 Problem statement and research motivation

Simultaneously addressing climate change, natural resource degradation, and poverty is the pressing problem of this century (Ananta et al., 2014; Barbier & Hochard, 2018; Winsemius et al., 2018). Climate has always been in change, but the speed of the current temperature increase is unprecedented in Earth's history (Fischer et al., 2018). Human activities that continue to emit large amounts of greenhouse gases, such as CO_2, into the atmosphere are mainly responsible for climate change (IPCC, 2022). The marine and terrestrial ecosystems make an important contribution to carbon sequestration (Boyd et al., 2019; IPCC, 2022). However, these ecosystems are at risk or even completely degraded. For instance, forests are still being cut down for e.g. agricultural activities (Hübler, 2017; Leblois et al., 2017; Schielein & Börner, 2018). At the same time, forests comprise most of the terrestrial biodiversity and provide important ecosystem services, such as protection against erosion or water regulation (FAO, 2022).

The consequences of natural resource degradation and climate change are manifold and range from general global warming to rising sea level and extreme weather events, such as storms, floods, and heat waves. Not only the environment, but also people and their livelihoods suffer severe damage to property, crops, production facilities, and infrastructure, resulting in economic losses (UN, 2019; Winsemius et al., 2018). According to the Global Climate Risk Index, Southeast Asia belongs to the regions that are most affected by climate change because of long coastal stretches and the geographical location in the tropical cyclone belt (Eckstein et al., 2021; Raktham et al., 2015). Simultaneously, this region encompasses a large part of tropical rainforest which is important as a carbon sink in the presence of climate change (Mitchard, 2018).

Despite strong poverty reduction in recent decades, there is still a high level of poverty and inequality in many low- and middle-income countries which was reinforced by the setback due to Covid-19 (UN, 2022; World Bank, 2022). The proportion of people living below the poverty line also declined in Southeast Asia, even though rural-urban differences remain (ADB, 2022). In this regard, rural poverty differs from urban poverty (FAO, 2021). Although rural people diversify their livelihoods by engaging in off-farm or self-employment, the returns to these activities is often constrained because of insufficient infrastructure and poor access to markets. Therefore, rural households tend to send working migrants into the urban areas in order to receive remittances (L. D. Nguyen et al., 2015). By diversifying their livelihoods, they participate increasingly in the global market and become vulnerable to global shocks (Waibel et al., 2020). Those who stay in the rural areas mainly pursue livelihood strategies based on natural resources, such as farming and natural resource extraction (Ananta et al., 2014; Barbier & Hochard, 2018). The main difference between these two livelihood strategies is that agricultural activities refer to cultivated sources, e.g. cropland, cultivated forests, or aquaculture, while natural resource extraction refers to uncultivated sources, such as timber from a natural forest or fish from a lake (Angelsen et al., 2014). The reliance on natural resources makes rural people particularly vulnerable to climate change and natural resource degradation, further exacerbating poverty (T. T. Nguyen et al., 2020). However, previous research argues that natural resource extraction functions as a safety net to cope with shocks (Wunder et al., 2014), maintains current consumption (Angelsen et al., 2014), and even reduces income inequality (López-Feldman, 2014; Nguyen et al., 2018a). This might be relevant as the rural population is not homogenous. For instance, ethnic minorities in Vietnam are still poorer than the ethnic majority.

Therefore, a deeper understanding of natural resource extraction appears to be central for the reduction of rural poverty and inequality as well as for the sustainable use of natural resources at the local level. This thesis contributes to the existing literature by investigating

    i.   the impact of remittances on environmental income,

   ii.   the interrelationship between farming efficiency and environmental resource dependence,

  iii.   the importance of natural resource extraction for ethnic inequality, and

  iv.   the role of extraction in the context of Covid-19.

The thesis is based on four essays that all use data from the Thailand Vietnam Socio Economic Panel (TVSEP). This long-term project creates a database for better analyzing income and poverty dynamics in rural parts of these two emerging economies. The sample covers almost 4,400 households from the three rural provinces Nakhon Phanom, Buriram, and Ubon Ratchathani in Thailand as well as from the three rural provinces Ha Tinh, Thua Thien Hue, and Dak Lak in Vietnam. Due to a stratified random sampling, the sample can be considered as representative for the rural poor areas in Thailand and Vietnam (Hardeweg et al., 2013). The wide range of topics included in the household and village head questionnaires allows for a comprehensive analysis of rural livelihoods. Hence, the dataset enables a closer look at the importance of natural resource extraction and its relationship to other livelihood strategies as well as to household welfare.

The thesis is structured as follows: Chapter 1 motivates the overall research questions, introduces the Sustainable Livelihoods Framework as the conceptual approach, and summarizes the main results of the subsequent chapters. Each of the following chapters (Chapter 2 to 5) contains an individual paper with research motivation, literature review, data and methodology, results and discussion as well as an own conclusion.

1.2 Sustainable Livelihoods Framework for analyzing natural resource extraction

The decision on livelihood strategies is essential in the context of rural development and natural resource management. The Sustainable Livelihoods Framework (Ashley & Carney, 1999; Scoones, 1998) allows to investigate this complex and dynamic decision-making process of rural households. Livelihoods include the capabilities, assets, and activities that are needed to pursue certain means of living (Chambers & Conway, 1992). For long-lasting well-being, the livelihoods must be sustainable, i.e. they have to be independent from major external support, resilient to shocks, and harmonized with other people's livelihoods and the environment (Ashley & Carney, 1999).

Figure 1.1 illustrates how the combination of livelihood platforms enables different livelihood strategies resulting in a number of livelihood outcomes. This process takes place in an institutional and structural context that includes for example local, national, and international policies. The livelihood platforms form the basis for any livelihood strategy choice. They include tangible and intangible assets, such as natural capital (natural resource stocks and

ecosystem services), human capital (e.g. education, health, ethnic background), physical capital (e.g. vehicles, equipment), financial capital (e.g. savings, credits), and social capital (e.g. social networks, associations). In the context of rural livelihoods, natural capital is of particular importance (Ellis, 2000; Scoones, 1998). As a rule, it is a common good, while the other four types of capital can be assigned to concrete households (Angelsen et al., 2014; T. T. Nguyen et al., 2015). By combining these different livelihood platforms, households can pursue certain livelihood strategies, such as natural resource extraction, farming, non-farm self-employment, off-farm employment, and migration. Some households tend to focus on specific livelihood strategies, while others seek diversification. The chosen livelihood strategies as well as their combinations cause livelihood outcomes, such as sustainable natural resource use, reduced poverty, more consumption, or a higher shock-coping capacity. To put the Sustainable Livelihoods Framework into practice, it is necessary to take into account the vulnerability that arises, in particular, from shocks that affect livelihoods at multiple stages.

Institutional and structural context

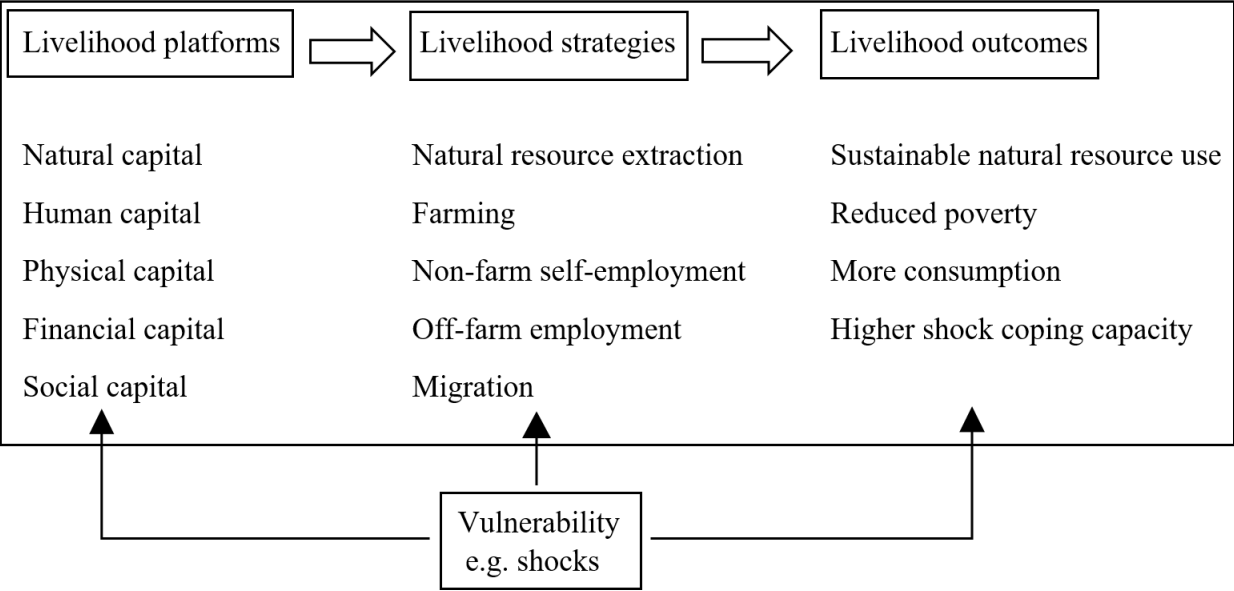| Livelihood platforms		Livelihood strategies		Livelihood outcomes
Natural capital		Natural resource extraction		Sustainable natural resource use
Human capital		Farming		Reduced poverty
Physical capital		Non-farm self-employment		More consumption
Financial capital		Off-farm employment		Higher shock coping capacity
Social capital		Migration		

Vulnerability e.g. shocks

Figure 1.1 Sustainable Livelihoods Framework
(based on Ashley & Carney (1999), Ellis (2000), and Scoones (1998))

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1.3 Brief summary of chapters and author's contribution

The Sustainable Livelihoods Framework facilitates the impact analysis of natural resource extraction on rural households and the interconnectedness of extraction with other livelihood strategies. In this regard, the thesis consists of four research papers that address different aspects of the framework. Each of the following chapters includes one of these papers. Table 1.1 provides an overview of papers, including publication status and conferences where the papers have been presented. The contribution of the author is outlined under the table.

Chapter 2 tackles the interrelationship between natural resource extraction and migration in rural Vietnam in 2013, 2016, and 2017. The research questions are as follows:

1. How important are environmental income and remittances for rural households?
2. What are the factors that impact the decision of migrants to send remittances home and the amount of remittances?
3. How do remittances impact natural resource extraction?

The paper uses a Heckman model in order to identify the determinants affecting the decision to send remittances and the amount of these remittances. Furthermore, a fixed effects two-stage least squares analysis and a quantile regression are conducted to investigate the factors that impact environmental income as well as the distribution of these effects by asset quartiles. Thereby, remittances appear to have a different impact on environmental income depending on the household's asset value. Asset-poor households rely more on labor-intensive extraction activities, such as collecting firewood. Therefore, remittances and the labor loss associated with migration lead to lower environmental income for asset-poor households. However, asset-rich households are more likely to engage in capital-intensive extraction activities, such as cutting down trees. Therefore, remittances increase their extraction. Although natural resource extraction and migration are found to be important livelihood strategies of rural people (Angelsen et al., 2014; T. T. Nguyen et al., 2015), the existing literature is scarce (López-Feldman & Chávez, 2017). The paper provides a theoretical and empirical explanation of this interrelationship by additionally solving the endogeneity problem of migration and remittances. The findings improve the understanding of how natural resource conservation and rural development can be encouraged simultaneously. Particularly for the poor it is important to improve the access to alternative income sources that provide higher returns. At the same time,

a good management of resources and enforcement of access regulations is necessary to prevent over-extraction of richer households.

Chapter 3 analyzes the interrelationship between farming efficiency and environmental resource dependence in rural Vietnam in 2013, 2016, and 2017. Additionally, the paper proposes a new measure of dependence, called Environmental Resource Dependence Index (ERDI). The research questions are:

1. What are the determinants affecting farming efficiency and environmental resource dependence?
2. How are farming efficiency and environmental resource dependence interrelated?

Farming efficiency is estimated with a true random effects stochastic frontier model with Mundlak's adjustment in order to eliminate potential endogeneity. For environmental resource dependence, the paper proposes the ERDI to better capture the multidimensionality of dependence. Previously, resource dependence was measured in monetary terms (Nerfa et al., 2020; Nielsen et al., 2012). However, this is not adequate with respect to poor people who rather consume than sell their environmental products. Our analysis reveals that with the usual monetary measure the extent of dependence is underestimated. The determinants of farming efficiency and environmental resource dependence as well as their interrelationship are investigated with a simultaneous equations model. The findings reveal that improved farming efficiency reduces the dependence on environmental resources, i.e. the pressure on the resource base decreases with higher efficiency. Therefore, improving farming efficiency is necessary to reduce dependence and extraction concerning natural resources. The paper expands the research on the relationship between agriculture and extraction by focusing on environmental resource dependence instead of environmental income (Illukpitiya & Yanagida, 2010; Nguyen et al., 2018b). Especially poor people are dependent on natural resources since their access to other livelihood strategies is limited (Nguyen et al., 2018a). In this regard, the paper emphasizes the insufficient targeting of environmentally dependent people.

Chapter 4 considers the importance of natural resource extraction for ethnic inequality in the Vietnamese province Dak Lak in 2010, 2013, and 2016. Referring to the Sustainable Livelihoods Framework, the paper links social capital, namely ethnicity, with natural capital and the corresponding extraction. The research questions are as follows:

1. How does environmental income contribute to reducing ethnic income inequality in Vietnam?
2. What are the socio-economic drivers of differences in natural resource extraction between majority and minority ethnic groups?
3. What are the effects of natural resource extraction on household consumption of majority and minority ethnic groups?

The calculation of Gini-coefficients shows that environmental income reduces income inequality, especially among ethnic minority households. In addition, the results from an Oaxaca-Blinder decomposition suggest that differences in extraction are mainly because of differences in group characteristics between majority and minority. However, there is also a structural component of ethnic inequality. Endogenous switching regressions and treatment effects indicate that natural resource extraction supports in particular the consumption of minorities since the consumption of extracting minority households would decrease if they would stop to extract. For extracting majority households, however, consumption would even increase if they would quit the extraction activity. There is already a body of literature about ethnic inequality in Vietnam (T.-T. Nguyen et al., 2020; Van de Walle & Gunewardena, 2001; Vo et al., 2021) as well as the importance of extraction in the context of inequality reduction and welfare (Kabubo-Mariara, 2013; López-Feldman, 2014; Nguyen et al., 2018a), but so far there is no research that looks at the importance of extraction for ethnic inequality and welfare in rural Vietnam. In this regard, the paper sheds light on the potentials and constraints of extraction for ethnic minorities. It suggests that – apart from a better shock-coping capacity – preserving and improving the natural base is particularly necessary for ethnic minority households with respect to ethnic inequality reduction and welfare.

Chapter 5 stresses the function of different livelihood strategies such as natural resource extraction during the profound crisis of Covid-19. By looking at data from 2020 and 2022 collected in rural Thailand, the following research questions are examined:

1. What is the impact of Covid-19 on the livelihoods of rural households in Thailand?
2. What are the determinants that increase the likelihood for adverse financial effects on households?
3. What implications for future crises can be drawn regarding household's resilience and policy interventions?

The findings suggest mainly short-term livelihood disruptions in the initial phase of the pandemic. Furthermore, rural households that are more involved in global value chains are more likely to be negatively affected. With the onset of the pandemic, it was expected that rural households would increase their extraction activities (Waibel et al., 2020). However, the findings of the paper do not fully support this presumption. Since Covid-19 differs from other kinds of shocks such as natural disasters or illnesses, it has only small effects on small-scale and subsistence farmers who are those that are generally more familiar with extraction. This implies that extraction might be still relevant with respect to other shocks. Additionally, the paper argues that livelihood diversification remains essential. It contributes to the literature by using panel data and examining longer-term effects of the pandemic in a rural setting of an emerging economy (Bundervoet et al., 2022; World Bank, 2020). In addition, it looks at the contribution of extraction during the pandemic and takes into account that different kinds of shocks have unequal impacts depending on household characteristics and livelihood strategies. Thereby, the paper calls for targeted and sustained policy interventions that identify those in need by considering the kind of shock.

On the whole, natural resource extraction is still an important component of rural livelihoods in low- and middle-income countries. It sustains consumption and reduces inequalities. At the same time, it is closely interrelated with other livelihood strategies and the socio-economic conditions. The findings of this thesis support the claim for encouraging the access to rural labor markets and education, especially for the most disadvantaged people. Poor rural households are not the main drivers of natural resource degradation, but they can play a role in the extensive and lengthy task of restoring the ecosystems. To address the tragedy of the commons and apart from institutional responsibility, a possible solution is to enforce a collective and sustainable natural resource management. This should include clearly defined boundaries of groups and common pool resources, congruence between rules and local conditions, joint decision-making, efficient monitoring, sanctions based on the offence, conflict-resolution mechanism as well as governmental recognition about the common pool institution (Ostrom, 1990). Moreover, in preparation for future shocks and global crises, it is required to apply sustained policy interventions that target those most in need.

Table 1.1 Overview of papers included in the thesis

Chapter	Title	Authors	Publication status / Presented at
2	Environmental income and remittances: Evidence from rural central highlands of Vietnam	Sina Bierkamp, Trung Thanh Nguyen, Ulrike Grote	Published in: *Ecological Economics* 2021, 179, 106830. Presented at: 6th Mahidol Migration Center Conference, Mahidol University, Bangkok, December 1-2, 2022.
3	Farming efficiency and environmental resource dependence: Evidence from panel data for rural Central Vietnam	Sina Bierkamp, Trung Thanh Nguyen, Ulrike Grote	Published in: *Australian Journal of Agricultural and Resource Economics* 2023, 1-23. Presented at: International TVSEP Conference on "Shocks and resilience in rural Southeast Asia", Göttingen, May 23-24, 2022. German Development Economics Conference, Verein für Socialpolitik, Stuttgart-Hohenheim, June 2-10, 2022.
4	Natural resource extraction and ethnic inequality in Dak Lak, Vietnam	Sina Bierkamp, Trung Thanh Nguyen, Ulrike Grote	Published in: *Economics of Development and Environment* 2023, 1-21.
5	Rural livelihoods in Thailand after two years of Covid-19	Niels Wendt, Sina Bierkamp	Submitted to: *Journal of Rural Studies*

Note on author's contribution: Chapter 2 was developed by the author together with Trung Thanh Nguyen. The author analyzed the data, reviewed the literature, and wrote the paper with advices from Trung Thanh Nguyen and Ulrike Grote throughout the process. For Chapter 3 and 4, the author did the conceptualization, literature review, data analysis, and writing with suggestions from Trung Thanh Nguyen and Ulrike Grote. Chapter 5 is a joint work with Niels Wendt with equal contributions.

References

ADB (2022). Key Indicators for Asia and the Pacific 2022. Asian Development Bank. Manila, Philippines.

Ananta, A., Bauer, A., & Thant, M. (2014). A new triple-win option for the environment of the poor. In: Ananta, A., Bauer, A., & Thant, M. (eds.): The environments of the poor in Southeast Asia, East Asia, and the Pacific (pp. 3–12). Institute of Southeast Asian Studies. Singapore.

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S., Börner, J., Smith-Hall, C., & Wunder, S. (2014). Environmental Income and Rural Livelihoods: A Global-Comparative Analysis. *World Development*, *64*, S12–S28.

Ashley, C., & Carney, D. (1999). Sustainable livelihoods: Lessons from early experience. Department for International Development. London, United Kingdom.

Barbier, E. B., & Hochard, J. P. (2018). Land degradation and poverty. *Nature Sustainability*, *1*(11), 623–631.

Boyd, P. W., Claustre, H., Levy, M., Siegel, D. A., & Weber, T. (2019). Multi-faceted particle pumps drive carbon sequestration in the ocean. *Nature*, *568*(7752), 327–335.

Bundervoet, T., Dávalos, M. E., & Garcia, N. (2022). The short-term impacts of COVID-19 on households in developing countries: An overview based on a harmonized dataset of high-frequency surveys. *World Development*, *153*, 105844.

Chambers, R., & Conway, G. (1992). Sustainable rural livelihoods: Practical concepts for the 21st century. *Institute of Development Studies Discussion Paper, 296*. Brighton, United Kingdom.

Eckstein, D., Künzel, V., & Schäfer, L. (2021). Global Climate Risk Index 2021. Who suffers Most from Extreme Weather Events? Weather-related Loss Events in 2019 and 2000 to 2019. Germanwatch. Bonn, Germany.

Ellis, F. (2000). Rural livelihoods and diversity in developing countries. Oxford University Press. Oxford, United Kingdom.

FAO (2021). Rural poverty analysis. Food and Agriculture Organization. Rome, Italy.

FAO (2022). The State of the World's Forests 2022. Food and Agriculture Organization. Rome, Italy.

Fischer, H., Meissner, K. J., Mix, A. C., Abram, N. J., Austermann, J., Brovkin, V., Capron, E., Colombaroli, D., Daniau, A.-L., Dyez, K. A., Felis, T., Finkelstein, S. A., Jaccard, S. L., McClymont, E. L., Rovere, A., Sutter, J., Wolff, E. W., Affolter, S., Bakker, P., … Zhou, L. (2018). Palaeoclimate constraints on the impact of 2 °C anthropogenic warming and beyond. *Nature Geoscience*, *11*(7), 474–485.

Hardeweg, B., Klasen, S., & Waibel, H. (2013). Establishing a database for vulnerability assessment. In: Klasen, S., & Waibel, H. (eds): Vulnerability to Poverty: Theory, Measurement and Determinants, with Case Studies from Thailand and Vietnam (pp. 50–79). Palgrave Macmillan. London, United Kingdom.

Hübler, M. (2017). How to curb poverty-related deforestation? *Applied Economics Letters*, *24*(6), 374–380.

Illukpitiya, P., & Yanagida, J. F. (2010). Farming vs forests: Trade-off between agriculture and the extraction of non-timber forest products. *Ecological Economics*, *69*(10), 1952–1963.

IPCC (2022). Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change. Geneva, Switzerland.

Kabubo-Mariara, J. (2013). Forest-poverty nexus: Exploring the contribution of forests to rural livelihoods in Kenya. *Natural Resources Forum*, *37*(3), 177–188.

Leblois, A., Damette, O., & Wolfersberger, J. (2017). What has Driven Deforestation in Developing Countries Since the 2000s? Evidence from New Remote-Sensing Data. *World Development*, *92*, 82–102.

López-Feldman, A. (2014). Shocks, Income and Wealth: Do They Affect the Extraction of Natural Resources by Rural Households? *World Development*, *64*, S91–S100.

López-Feldman, A., & Chávez, E. (2017). Remittances and Natural Resource Extraction: Evidence from Mexico. *Ecological Economics*, *132*, 69–79.

Mitchard, E. T. A. (2018). The tropical forest carbon cycle and climate change. *Nature*, *559*(7715), 527–534.

Nerfa, L., Rhemtulla, J. M., & Zerriffi, H. (2020). Forest dependence is more than forest income: Development of a new index of forest product collection and livelihood resources. *World Development*, *125*, 104689.

Nguyen, L. D., Raabe, K., & Grote, U. (2015). Rural–Urban Migration, Household Vulnerability, and Welfare in Vietnam. *World Development*, *71*, 79–93.

Nguyen, T. T., Do, T. L., Bühler, D., Hartje, R., & Grote, U. (2015). Rural livelihoods and environmental resource dependence in Cambodia. *Ecological Economics*, *120*, 282–295.

Nguyen, T. T., Do, T. L., & Grote, U. (2018a). Natural resource extraction and household welfare in rural Laos. *Land Degradation & Development*, *29*(9), 3029–3038.

Nguyen, T. T., Do, T. L., Parvathi, P., Wossink, A., & Grote, U. (2018b). Farm production efficiency and natural forest extraction: Evidence from Cambodia. *Land Use Policy*, *71*, 480–493.

Nguyen, T. T., Nguyen, T.-T., Le, V.-H., Managi, S., & Grote, U. (2020). Reported weather shocks and rural household welfare: Evidence from panel data in Northeast Thailand and Central Vietnam. *Weather and Climate Extremes*, *30*, 100286.

Nguyen, T.-T., Nguyen, T. T., & Grote, U. (2020). Credit and Ethnic Consumption Inequality in the Central Highlands of Vietnam. *Social Indicators Research*, *148*(1), 143–172.

Nielsen, M. R., Pouliot, M., & Kim Bakkegaard, R. (2012). Combining income and assets measures to include the transitory nature of poverty in assessments of forest dependence: Evidence from the Democratic Republic of Congo. *Ecological Economics*, *78*, 37–46.

Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action (1st ed.). Cambridge University Press. Cambridge, United Kingdom.

Raktham, C., Bruyère, C., Kreasuwun, J., Done, J., Thongbai, C., & Promnopas, W. (2015). Simulation sensitivities of the major weather regimes of the Southeast Asia region. *Climate Dynamics*, *44*(5–6), 1403–1417.

Schielein, J., & Börner, J. (2018). Recent transformations of land-use and land-cover dynamics across different deforestation frontiers in the Brazilian Amazon. *Land Use Policy*, *76*, 81–94.

Scoones, I. (1998). Sustainable rural livelihoods: A framework for analysis. *Institute of Development Studies Working Paper, 72*. Brighton, United Kingdom.

UN (2019). Climate action and support trends. United Nations Climate Change Secretariat. Bonn, Germany.

UN (2022). The Sustainable Development Goals Report 2022. United Nations. New York City, USA.

Van de Walle, D., & Gunewardena, D. (2001). Sources of ethnic inequality in Viet Nam. *Journal of Development Economics*, *65*(1), 177–207.

Vo, D., Van, L. T.-H., Tran, D. B., Vu, T. N., & Ho, C. M. (2021). The Determinants of Gender Income Inequality in Vietnam: A Longitudinal Data Analysis. *Emerging Markets Finance and Trade*, *57*(1), 198–222.

Waibel, H., Grote, U., Min, S., Nguyen, T. T., & Praneetvatakul, S. (2020). COVID-19 in the Greater Mekong Subregion: How resilient are rural households? *Food Security*, *12*(4), 779–782.

Winsemius, H. C., Jongman, B., Veldkamp, T. I. E., Hallegatte, S., Bangalore, M., & Ward, P. J. (2018). Disaster risk, climate change, and poverty: Assessing the global exposure of poor people to floods and droughts. *Environment and Development Economics*, *23*(3), 328–348.

World Bank (2020). Poverty and Distributional Impacts of COVID-19: Potential Channels of Impact and Mitigating Policies. World Bank. Washington, D.C., USA.

World Bank (2022). Poverty and Shared Prosperity 2022: Correcting Course. World Bank. Washington, D.C., USA.

Wunder, S., Börner, J., Shively, G., & Wyman, M. (2014). Safety Nets, Gap Filling and Forests: A Global-Comparative Perspective. *World Development*, *64*, S29–S42.

Chapter 2

Environmental income and remittances: Evidence from rural central highlands of Vietnam

This chapter is published as:

Chapter 3

Farming efficiency and environmental resource dependence: Evidence from panel data for rural Central Vietnam

This chapter is published as:

Chapter 4

Natural resource extraction and ethnic inequality in Dak Lak, Vietnam

This chapter is published as:

Chapter 5

Rural livelihoods in Thailand after two years of Covid-19

This chapter is submitted to:

Journal of Rural Studies

Abstract

The Covid-19 pandemic was expected to have profound and long-lasting negative effects on livelihoods in low- and middle-income countries. We test this claim by analyzing the impact of Covid-19 on rural households in Thailand two years after the outbreak of the pandemic. Hereby, we use a long-term dataset from three provinces. By conducting descriptive analyses, we investigate how severely households are impacted. Additionally, applying a binary logistic regression, we identify which livelihood strategies are most likely to be affected. From the results, we assess whether the policy interventions adequately supported and reached those most in need. Our data indicate primarily short-term disruptions in the initial phase of the pandemic. Furthermore, the findings emphasize that households that are involved in global value chains through domestic markets tend to be more negatively affected. To cope with other types of shocks, livelihood diversification remains important. In preparation for future global crises, it is required to find ways to implement sustained and targeted policy interventions that reach the people most in need.

Keywords: Covid-19; Rural livelihoods; Resilience; Binary logistic regression; Thailand

5.1 Introduction

The Covid-19 pandemic evoked an unprecedented global crisis with far-reaching implications for health, economies, and societies (Bundervoet et al., 2022; Pokhrel & Chhetri, 2021; Workie et al., 2020). In a globalized world, it is likely that such crises will occur more frequently and with increased severity in the future (Rasul, 2021; Workie et al., 2020). The pandemic has exposed the weaknesses of economic and social systems (Dandekar & Ghai, 2020; Rasul, 2021). Poverty and inequality increased, particularly in low- and middle-income countries (Dandekar & Ghai, 2020; Workie et al., 2020; World Bank, 2020a). According to early studies, the pandemic impacted rural livelihoods, with many households experiencing a loss of income (Bhagat et al., 2020; Bundervoet et al., 2022; Nolte et al., 2022). Due to global value chains, a variety of economic sectors are affected, including farming which is still the most important component of rural livelihood strategies (Nolte et al., 2022; Rasul, 2021; Workie et al., 2020). At the same time, many households have diversified their livelihoods by engaging in off-farm employment and non-farm self-employment in recent years (Dedehouanou et al., 2018; Waibel et al., 2020; Zhang et al., 2018). However, these income sources are most affected by Covid-19 (Bundervoet et al., 2022). In the short-term, the pandemic led to a decline in household consumption due to lower purchasing power and preventive measures (Chen et al., 2021; Turner et al., 2021; Workie et al., 2020). In addition, school closures and shortcomings in health systems can lead to long-lasting effects (Pokhrel & Chhetri, 2021; World Bank, 2020a).

The severity and extent of negative impacts from Covid-19 vary among countries and regions depending on policy, resilience, and capacity. Especially financial resources, but also social and state support, determine how successfully households cope with the crisis (Barrett & Constas, 2014; Laborde et al., 2020; Marome & Shaw, 2021). Additionally, households in low- and middle-income countries are already experiencing a variety of shocks, such as natural disasters (Waibel et al., 2020).

In recent decades, Thailand has rapidly evolved from a low-income to an upper middle-income country (Lin & Liang, 2019; World Bank, 2020b). Rural Thai households increasingly diversify their livelihoods and fewer people rely solely on subsistence farming (Nguyen et al., 2017). However, the disparities between rural and urban areas remain prevalent and rural households frequently send working migrants to the urbanized regions (World Bank, 2020b). Even within cities, migrants experience poverty and inequality which is likely to increase due to Covid-19

(Bundervoet et al., 2022; World Bank, 2020b). During the pandemic, the Thai government took extensive measures to prevent the spread of the virus and to avert the negative impact of Covid-19 on the population (Marome & Shaw, 2021). These measures encompass both financial support and restrictions.

The aims of this study are to (1) investigate how severely are households in rural Thailand affected by Covid-19 during the two years after the onset of the pandemic. (2) Based on the Sustainable Livelihoods Framework (Ashley & Carney, 1999; Scoones, 1998), we analyze which livelihood platforms and strategies are most likely to be affected. (3) Consequently, we assess whether the implemented policy interventions adequately supported and reached those most in need. The first objective will be analyzed descriptively, the second draws on a binary logistic regression model, and the third combines the results of both methods.

This study contributes to the research on the effects of the pandemic in low- and middle-income countries, using the example of rural Thailand. Although most Covid-19 studies provide useful insights, they are often based on literature reviews or own expertise (Pokhrel & Chhetri, 2021; Waibel et al., 2020; Workie et al., 2020). Empirical studies are mostly limited to closed-ended questions or cover a short period of time only (Bundervoet et al., 2022). Long-term effects of the pandemic are difficult to predict, but panel data, which remain sparse in low- and middle-income countries, can provide useful insights (Klasen & Povel, 2013; World Bank, 2020a). These are of great relevance for future crises since understanding the underlying mechanisms behind the effects of Covid-19 can form the basis for swiftly implemented good governance.

Extending on previous research, we use a comprehensive long-term panel dataset from Thailand, provided by the Thailand Vietnam Socio Economic Panel (TVSEP) project. We rely on the household surveys from July 2019 and May 2022 as well as a Covid-19 special survey conducted in November and December 2020. This dataset covers the period before, during, and after the pandemic and allows for a closer look at different aspects of rural livelihoods as the pandemic unfolded.

The paper is organized as follows: Section 2 reviews the literature on the impact of Covid-19 in rural Thailand and introduces the Sustainable Livelihoods Framework as the basis for the further analysis. Section 3 describes the data and methodology. Section 4 presents and discusses the findings. Section 5 summarizes and provides policy implications.

5.2 Literature review

5.2.1 The impact of Covid-19 on rural Thailand

The first case of the Corona Virus Disease 19 (Covid-19) was discovered at a seafood market in Wuhan, China, in December 2019. The virus is transmitted via droplets and aerosols, with globalization and urbanization facilitating a rapid spread all over the world. The severity and extent of the pandemic in each country also depend on political, climatic, and socio-economic characteristics (Marome & Shaw, 2021; Tantrakarnapa et al., 2022). For instance, societies with a higher proportion of elderly and vulnerable people are more severely affected (Tantrakarnapa et al., 2022). In response, governments enforced a range of similar – yet differently implemented – preventive measures, such as physical distancing, travel restrictions, face masks, school closures, no mass gatherings, and lockdowns (Hale et al., 2021).

In mid-January 2020, the first Covid-19 case outside of China was reported in Thailand. Due to early and cautious measures, Thailand was at first very effective in limiting the spread of the virus (Marome & Shaw, 2021; Tantrakarnapa et al., 2022; Turner et al., 2021). The measures focused on reducing Covid-19 cases, but initially paid little attention to the long-term economic and social costs (Marome & Shaw, 2021; World Bank, 2020a). Thus, according to the expertise of researchers and early-stage data collection, poverty and inequality will increase as the pandemic impacts the main livelihood strategies of many households (Bundervoet et al., 2022; Sapbamrer et al., 2022; Turner et al., 2021; Workie et al., 2020; World Bank, 2020a): In farming, the interruption of global value chains reduced the supply of inputs, such as pesticides and labor. With lower demand for agricultural outputs and less transportation, households may also have limited opportunities to sell their products (Nolte et al., 2022; Sapbamrer et al., 2022; Waibel et al., 2020). Those engaged in off-farm employment like in manufacturing, commerce, and other services were at greater risk to temporarily or permanently stop their work and suffer a loss of income (Bundervoet et al., 2022; Komin et al., 2021). In recent decades, rural households increased their dependence on remittances generated by labor migration (Waibel et al., 2020). With the outbreak of the Covid-19 pandemic, researchers therefore assumed more return migration which puts additional pressure on migrant-sending households (Dandekar & Ghai, 2020; Waibel et al., 2020).

The Thai government provided large-scale aid packages for the population in order to mitigate the negative implications of Covid-19 (Marome & Shaw, 2021; Turner et al., 2021). Nevertheless, households have to adapt their livelihoods. For instance, researchers note that rural households tend to use natural resources as a safety net (Angelsen et al., 2014; Dokken & Angelsen, 2015). However, increasing extraction of already degraded forests, rivers, and lakes additionally strains these environments (Nguyen et al., 2015; Waibel et al., 2020). Further, households may temporarily return to subsistence agriculture as a coping measure (De Janvry & Sadoulet, 2011; Rudolf, 2019). Other strategies are to reduce consumption, sell assets, deplete savings, or borrow money. However, all of these strategies worsen the situation of rural households in the medium- and long-term (Turner et al., 2021; World Bank, 2020a).

5.2.2 Sustainable Livelihoods Framework

The Sustainable Livelihoods Framework, originally developed by Ashley and Carney (1999) as well as Scoones (1998), allows a better understanding of how households in low- and middle-income countries make the decision concerning their livelihoods. According to Chambers and Conway (1992), livelihoods involve the capabilities, assets, and activities that are necessary to sustain certain means of living. Figure 5.1 illustrates how the combination of livelihood platforms enables different livelihood strategies, resulting in various livelihood outcomes. Livelihood platforms include human capital (e.g. education), social capital (e.g. migrant networks), natural capital (e.g. land), financial capital (e.g. savings), as well as physical capital (e.g. assets).
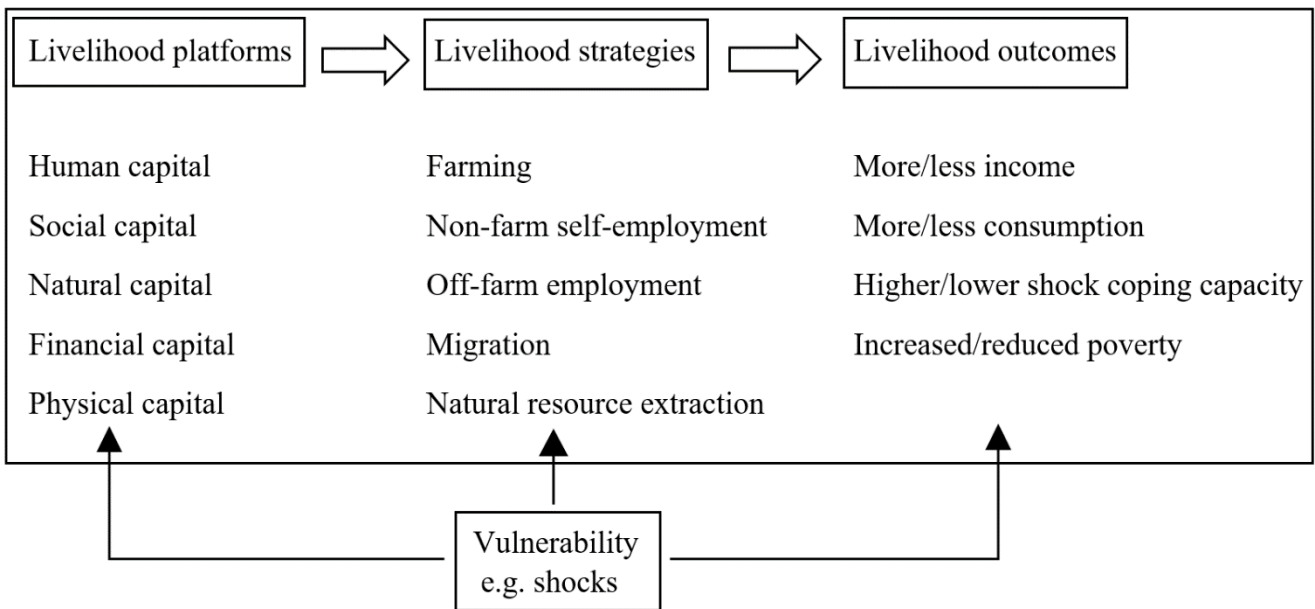
Institutional and structural context

Figure 5.1 Sustainable Livelihoods Framework
(based on Ashley & Carney (1999) and Scoones (1998)).

The Sustainable Livelihoods Framework is characterized by its dynamic nature. Hereby, it accounts for changes that are introduced through shocks and other influencing factors. For instance, if in the short-run income decreases, a household has to reduce consumption or to use savings. However, financial and physical capital is finite because savings, for example, might be depleted the longer a stressor is applied or the more frequently a stressor occurs. In the medium-run, the household might seek alternative livelihood strategies or increase its livelihood diversification. Another main feature of the Sustainable Livelihoods Framework is that it combines the macro-level politics with the micro-level reality of people in low- and middle-income countries. Therefore, the institutional and structural context influences which livelihood strategies and outcomes can be achieved or not. For instance, governmental transfers and borrowing money can help to overcome income shortfalls. However, sustainable livelihoods are characterized by independence from external support, resilience to shocks, and a responsible interaction with other people and the environment.

5.2.3 Impact of Covid-19 on rural livelihoods in Thailand

Covid-19 differs from other types of shocks (Bundervoet et al., 2022; Pokhrel & Chhetri, 2021; Workie et al., 2020). It is not an isolated stressor to a household, but entails multitudinous effects on the global and national economy, trickling down further to rural households.

Following the Sustainable Livelihoods Framework of Figure 5.1, Covid-19 is likely to impact livelihood platforms and livelihood strategies of these rural households. In this context, it has to be highlighted that human beings do not behave rationally, leading to heterogeneous responses to the crisis (Gasiorowska, 2014; Tan et al., 2020). This further has an impact on livelihoods since a household makes different decisions if it subjectively perceives a crisis as more severe than it is objectively. Nevertheless, Covid-19 has the potential to affect all livelihood strategies the households have, be it through fluctuations in the availability of agricultural input factors, unemployment, or lack of demand for household businesses (Laborde et al., 2021, 2020; Swinnen & McDermott, 2020; Waibel et al., 2020; World Bank, 2020b). Some of these effects will reach the households with a time lag, for instance remittance transfers. Additionally, Covid-19 can directly affect livelihood outcomes, by e.g. draining funds to maintain consumption. To cushion the negative effects of the pandemic, governments in Thailand and all over the world implemented preventive and supportive measures (Fajardo-Gonzalez et al., 2021; Hale et al., 2021; Marome & Shaw, 2021).

Following the literature, our study hence focuses on the following research questions: (1) How severely are households in rural Thailand affected by Covid-19 during the two years after the onset of the pandemic? (2) Which livelihood platforms and strategies are most likely to be affected? Hereby, we focus on the subjectively perceived impacts. (3) Did the policy interventions adequately support and reach those most in need?

5.3 Data and Methodology

5.3.1 Study site and data collection

This study uses a dataset from Thailand provided by the Thailand Vietnam Socio Economic Panel (TVSEP), a long-term panel survey conducted in three provinces of Thailand since 2007. The aim of this project is to deepen the understanding of income and poverty dynamics in rural areas of this emerging economy. By applying a stratified random sampling, the sample is representative for the rural population in the survey areas (Hardeweg et al., 2013).
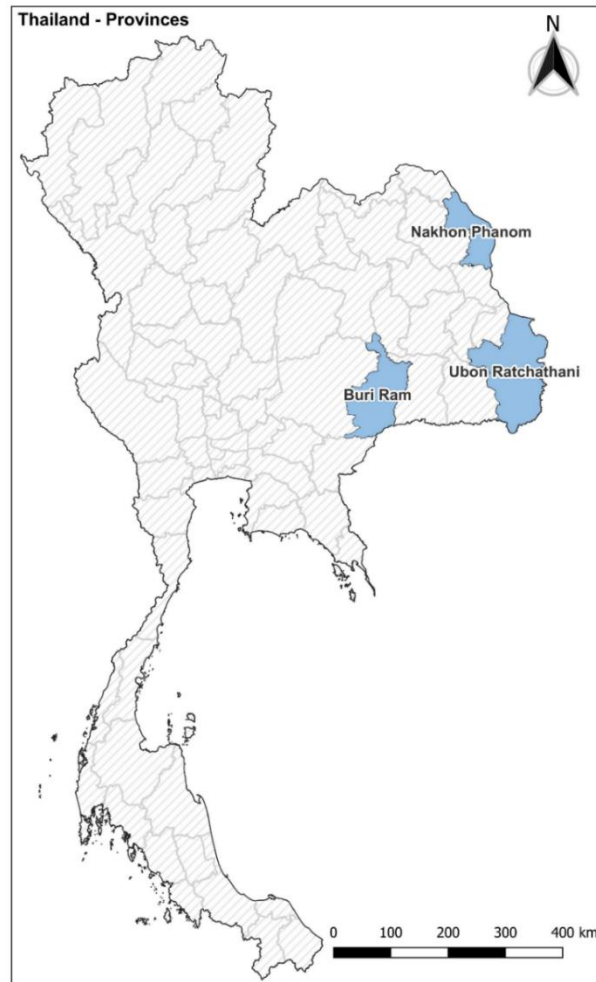
Figure 5.2 TVSEP survey provinces

(shape source: Humanitarian Data Exchange (2022))

With the onset of the Covid-19 pandemic, TVSEP implemented a Covid-19 special survey in Thailand during November and December 2020. The household and village head survey covers 2,141 households in 220 villages in the three TVSEP provinces of Buri Ram, Ubon Ratchathani, and Nakhon Phanom (Figure 5.2). The survey was conducted as face-to-face interviews by enumerators on location, with the same households as in the regular household surveys.

For this study, household data from the household surveys in 2019 and 2022, household and village head data from the Covid-19 special survey as well as data from the village head survey in 2022 are used. Four reference periods are considered as shown in Table 5.1. These are named and defined consistently with the respective questionnaires by the TVSEP.

The datasets are well suited for the topic of this study, as modules on both economic and behavioral impacts of Covid-19 are included. Of particular interest are numerical questions that allow to quantify the effects of the pandemic beyond the scope of closed-ended questions.

Table 5.1 Reference periods

Reference periods	Timeframe	Description	Source
"Before Covid-19"	05/2019 – 02/2020	Reference for values of income, consumption, etc.	Covid-19 special survey (2020)
"Lockdown"	03/2020 – 05/2020	First national lockdown in Thailand	Covid-19 special survey (2020)
"Post-Lockdown I"	06/2020 – 10/2020	"Lockdown" until the Covid-19 special survey in 11/2020	Covid-19 special survey (2020)
"Post-Lockdown II"	11/2020 – 04/2022	Covid-19 special survey until the household survey in 05/2022	Household survey (2022)

5.3.2 Identifying and modelling the impact of Covid-19

This study analyzes the impact of Covid-19 on rural livelihoods in Thailand and the factors thereof from multiple angles. In order to assess the severity in accordance with the Sustainable Livelihoods Framework (Figure 5.1) and with the findings of the literature review, we conduct an extensive descriptive analysis. The statistics therein cover the major issues commonly associated with rural livelihoods, such as household income, transfer payments, migration, and consumption.

Further, we fit a binary logistic regression to model the effect of household characteristics on the likelihood of suffering financial losses during the pandemic. The dependent variable is a dichotomous indicator I, capturing whether a household i reported a negative impact of Covid-19 on the household's financial situation at any point during the pandemic. Accordingly, the model is specified as:

$$ln\left[\frac{P_i(I=1)}{1-P_i(I=1)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k \qquad (5.1)$$

$$\text{with } I_i = 1 \; if \; negative \; impact \qquad (5.2)$$

$$I_i = 0 \; otherwise$$

where β_0 is a constant, vector X_k includes the independent variables with β_k as the corresponding coefficients. Interpreting the model requires the calculation of odds ratios as follows:

$$\left[\frac{P_i(I=1)}{1 - P_i(I=1)} \right] = e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k} \tag{5.3}$$

with the odds ratio as the likelihood of a household to suffer a negative impact on its financial situation due to Covid-19. It can be hypothesized that this likelihood is influenced by several predictors (Table 5.2). Referring to the literature in Table 5.2 as well as the framework presented in Figure 5.1, this study considers human capital such as mean age, nucleus size, and mean education of all members that have concluded their education. In addition, the share of working migrants in relation to all household members is used to account for a diversification of the household's livelihood as well as for social networks that go beyond the nucleus household. Further, the total land held by a household represents its natural capital. Different components of financial capital are included: The monthly household per capita income before the pandemic, savings before the pandemic, and the amount of debt at the onset of the pandemic reflect the household's initial situation. Per capita public transfers reflect additional support during Covid-19. The value of assets is incorporated as physical capital. To consider the impact of different livelihood strategies, a dichotomous variable each for farming, off-farm employment, and non-farm self-employment is used. The interaction between total land area and the variable for farming may reveal nuances in farming-based households. A dichotomous variable for natural resource extraction accounts for the opportunity of extraction as a safety net in times of crises. To control for the potential bias and the exacerbated impacts by a parallel occurrence of additional shocks unrelated to Covid-19, the reported number of such shocks is included. In addition, the province of the household controls for location specific effects. The impact direction of the independent variables is hypothesized as illustrated in Table 5.2. The calculation of correlation coefficients suggests that endogeneity of independent variables is no serious problem (Appendix 5.1). In addition, variance inflation factors (VIF) indicate that there is no multicollinearity between independent variables (Appendix 5.2).

Table 5.2 Independent variables and their hypothesized effects on the probability of suffering a negative financial impact

Variable	Unit	Direction of odds ratio	Sources
Human capital			
Mean Age	Years	-	Bundervoet et al. (2022), World Bank (2020a)
Nucleus Member	No.	-/+	Cassidy & Barnes (2012)
Mean Education	Degree (Primary/None, Secondary, Tertiary)	-	Bundervoet et al. (2022), World Bank (2020a)
Social capital			
Migrant Share	% of all members	+	Bhagat et al. (2020), Dandekar & Ghai (2020)
Natural capital			
Land Area	Rai	-	Carter & Barrett (2006)
Financial capital			
Per Capita Income before Covid-19 (Covid-19 special survey)	Log(THB/month)	-	Bundervoet et al. (2022), World Bank (2020a)
Per Capita Public Transfers	Log(THB)	-	Fajardo-Gonzalez et al. (2021)
Savings (household survey 2019)	Log(THB)	-	Turner et al. (2021), World Bank (2020a)
Debt (household survey 2019)	Log(THB)	+	Turner et al. (2021), World Bank (2020a)
Physical capital			
Assets (household survey 2019)	Log(THB)	-	Turner et al. (2021), World Bank (2020a)
Livelihood strategies			
Farming	1 = "Yes", 0 = "No"	-/+	de Janvry & Sadoulet (2011), Rudolf (2019), Nolte et al. (2022)
Self-Employment	1 = "Yes", 0 = "No"	+	Bundervoet et al. (2022)., Waibel et al. (2020), Workie et al. (2020)
Off-Farm Employment	1 = "Yes", 0 = "No"	+	Bundervoet et al. (2022)., Waibel et al. (2020), Workie et al. (2020)
Natural Resource Extraction	1 = "Yes", 0 = "No"	-	Angelsen et al. (2014), Dokken & Angelsen (2015)
Other control variables			
Shocks	No.	+	Klasen & Waibel (2013)
Province	31 = "Buriram", 34 = "Ubon Ratchathani", 48 = "Nakhon Phanom"	-/+	Klasen & Waibel (2013)

5.4 Results and discussion

5.4.1 Descriptive findings

Figure 5.3 illustrates the effect of Covid-19 on overall household income as estimated by the households compared to before the pandemic. Reduced income is most prevalent in the "Lockdown" period and subsequently declines in severity, although even in the "Post-Lockdown II" period close to 500 households remain strongly affected. Conversely, the number of unaffected households increases throughout the pandemic, however, positive impacts are most frequently observed in the "Post-Lockdown I" period. Overall, the pandemic appears to impact households most severely in the first months.
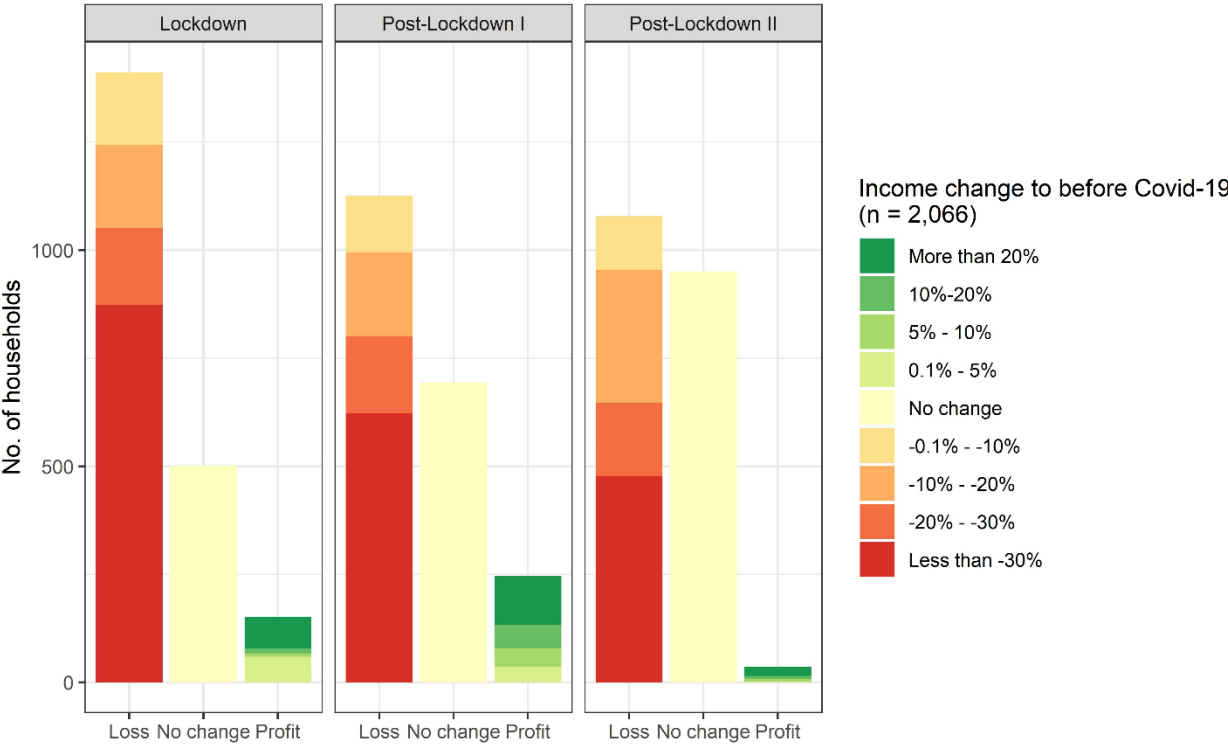
Figure 5.3 Subjective assessment of income effects in comparison to before Covid-19

The impact of Covid-19 on agriculture, off-farm employment, and self-employment is presented in Table 5.3. Thereby, the effects on agriculture are small in comparison to the effects on off-farm employment and self-employment, with "suffered losses" being the most frequently reported. This could relate to farmers that exhibit stronger ties with global value chains and are therefore more affected by shifts in supply and demand of agricultural inputs and goods (Nolte et al., 2022; Rasul, 2021). Additionally, income streams do not necessarily cease entirely but reduce by e.g. receiving lower wages. Further, during the initial phases of the pandemic, more severe impacts are observed. In particular, the strong effects on off-farm employment subside after the initial impact. This may be caused by the strict lockdown measures, implemented by the Thai Government as the pandemic unfolded. Consistency with the estimated aggregate income effects in Figure 5.3 is observed.

Table 5.3 Impact of Covid-19 on agriculture, off-farm employment, and self-employment

Agriculture			Off-Farm Employment			Self-Employment		
	Percent of households			Percent of households			Percent of households	
Effect	Reference period "Lockdown"/ "Post-Lockdown I" (n = 2,141)	"Post-Lockdown II" (n = 2,101)	Effect	Reference period "Lockdown"/ "Post-Lockdown I" (n = 2,141)	"Post-Lockdown II" (n = 2,101)	Effect	Reference period "Lockdown"/ "Post-Lockdown I" (n = 2,141)	"Post-Lockdown II" (n = 2,101)
Made Profits	0.33	0.24	Higher wage	0.28	0	Made profits	0.37	0.33
Suffered losses	5.89	5.66	Lower wage	14.11	0.62	Suffered losses	15.6	4.47
Increased Production	2.01	0.76	Work at increased hours	0.09	0	Opened the business	0.33	0
Decreased production	1.77	3.43	Work at reduced hours	17.05	0.57	Had to close business	2.76	0.9
Bought livestock/fish	0.05	0	Temporarily no work	10.32	1	Opened the Covid-19 related business but already closed it	0	0.05
Sold livestock/fish	2.01	0.19	Job loss	9.01	0.52			

Note: Multiple answers are possible.

Table 5.4 illustrates the impact of Covid-19 on the migrant members of the panel households and their subsequent coping measures. Contrary to early predictions, few migrants lost their jobs (4.22%) in the "Lockdown" and "Post-Lockdown I" periods, while lower income or reduced work hours were much more common. In coping with the pandemic, the most frequent strategy was observed to be a reduction in consumption. Further strategies were to use savings or to take up an additional occupation. Only a very small share of migrants in the panel were indicated to have moved back to the rural household or to a different place permanently. Figure 5.4 depicts the changes in remittance transfers during "Lockdown" and "Post-Lockdown I". As expected, migrants experience increased financial pressure, thus more than 50% of the households report either reduced or entirely stopped remittances during "Lockdown". In the "Post-Lockdown I" period, more households return to the usual or an increased level, however, numerous households with reduced and stopped remittances remain.

Table 5.4 Impact of Covid-19 on the migrant members of panel households

	Percent of migrants	
Reference period Impact	"Lockdown"/ "Post-Lockdown I" (n = 2,248)	"Post-Lockdown II" (n = 1,111)
Job loss	4.22	1.08
Had to work reduced hours	12.59	4.05
Lower income	13.97	15.57
Move to a cheaper accommodation	0.89	1.17
Reduce consumption	18.91	16.56
Take up additional occupation	2.98	1.08
Used savings	3.91	2.07

Note: Migrant definition varies between surveys, resulting in a different number of migrants.
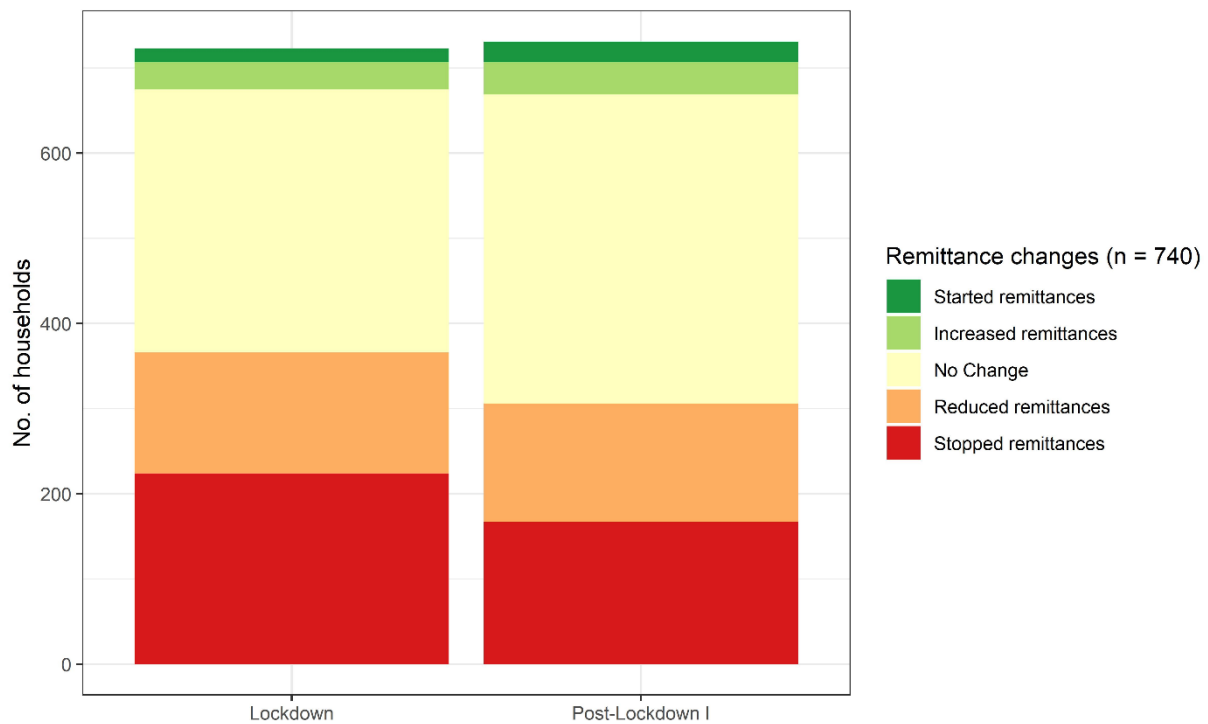
Figure 5.4 Impact of Covid-19 on remittance streams
during "Lockdown" and "Post-Lockdown I"

Figure 5.5 illustrates the number of households receiving public transfers in each month. The swiftly implemented support schemes by the Thai Government during the first national lockdown are visible between April 2020 and August 2020. These are received by up to 61% of households in the panel in July 2020. Notably, the number of supported households declines as the pandemic progresses. This may be related to the different kinds of support schemes that are potentially less accessible for rural households, e.g. because of the requirement to register using a smartphone.
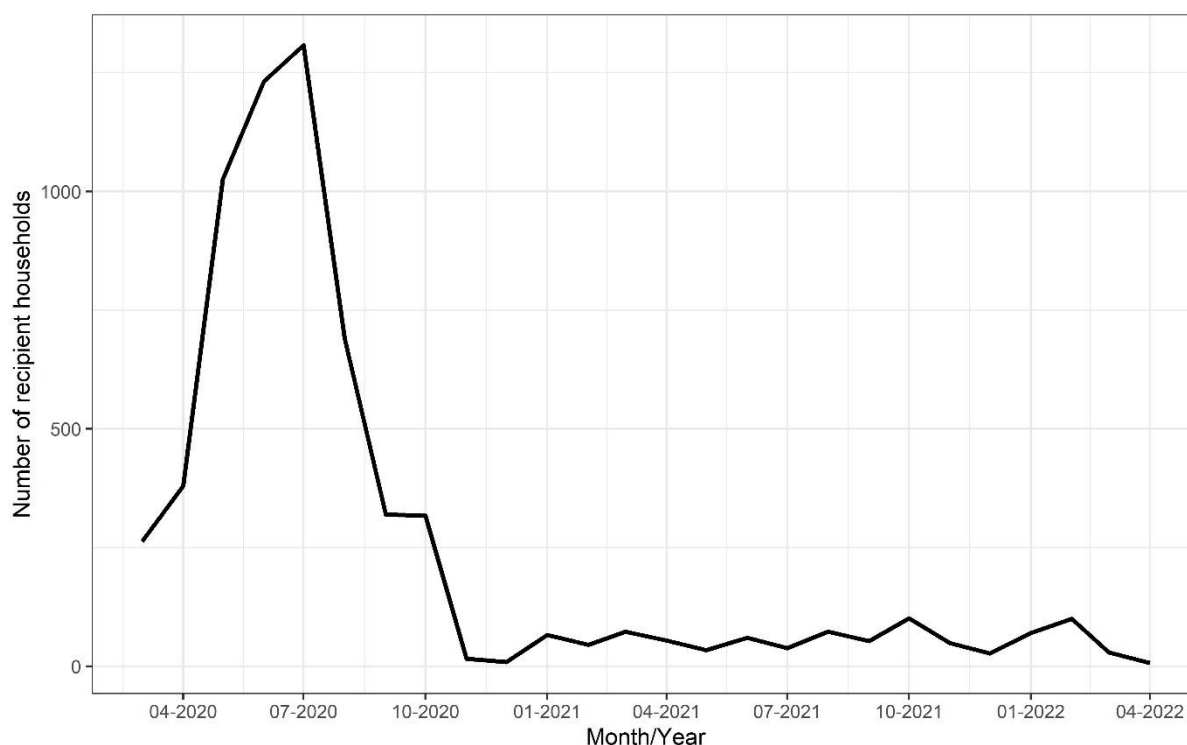
Figure 5.5 Number of households receiving public transfers

As observable in Table 5.5, the effect of Covid-19 on the borrowing behavior of the households in the panel is limited, with only some 16% of households taking up a Covid-19 induced loan in the initial phase of the pandemic. Most of these are recorded during the first lockdown and exhibit a rather low volume of on average 200,000 THB in the Covid-19 special survey and 500,000 THB in the household survey (2022). Those who take up a loan because of Covid-19 mostly use it to pay for everyday consumption. Fewer loans are utilized to sustain current livelihood strategies such as agriculture and businesses. In comparison, the household survey (2019) exhibits an emphasis on investments.

Table 5.5 Usage of borrowed money due to Covid-19

Usage of borrowed money	Percent of households (n = 354)
Used to pay back another loan	10.24
Investment	3.15
Put in savings account	1.18
Pay for everyday consumption	87.8
Used to buy inputs for agriculture	14.17
Used to buy inputs for business	4.33
Other reason	3.15

Note: Multiple answers are possible.

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Depicted in Figure 5.6 is the evolution of all first and subsequent vaccinations as well as infections with Covid-19 amongst household members in the panel. Initially the vaccination campaign progresses slowly and only picks up in the summer of 2021. First, the majority of vaccines used are of Chinese origin (Sinovac and Sinopharm), however, their effectiveness remains controversial (Wee & Londoño, 2021), hence cross-vaccination with other brands upon availability is favored. Vaccinations of the brand "Astrazeneca" are used in substantial numbers, as these become more available once other countries predominantly shift to using mRNA vaccines. mRNA vaccines are available much later in Thailand and as of 2022 become the main type of vaccine. Thailand reports relatively low numbers of Covid-19 infections for most of the pandemic, only experiencing temporary waves with more regional outbreaks in e.g. the province of Samut Sakhon in late 2020 (Sriring & Perawongmetha, 2020). However, in 2022, infections increase substantially, both in the dataset as well as nationally.
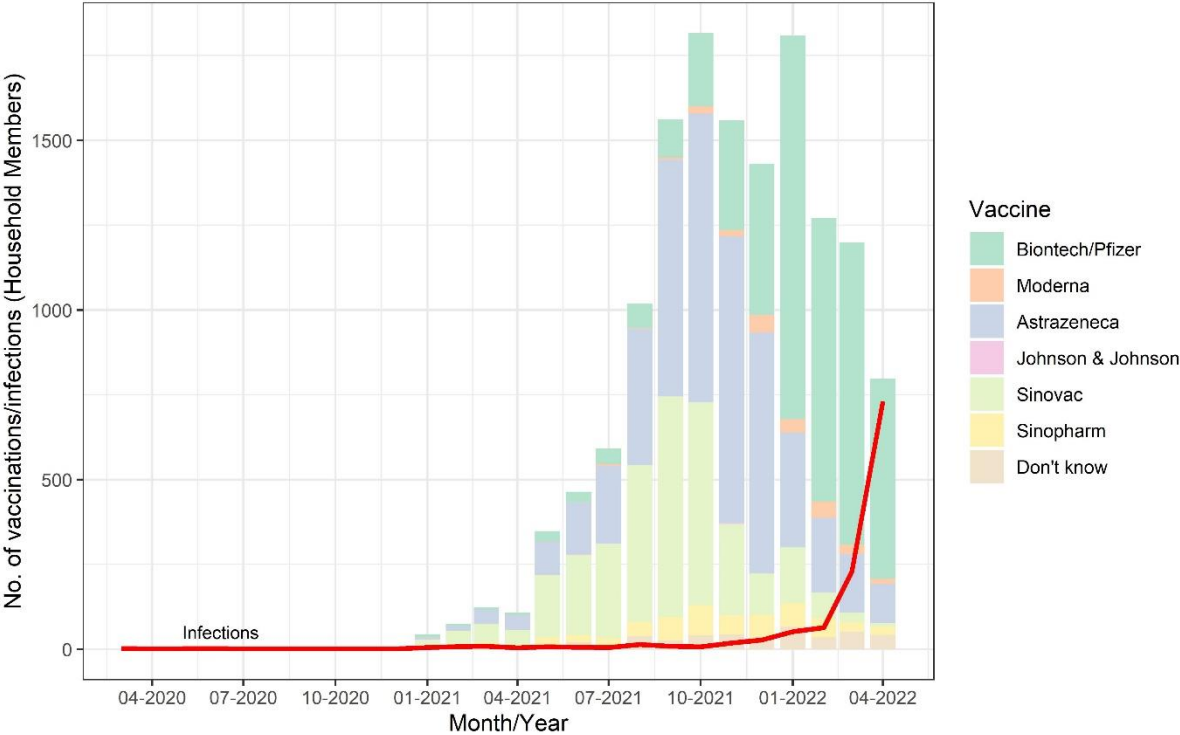
Figure 5.6 Vaccinations and infections with Covid-19 among household members

Table 5.6 indicates the changes in consumption expenditures due to Covid-19 compared to before the pandemic. Especially during the "Lockdown" and "Post-Lockdown I" periods, many households spend less on proteins (meat, fish, milk products), even though in the "Post-Lockdown II" period households tend to increase their protein consumption. With respect to vitamins, households report a decline as well but little increase later on. Unobservable in the table are shifts regarding the quality of purchased items (quantity vs. quality) as well as changes

in the share of self-produced items. Additionally, households alter their non-food expenditures. However, the interpretation is impeded as this category includes many different kinds of goods. With the onset of the pandemic, the expenditures for lottery and gambling decline, but swiftly return to the initial level. A persistent increase in expenditures is observable for health.

Table 5.6 Changes in consumption expenditures due to Covid-19

Expenditures	Percent of households			
	"Lockdown"/ "Post-Lockdown I" (n = 2,141)		"Post-Lockdown II" (n = 2,101)	
	Decrease	**Increase**	**Decrease**	**Increase**
Carbohydrates (rice, noodle, root crops)	5.65	5.18	1.48	4.76
Protein (meat, fish, milk products)	16.58	7.43	4.95	13.04
Vitamins (vegetables, fruits)	8.45	2.62	1.86	3.14
Non-food expenditures (care supplies, energy cost, transportation, etc.)	18.82	14.48	3.28	16.18
Lottery and gambling	19.76	1.21	4.47	1.05
Health (preventive and curative)	0.19	16.16	1.24	11.52

5.4.2 Factors of households financially impacted by Covid-19

In this section, the factors influencing the probability of a negative impact of Covid-19 on a household's financial situation are presented in Table 5.7. The model achieves a McFadden R^2 of 0.13. A ten-fold cross validation, whereby the dataset is randomly split into a training and testing dataset 10 times, yields an accuracy of 78%.

The odds of suffering a negative impact of Covid-19 on a household's financial situation are statistically significantly influenced by the household's members mean age and mean education. Households that are on average older are less likely to experience a financial loss due to their rather self-sustained livelihoods that are less involved in the globalized economy (Kassie et al., 2017; Xu et al., 2015). In addition, households with a higher average level of education amongst their members show reduced odds, as it may enable them to manage and mitigate crises more effectively. Mean education and mean age lower the odds by 46% and 3.3% per unit increase respectively.

Table 5.7 Influencing factors on the probability of suffering a negative financial impact

	Odds ratio (SE)
Household characteristics	
Mean age	0.967*** (0.006)
Nucleus member	1.056 (0.044)
Mean education	0.539*** (0.149)
Migrant share	1.368 (0.508)
Economic characteristics	
Per capita income before Covid-19 (Covid-19 special survey)	2.305*** (0.175)
Farming	1.03 (0.169)
Off-farm employment	1.576*** (0.144)
Self-employment	3.046*** (0.173)
Per capita public transfers	1.128*** (0.042)
Assets (household survey 2019)	1.047 (0.064)
Savings (household survey 2019)	1.007 (0.028)
Land area	0.963** (0.018)
Farming#Land area	1.031* (0.018)
Debt (household survey 2019)	1.013 (0.023)
Natural resource extraction	0.57 (0.549)
Other control variables	
Shocks	1.345*** (0.059)
Province Buriram (Nakhon Phanom as basis)	0.674** (0.171)
Province Ubon Ratchathani (Nakhon Phanom as basis)	0.624*** (0.166)
Constant	0.662 (0.744)
R² (McFadden)	0.13
Number of observations	2,064

*Note: Standard errors (SE) in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.*

The household's per capita income before the pandemic, the involvement of the household in off-farm employment and/or self-employment as well as the volume of public transfers show a statistically significant correlation with the odds. Thereby, a household with a higher per capita income before the pandemic is more likely to incur a negative financial impact due to the more globalized nature of higher revenue generating activities. The involvement in either off-farm employment or self-employment increases the likelihood of suffering adverse effects by a factor of 1.57 and a factor of 3 respectively. Conversely, involvement in farming yields no significance, unless interacted with the total land area of the household. Larger-scale farms are more likely to be affected, indicating a higher level of dependence on domestic and global

markets. However, land area in households without farming is shown to reduce the odds of negative financial impacts with increasing size. The results from the logistic regression further indicate that receiving more public transfers increases the likelihood of a financial loss. This shows that households that receive more support were indeed those affected most by the pandemic, indicating the relevance of targeted policy interventions.

In addition, both variables controlling for the reported number of other shocks and the location show statistically significant effects. Thereby, a higher number of other shocks experienced by the household also increases the odds ratio of a negative financial effect due to Covid-19 by 35%. This may be related to either a reporting bias or a reduced capacity of the household in coping with multiple stressors. Further, the province in which the household is located, shows a higher likelihood for a negative financial impact in the province of Nakhon Phanom compared to the other two provinces in the survey.

5.4.3 Sustainable rural livelihoods against the background of Covid-19

Discussing our empirical results in light of the Sustainable Livelihoods Framework presented in Figure 5.1, Covid-19 has long-lasting impacts. Education – which is an important part of human capital – proved to be a statistically significant enabler for households to mitigate the effects of the crisis. However, financial and physical capital, e.g. savings and assets, appeared to be of little relevance. The choice of livelihood strategies has a statistically significant influence on whether households experience a negative financial impact. While diversified livelihood strategies are commonly regarded as desirable in the context of rural livelihoods, Covid-19 particularly impacts those households involved in domestic and global markets. Conversely, small-scale farming reduces negative impacts. In light of these observations, it is noteworthy that Covid-19 is dissimilar from other shocks commonly experienced by households in the study area. In addition, the simultaneous occurrence of different shocks further worsens livelihood outcomes. In response to Covid-19, some households swiftly change their consumption, while others prefer to expend resources, e.g. loans, to uphold consumption. In summary, Covid-19 has affected livelihood platforms, strategies, and outcomes alike.

This exposes the multitudinous weaknesses of rural livelihoods and raises the issue of how better policies can be implemented to cushion the effects of future crises. Our analysis exposes the households that require the most support which in turn could be utilized to better target

these. Especially during the initial phase of the pandemic, vast amounts of money were distributed to most of the households in the panel, regardless of their actual situation. Combining the characteristics of the crisis at hand as well as the inclusion of detailed data yields a more targeted and therefore sustainable policy design, ideally aimed at those with the highest likelihood of suffering a financial loss.

5.5 Conclusion

The Covid-19 pandemic was expected to have profound and long-lasting effects on households in low- and middle-income countries. Applying a descriptive approach, we observe that Covid-19 predominantly affects households that already exhibit a degree of involvedness in domestic and global markets, e.g. by pursuing off-farm employment or non-farm self-employment. In summary, our dataset confirms the occurrence of most predicted adverse effects from the literature, albeit with a strong emphasis on the first months of the pandemic. Although improvements can be observed, as the pandemic progresses, even two years after its onset, negative impacts remain notable.

These findings are reflected in the binary logistic regression model, particularly, in the correlation between involvement in global value chains and likelihood to be negatively impacted. Conversely, households with a higher average age, lower education, and smaller farm size are less likely to be affected. In the context of rural livelihoods, this points to the differences between various kinds of shocks. While higher income and diversified livelihood strategies increase resilience against natural disasters, precisely these strategies exhibit higher vulnerability to economic shocks. Nevertheless, livelihood diversification remains essential. In any case, the aggregate effects of multiple shocks put additional pressure on households and worsen their livelihood outcomes.

Initially, the governmental transfer payments reach the people most in need. In later stages of the pandemic, households receive substantially lower amounts. Following these observations, it seems more desirable to implement more targeted support policies that are sustainable over a longer period of time. Data collection at an early stage to obtain a better understanding of who is most affected, is key in facilitating such policies.

This study demonstrates the importance of data driven conclusions about the impact of crises. Although our dataset provides detailed information on the household's situation before and

during the pandemic, it is not without limitations. Some data about the impact on income and consumption are aggregated estimates by the respondents with inherent inaccuracies. Further, this study only considers two years after the onset of the pandemic, whereby longer-term effects are yet to unfold. However, as the data covers most of the pandemic until April of 2022, whereafter Covid-19 slowly entered a recession, any following impacts on the households may not be clearly attributable to the pandemic but to the general economic situation. At the same time, the availability of data limits the regional scope of this study, with similar large-scale household surveys only being conducted in few countries. Since Covid-19 is a global phenomenon, extending the analysis of this study to other regions may improve the response to future crises.

References

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S., Börner, J., Smith-Hall, C., & Wunder, S. (2014). Environmental Income and Rural Livelihoods: A Global-Comparative Analysis. *World Development*, *64*, S12–S28.

Ashley, C., & Carney, D. (1999). Sustainable livelihoods: lessons from early experience. Department for International Development, London.

Barrett, C. B., & Constas, M. A. (2014). Toward a theory of resilience for international development applications. *Proceedings of the National Academy of Sciences*, *111*(40), 14625–14630.

Bhagat, R. B., Reshmi, N., Sahoo, H., Roy, A. K., & Govil, D. (2020). The COVID-19, migration and livelihood in India: Challenges and policy issues. *Migration Letters, 17*(5), 705–718.

Bundervoet, T., Dávalos, M. E., & Garcia, N. (2022). The short-term impacts of COVID-19 on households in developing countries: An overview based on a harmonized dataset of high-frequency surveys. *World Development*, *153*, 105844.

Chambers, R., & Conway, G. (1992). Sustainable rural livelihoods: practical concepts for the 21st century. IDS Discussion Paper.

Chen, H., Qian, W., & Wen, Q. (2021). The Impact of the COVID-19 Pandemic on Consumption: Learning from High-Frequency Transaction Data. *American Economic Association Papers and Proceedings*, *111*, 307–311.

Dandekar, A., & Ghai, R. (2020). Migration and reverse migration in the age of COVID-19. *Economic and Political Weekly*, *55*(19), 28–31.

De Janvry, A., & Sadoulet, E. (2011). Subsistence farming as a safety net for food-price shocks. *Development in Practice*, *21*(4–5), 472–480.

Dedehouanou, S. F. A., Araar, A., Ousseini, A., Harouna, A. L., & Jabir, M. (2018). Spillovers from off-farm self-employment opportunities in rural Niger. *World Development*, *105*, 428–442.

Dokken, T., & Angelsen, A. (2015). Forest reliance across poverty groups in Tanzania. *Ecological Economics*, *117*, 203–211.

Fajardo-Gonzalez, J., Gray Molina, G., Montoya-Aguirre, M., & Ortiz-Juarez, E. (2021). Global Estimates of the Impact of Income Support during the Pandemic. United Nations Development Programme. New York City, USA.

Gasiorowska, A. (2014). The relationship between objective and subjective wealth is moderated by financial control and mediated by money anxiety. *Journal of Economic Psychology, 43*, 64–74.

Hale, T., Angrist, N., Goldszmidt, R., Kira, B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas, L., Majumdar, S., & Tatlow, H. (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nature Human Behaviour*, *5*(4), 529–538.

Hardeweg, B., Klasen, S., & Waibel, H. (2013). Establishing a database for vulnerability assessment. In: Klasen, S., & Waibel, H. (eds): Vulnerability to Poverty: Theory, Measurement and Determinants, with Case Studies from Thailand and Vietnam (pp. 50–79). Palgrave Macmillan. London, United Kingdom.

Humanitarian Data Exchange (2022). Thailand – Subnational Administrative Boundaries. Available at https://data.humdata.org/dataset/cod-ab-tha.

Kassie, G. W., Kim, S., Fellizar, F. P., & Ho, B. (2017). Determinant factors of livelihood diversification: Evidence from Ethiopia. *Cogent Social Sciences*, *3*(1), 1369490.

Klasen, S., & Povel, F. (2013). Defining and Measuring Vulnerability: State of the Art and New Proposals. In: Klasen, S., & Waibel, H. (eds): Vulnerability to Poverty: Theory, Measurement and Determinants, with Case Studies from Thailand and Vietnam (pp. 17–49). Palgrave Macmillan. London, United Kingdom

Klasen, S., & Waibel, H. (eds.) (2013). Vulnerability to Poverty. Palgrave Macmillan. London, United Kingdom.

Komin, W., Thepparp, R., Subsing, B., & Engstrom, D. (2021). Covid-19 and its impact on informal sector workers: A case study of Thailand. *Asia Pacific Journal of Social Work and Development*, *31*(1–2), 80–88.

Laborde, D., Martin, W., Swinnen, J., & Vos, R. (2020). COVID-19 risks to global food security. *Science*, *369*(6503), 500–502.

Laborde, D., Martin, W., & Vos, R. (2021). Impacts of COVID-19 on global poverty, food security, and diets: Insights from global model scenario analysis. *Agricultural Economics*, *52*(3), 375–390.

Marome, W., & Shaw, R. (2021). COVID-19 Response in Thailand and Its Implications on Future Preparedness. *International Journal of Environmental Research and Public Health*, *18*(3), 1089.

Nguyen, T. T., Do, T. L., Bühler, D., Hartje, R., & Grote, U. (2015). Rural livelihoods and environmental resource dependence in Cambodia. *Ecological Economics*, *120*, 282–295.

Nolte, K., Sipangule, K., & Wendt, N. (2022). Agricultural households in times of crisis. The COVID-19 pandemic, livelihoods and land-use decisions. *Journal of Land Use Science*, *17*(1), 134–160.

Pokhrel, S., & Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Higher Education for the Future*, *8*(1), 133–141.

Rasul, G. (2021). Twin challenges of COVID-19 pandemic and climate change for agriculture and food security in South Asia. *Environmental Challenges*, *2*, 100027.

Rudolf, R. (2019). The impact of maize price shocks on household food security: Panel evidence from Tanzania. *Food Policy*, *85*, 40–54.

Sapbamrer, R., Chittrakul, J., Sirikul, W., Kitro, A., Chaiut, W., Panya, P., Amput, P., Chaipin, E., Sutalangka, C., Sidthilaw, S., Promrak, P., Kamolsan, P., & Hongsibsong, S. (2022). Impact of COVID-19 Pandemic on Daily Lives, Agricultural Working Lives, and Mental Health of Farmers in Northern Thailand. *Sustainability*, *14*(3), 1189.

Scoones, I. (1998). Sustainable rural livelihoods: a framework for analysis. IDS Working Paper.

Sriring, O., & Perawongmetha, A. (2020, December 20). Thailand to test thousands after shrimp market COVID outbreak. Available at https://www.reuters.com/article/us-health-coronavirus-thailand-idUSKBN28U070

Swinnen, J., & McDermott, J. (2020). COVID-19 and global food security. International Food Policy Research Institute. Washington, D.C., USA.

Tantrakarnapa, K., Bhopdhornangkul, B., & Nakhaapakorn, K. (2022). Influencing factors of COVID-19 spreading: A case study of Thailand. *Journal of Public Health*, *30*(3), 621–627.

Turner, S., Langill, J. C., & Nguyen, B. N. (2021). The utterly unforeseen livelihood shock: COVID -19 and street vendor coping mechanisms in Hanoi, Chiang Mai and Luang Prabang. *Singapore Journal of Tropical Geography*, *42*(3), 484–504.

Waibel, H., Grote, U., Min, S., Nguyen, T. T., & Praneetvatakul, S. (2020). COVID-19 in the Greater Mekong Subregion: How resilient are rural households? *Food Security*, *12*(4), 779–782.

Wee, S.-L., & Londoño, E. (2021, January 13). Disappointing Chinese Vaccine Results Pose Setback for Developing World. New York Times. Available at https://www.nytimes.com/2021/01/13/business/chinese-vaccine-brazil-sinovac.html

Workie, E., Mackolil, J., Nyika, J., & Ramadas, S. (2020). Deciphering the impact of COVID-19 pandemic on food security, agriculture, and livelihoods: A review of the evidence from developing countries. *Current Research in Environmental Sustainability*, *2*, 100014.

World Bank (2020a). Poverty and Distributional Impacts of COVID-19: Potential Channels of Impact and Mitigating Policies. World Bank. Washington, D.C., USA.

World Bank (2020b). COVID-19 Crisis Through a Migration Lens. World Bank. Washington, D.C., USA.

Xu, D., Zhang, J., Rasul, G., Liu, S., Xie, F., Cao, M., & Liu, E. (2015). Household Livelihood Strategies and Dependence on Agriculture in the Mountainous Settlements in the Three Gorges Reservoir Area, China. *Sustainability*, *7*(5), 4850–4869.

Zhang, L., Dong, Y., Liu, C., & Bai, Y. (2018). Off-farm employment over the past four decades in rural China. *China Agricultural Economic Review*, *10*(2), 190–214.

Appendix

Appendix 5.1 Correlation coefficients of independent variables

	Age	Member	Education	Migrant Share	Land Area	Income before Covid-19	Public Transfers	Debt	Savings	Assets	Farming	Off-Farm	Self	Extraction	Shocks
Age	1														
Member	-0.51***	1													
Education	-0.28***	0.17***	1												
Migrant Share	-0.14***	-0.13***	0.21***	1											
Land Area	-0.04*	0.13***	0.10***	0.00	1										
Income before Covid-19	-0.04*	-0.12***	0.22***	-0.17***	0.06***	1									
Public Transfers	-0.15***	0.05**	-0.03	0.03	0.04*	0.05**	1								
Debt	-0.20***	0.15***	0.08***	0.03	0.10***	0.08***	0.09***	1							
Savings	-0.03	0.02	0.08***	-0.02	0.09***	0.12***	0.04*	0.05**	1						
Assets	-0.24***	0.20***	0.30***	0.00	0.25***	0.31***	0.07***	0.16***	0.18***	1					
Farming	-0.13***	0.13***	-0.01	0.02	0.34***	0.00	0.10***	0.12***	0.12***	0.22***	1				
Off-Farm	-0.29***	0.17***	0.23***	0.50***	-0.11***	-0.08***	0.06***	0.04*	-0.03	-0.01	-0.09***	1			
Self	-0.08***	0.12***	0.16***	-0.02	-0.03	0.20***	0.08***	0.02	0.04*	0.17***	-0.05**	-0.06***	1		
Extraction	-0.02	0.01	-0.01	0.03	-0.03	0.01	0.00	0.01	0.02	-0.01	-0.02	0.04*	-0.03	1	
Shocks	-0.08***	0.10***	0.01	-0.01	0.08***	0.01	0.06***	0.06**	0.05**	0.07***	0.18***	0.04*	0.01	0.03	1
Province	0.05**	-0.01	0.05**	-0.06**	0.03	0.07***	-0.01	-0.15***	-0.02	0.06***	-0.06***	-0.03	0.03	0.02	0.00

Note: * p < 0.1, ** p < 0.05, *** p < 0.01.

Appendix 5.2 Variance inflation factor (VIF) values

	VIF
Human capital	
Mean Age	1.292
Nucleus Member	1.314
Mean Education	1.175
Social capital	
Migrant Share	1.301
Natural capital	
Land Area	4.84
Financial capital	
Per Capita Income before Covid-19 (Covid-19 special survey)	1.141
Per Capita Public Transfers	1.023
Savings (household survey 2019)	1.026
Debt (household survey 2019)	1.062
Physical capital	
Assets (household survey 2019)	1.174
Livelihood strategies	
Farming	1.255
Self-Employment	1.036
Off-Farm Employment	1.291
Natural Resource Extraction	1.005
Farming#Land Area	5.077
Other control variables	
Shocks	1.023
Province	1.025