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The likelihood of migration

Changes in the likelihood of sending out a household member for migration after a prolonged drought in the Mekong Delta, Vietnam

Master thesis

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Abstract

Environmental events in coastal regions are expected to increase in the future, affecting millions of households that depend on environmental services for their livelihoods, one such area is the Mekong Delta in Vietnam. In 2016 the Mekong Delta was subjected to the worst drought in 90 years, affecting households directly and indirectly via destruction of land and crops, resulting in loss of livelihood for a majority of households dependent on agriculture in the region. In order to adapt to loss of income, migration can be used as an income-diversification technique, this thesis aimed to research changes in the likelihood of participating in migrating after the 2016 drought by analysing household and commune characteristics before, during and after the drought. To estimate the likelihood of migration a logistic regression model with data covering the years 2014, 2016 and 2018 was used, the data was collected from the Vietnamese Household and Living Standard Survey. In addition to the logistic regression model, income distribution of households and difference in their average income in relation to distinctive characteristics of the household heads was also analysed to indicate differences in income in the studied period. The results of the analysis indicated that there were no major changes in the likelihood of migration, however, in terms of income distribution, there is a bigger gap between the bottom 10 percent and the top 10 percent of income earners of the surveyed households after the drought. This research has contributed to the literature of migration in the Mekong Delta, in particular after an environmental event, by further strengthen the notion that more research, with detailed data, is needed to research the true impact that environmental events has on migration. Additionally this thesis contributed to an overview of the differences in income levels and income percentile groups to see the progression of average income over time and found that between 2016 and 2018 the average income increased, more for household in the higher income groups in comparison to lower income ones.

Acknowledgement

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1. Introduction

This thesis will research the differences in migrant household and non-migrant households, along with information regarding the likelihood of migration, after a prolonged drought. At the beginning of 2016, Vietnam was severely affected by the worst drought the country had experienced in over 90 years (UN Vietnam, 2016b, 2016c). Estimations indicate that 2.3 million people were affected by the event, mainly due to a shortage of food, shortage of water and destruction of crops (UN Vietnam, 2016a, 2016b, 2016c). Environmental changes, such as droughts and floods, tends to destroy crops and other income sources for households in rural areas, making households more vulnerable to future events (Bastakoti, Gupta, Babel, & van Dijk, 2014; Cattaneo et al., 2019; Tran, 2019; Warner, Hamza, Oliver-Smith, Renaud, & Julca, 2010). Poor households and household who has main income is from agriculture are more vulnerable to changes in the environment in comparison to wealthier households and households with non-farm income (Coxhead, Nguyen, & Vu, 2015; Coxhead, Nguyen, & Vu, 2019; Nguyen, Raabe, & Grote, 2015; Tacoli & Mabala, 2010)

The Mekong Delta is a mostly rural area in the southern part of Vietnam, see Figure 1, the region is characterized by its agricultural production, supplying over 50 percent of all rice in the country, the rice production, along with shrimp production is an important income source to the approximately 18 million people residing in the area (Tran, 2019).
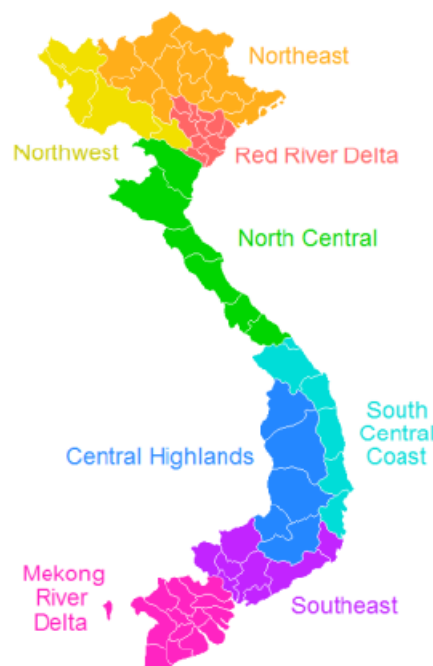

Figure 1 Map of the Vietnam, sourced from ISM and SINFONICA (2015) pp. 40

The International Panel of Climate Change (IPCC) (2014) states that the Mekong Delta will be severely affected by climatic and environmental change in the future, imposing risk to households and their livelihoods. Amongst the most vulnerable are poor households and farming households, due to lack of

adaptation possibilities in form of income-diversification and on-farm adaptation (Anh, Dipierri, & Leonardelli, 2017; IPCC, 2014; Nguyen et al., 2015). The Mekong Delta has long been subjected to seasonal environmental changes such as flooding and droughts, however, within the past couple of years, these events have become severe and last for a longer period (Mekong Delta Plan, 2013; Stewart & Coclanis, 2011). The coastal regions of the Mekong Delta are more affected by salinity intrusion, sea-level rise, and droughts, while inland provinces are more exposed to flooding (Mekong Delta Plan, 2013).

During droughts it is common for farmers to irrigate the land with water from water reserves, however, if there is already water shortages due to droughts, there is an increase in the likelihood of contaminating groundwater reserves with minerals and salts due to over depletion of water, making it unusable for human consumption and irrigational purposes, further affecting farmers livelihoods (Renaud, Le, Lindener, Guong, & Sebesvari, 2015; Stewart & Coclanis, 2011).

To combat the adverse effects of environmental changes in relation to livelihoods, households can change crops to more salinity resistance ones, or diversify income by changing occupation to non-farm work (Bastakoti et al., 2014). There is, however, usually a shortage of non-farm employment and a lack of other types of adaptations options in rural areas, therefore, another common adaptation technique is present in form of sending out a household member to earn income for the household via migration, often to areas where there are more work opportunities and wages are higher (Bernzen, Jenkins, & Braun, 2019; Käkönen, 2008; Le Dang, Li, Nuberg, & Bruwer, 2014; Pimhidzai, 2018; Tacoli & Mabala, 2010).

According to the New Economics of Labour Migration (NELM) framework, the decision to migrate is a joint household decision where the households weigh up the costs and benefits of migration, if the benefits exceed the cost the households send out a household member to migrate, which then can send back remittance to the household (Stark & Bloom, 1985).

This thesis aims to investigate how the likelihood of a household in the Mekong Delta sending out a migrant has changed after the 2016 drought. By analysing data prior, during and following the drought, the likelihood of migration can be estimated with the help of logistic regression models, along with the use of descriptive statistics and income distributions to explain the differences in migrant and non-migrant households, this thesis aims to contribute to the field of environmentally induced migration by research migration changes over time.

The topic of this thesis is of importance since future environmental changes are estimated to impact the lives of millions of individuals in the Mekong Delta, and it is therefore important to study which types households are most likely to engage in migration, which can be used in future research to predict future migration flows.

To reach the aim of the thesis, the thesis researched the following questions:

1. What are typical household and commune characteristics that influence migration in the Mekong Delta, and how do they differ between household with a migrant and non-migrant household?
2. How does the income distribution differ between households with and without a recent migrant for the surveyed households in the Mekong Delta?
3. Has the likelihood of sending out a household member change after the 2016 drought?

To answer the research questions the main dataset used is collected from the Vietnamese General Statistics Office (GSO). The data covers household and commune characteristics from the bi-annual Vietnamese Household and Living Standard Survey (VHLSS), enabling research of general population changes over time. In terms of the studied period, data prior (year 2014), during (year 2016) and after (year 2018) the 2016 drought will be compared to each other. In addition to the VHLSS data, data of poor households in the commune and the average salinity levels in communes will also be used.

This thesis starts with a literature review to bring up theoretical frameworks, followed by migration in Vietnam and the Mekong Delta, where drivers of migration are discussed. In the section following, data sources and methods have been presented. The last two parts of the thesis present the results of the estimation explained in the method section, followed by a discussion where the research questions are answered, results are discussed and limitations with the data is presented.

2. Previous research on migration in the region

2.1. Theoretical frameworks in migration literature

In terms of established theories within the field of migration, two types of theories are commonly used, one of them was brought up in the introduction which was NELM theory and the other, slightly older theory is the Classic Migration Theory.

The Classic Migration Theory, introduced by Ravenstein in 1885, states that push and pull factors contributes to the decision to migrate. Push factors are factors such as lack of job opportunities or environmental events such as land degradation or sea-level rise which makes it difficult to earn income in the area and pushes people away from the place of residency (Ravenstein, 1885). On the other hand, pull factors are factors that attract people to the city, such as higher wages, job opportunities and knowing other people from the commune that resides in the possible city to where migration takes place (Coxhead et al., 2019; Koubi, Spilker, Schaffer, & Bernauer, 2016; Ravenstein, 1885; Reuveny, 2007).

The NELM theory is shortly summarized in the introduction and was developed by Stark and Bloom (1985). The theory states that migration is a form of risk diversification and whether a household member migrates is a joint household decision. The household weighs up the cost and benefits of migration and if the benefits exceed the cost the household sends out a member (Fussell, Hunter, & Gray, 2014; Stark & Bloom, 1985). The household member then sends back remittance to the household, which results in fewer liquidity constraints, resulting in better livings standards for households. The theory further states other income diversification strategies which includes access to credit and insurance markets in the area of residency, which contributes to decrease in vulnerability in form of being able to save money for future events, but also the ability to borrow money can result in a reduction of risk (Kleemans, 2015; Nguyen et al., 2015; Phan & Coxhead, 2019; Stark & Bloom, 1985).

2.1.1. Theoretical frameworks in terms of migration and environmental change

In regards to migration due to environmental changes, there is not a set framework, however, development in the field is ongoing, but differences in opinion of the classification of an *environmental migrant* persist, as seen in the summarization of two articles presented below.

Renaud, Dun, Warner, and Bogardi (2011) discuss that an *environmental migrant* is only classified as such if the environmental event is the main reason for migration, if, for example, economic factors are the main reason the individuals will be classified as a *non-environmental migrant,* even though environmental events have indirectly caused a loss of income. Two other types of migrants discussed in the framework is an *environmentally forced migrant* where an environmental event displaces people, an *environmentally motivated migrant,* on the other hand, migrates due to future belief of the environment getting worse. In general, environmental changes should be the main motivator for migration, which is opposite to the view of Black et al. (2011).

Black et al. (2011)'s point of view is that an environmental event is one of the many factors that influence migration decisions and should be accounted for together with other factors such as social and economic ones. Environmental changes do not solely result in migration, but it does interact with other characteristics and drivers. The framework consists of five macro-drivers; *Political, demographical, economic, social*, and *environmental*, in addition to interacting with each other, household and individual characteristics also influence the choice of migrating. Interaction of all these terms results in whether or not households will participate in migration.

Examples of household and individual characteristics to include are age, gender, education level of the household head and the wealth of the household. In terms of environmental factors, Black et al. (2011) mention that slow-onset environmental changes (drought and salinity intrusion) can result in migration over time, while fast-onset environmental changes (flooding and typhoons) results in short and often temporary migration. If migration is already a part of the society in the area of research, it is better to focus on the net effect of environmental change and its effect on migration, instead of regarding environmental factors as the only reason for migration (Black et al., 2011).

2.2. An introduction to migration in Vietnam

Migration in Vietnam was restricted until the late 1990s via a household registration system (*Ho Khau*) that was implemented in 1964. At the start, *Ho Khau* was associated with access to social and political services along with food rations and crop quotas, enabling control of movements within Vietnam by limiting where people could live, permission to move was seldomly granted by the local authorities (Anh, Demombynes, & Vu, 2016; Liu, 2019). The *Doi Moi* reform, introduced in 1986, not only transformed Vietnam from a centrally planned economy to a market economy, but it also lessened restrictions for household registration, and thus migration (Anh et al., 2016; Liu, 2019). Rules still applied for individuals who wanted to settle in other provinces, but it was easier to get permission from local authorities (Liu & Dang, 2019). Since the *Doi Moi* reform, additional reforms have been implemented, enabling easier registration of temporary movements. It is now possible to move without permission from authorities, but individuals still have to apply for permanent registration in the commune they want to reside in, which can be a lengthy process (Anh et al., 2016; Liu & Dang, 2019).

Even though registration of household statuses are easier, there is a minimum of 5.6 million people without permanent registration in the location they reside in, many of who are rural migrants in industrialized or urban towns, making it difficult to estimate the actual number of migrants in Vietnam, relating to the term *hidden migration* (Anh, Hoang, Bonfoh, & Schelling, 2012; Liu & Dang, 2019). *Hidden migration* is a concept that describes individuals that are still registered in their home commune but live and work in other communes, which results in an underestimation of the real migration flow (Anh et al., 2012).

The Government of Vietnam recognizes two types of migration, *Spontaneous migration,* and *Organized migration* (Liu, 2019). The latter of the two indicates that the person has been a part of displacement in form of governmental programmes, such as the Living With Floods program, implemented by the Vietnamese government to permanently reallocate households that have been affected by floods (Entzinger & Scholten, 2016). *Spontaneous migration* regards migration of self-interest, which is often economic reasons and is the most common type of migration in Vietnam, and will be of focus in this thesis (Dang, Tacoli, & Hoang, 2003; Entzinger & Scholten, 2016).

The most common migration flow is between rural and urban areas, either within or outside the province of residency, the main motivator is higher wages in urban cities compared to rural places, along with more availability of non-farm work, relating to the pull factors of the Classic Migration Theory (Anh et al., 2012; Dun, 2012; Liu, 2019; Liu & Dang, 2019; Ravenstein, 1885; Reuveny, 2007). The most common occupation for migrants in urban cities is manual labour (Anh et al., 2012; Entzinger & Scholten, 2016; Liu & Dang, 2019).

Apart from reforming the Vietnamese economy, the *Doi Moi* reform also resulted in economic growth and reduced poverty rates (Pimhidzai, 2018). The estimated percentage of household living in poverty (according to the national poverty line) is 9.8 percent, or 9 million people, a reduction of around 40 percent since the 1980s (Pimhidzai, 2018; Quyen, 2019). Amongst the poorest are ethnic minorities and people living in mountainous areas (Pimhidzai, 2018). Regarding ethnicities, there are officially 54 ethnicities recognized by the Vietnamese government (Singhal & Beck, 2015). The majority ethnicity is Vietnamese (*Kinh)* representing 86 percent of the population of Vietnam, 96 percent of migrants identify as either *Kinh* or *Hoa*, *Hoa* is the largest minority ethnicity (Pimhidzai, 2018; Singhal & Beck, 2015). Due to ethnic minorities being subjected to higher poverty levels, there are more liquidity constraints present for these groups, which can affect migration decisions (Coxhead et al., 2015; Pimhidzai, 2018; Singhal & Beck, 2015; The World Bank, 2019).

It is important to note that the migration decision is a result of multiple factors, where the lack of job opportunities can be one of the factors affecting migration, and environmental reasons can be another, which in turn can affect income and economic factors (Black et al., 2011). According to The World Bank (2019), 84 percent of those participating in the rural labour force can access a jobcentre within a day of travel, which creates opportunities to diversify income without migrating, and the distance to a city is therefore important to control for.

2.3. Determinants for migration

Migration in the Mekong Delta is associated with movements to urban cities either within, or close to, the region (Entzinger & Scholten, 2016). Since 2014 the agricultural employment activity in rural areas has decreased by approximately 4 percent per year, indicating movements towards non-agricultural sectors (The World Bank, 2019). Tarp (2017) remarks that even if there are movements towards employment in non-agricultural sectors is present, households in rural areas are still participating in the agricultural sector, but not as their main source of income. Provinces with higher monthly income per capita and higher urban population are more likely to have higher in-migration rate, in comparison to communes with the rural population and low income(Anh et al., 2012). Contrary, the unemployment rate, school dropout rates and lack of non-farm income are factors that decrease the chances of in-migration on a commune level (Anh et al., 2012; Phuong, Tam, Nguyet, & Oostendorp, 2008).

The wealth of the household will influence the decision to participate in migration, wealthier households (non-farm income, larger farmland) do not have as high of a likelihood of participating in migration of a household member compared to non-wealthy households, which is mainly attributed to the higher income levels and additional adaptation possibilities (Coxhead et al., 2015; Liu & Dang, 2019).

Depending on the financial means of households, Kleemans (2015) describes two types of migration strategies, migration can either be seen as a risk diversification strategy due to negative changes in income (*survival migration*) for example, due to loss of land, or migration can be seen as an investment strategy if the household has experienced a series of positive impacts on income, which can be in form of non-farm work opportunities or the ability to save up for migration (*profitability/investment migration)*[1]. With the help of panel data covering 20 years and 39 000 individuals in Indonesia, Kleemans (2015) make use of multinomial logit models and mixed logit models to estimate migration decisions and migration costs. The results indicate that migration costs are higher for poorer households (farm households), additional factors that increase migration costs are lower than secondary school education of the individual and age of the household head (Kleemans, 2015). These findings provide useful information regarding migration strategies and choice depending on income level, households with higher income will often see migration as an investment strategy and migrate over a longer period of time, compared to those with lower income levels, and might opt for more permanent migration rather than temporary migration. Poorer households that participate in migration frequently use migration as a form of income-diversification to handle risk for uncertain events or negative incomes, these households can still participate in investment migration but only if they have savings to cover the upfront cost

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[1] Unfortunately, it is not possible to compare income change and migration over time due to limiting sample size too much. However, the article from Kleemans (2015) do provide interesting information regarding risk and income diversification, particularly in terms of migration decisions where the household income level can determine short/long term migration and short/long distance migration patterns, as well as how different households cope with changes. Weather shocks were found to decrease welfare amongst the individuals who migrated.

(Kleemans, 2015). In terms of the impact of weather, Kleemans (2015) finds that sudden weather events resulted in temporary migration, and increased the notion of *survival migration,* particularly since weather limits the ability to save for migration, limiting households to participate in *profitability/investment migration*.

In the context of income levels and livelihood in the Mekong Delta, Van Hoang, Tran, Nguyen, and Nguyen (2019) finds that households engaging in either formal work (waged work in businesses and enterprises, or work with labour contracts), self-engagement in business (have a business that earns income for the household) or self-employment in agriculture (owning land that makes a profit for the households), has higher income levels in comparison to household participating in the informal work sector (employment in agriculture or manual labour, or work with no labour contract) or non-labour income sources (remittances, loans et centra). To classify these different livelihood/income-based strategies Van Hoang et al. (2019) used VHLSS data from 2016 and cluster analysis methods, followed by statistical analysis using a multinomial logit model to compare different income groups. In addition to findings of livelihood strategies the study further investigated the relationship of owning land and income levels, the results yield that 80 percent of the total annual crop land belonged to 20 percent of household, this was examined using the Lorenzo curve. Furthermore, Van Hoang et al. (2019) identified that households with more household members have a higher probability of having employment in the informal sector, additionally, the education level of the household head plays a role in the probability of the household's participation the formal work sector, where higher education level indicated a higher likelihood of work in the formal work sector.

To analyse determinants of migration in Vietnam and their impacts Phuong et al. (2008) analysed VHLSS data from 2002 and 2004. Using a probit model with household and individual characteristics, Phuong et al. (2008) found that households with more household members engaged in migration to a larger extent compared to a household with fewer household members, the main reason for this is due to access labour which made it possible to gain from migrating. In addition to the findings that household size matters, the authors also mention that individual, household, and communal characteristics play a role. Regarding non-farm income the study indicates that non-farm employment reduces the short-term migration, but has little effect on long-term migration(Phuong et al., 2008). The authors further discuss limitations with the VHLSS data such as only including permanently registered household and having limited questions regarding migration.

The findings of Van Hoang et al. (2019) and Phuong et al. (2008) illustrates that commune, household and individual characteristics can contribute to different adaptation strategies of the households; these findings are further strengthened with findings in Coxhead et al. (2019) article that researched internal migration in Vietnam. Coxhead et al. (2019) used VHLSS data of 2010 and 2012, where findings imply that post-secondary education for household members increased their likelihood of participating in migration compared to no schooling, another variable that increased the likelihood of migration was if

the household has smaller landholdings. Age and gender of the household head provided evidence that female-led household had a higher out-migration rate, additionally, up until the household head is 67 years old the probability of migration is found to increase. There is also evidence indicating that if the household has previously sent out a family member for migration, the likelihood of participating in migration decreases, an explanation to this could be the higher migration cost of the second family member. Lastly, being of a minority ethnicity (non-Kinh) decreases the likelihood of participation in migration (Coxhead et al., 2019). To analyse the differences between migrant and non-migrant households Coxhead et al. (2019) applied a logistic regression model, later adapted to a multinomial logit model to investigate differences in migration location choices.

Additional characteristics that can influence the likelihood of participation in migration is if the household is in debt or not, dept from loans or borrowed money can help households to cover migration costs, however, it can also be an indicator that loans are needed to cover basic costs which can be due to generally lower income levels, and the household might not be able to cover migration costs either way (Cuong & Linh, 2018). Many households that engaged in farm work went into debt after the 2016 drought due to taking loans to restore their farmland for the upcoming crop season (UN Vietnam, 2016c). Another household characteristic to include is if the household lives in a permanent house or not, living in a permanent house (brick construction house with concrete roof) can indicate higher wealth levels, thus, the likelihood of sending out a migrant decrease (Coxhead et al., 2019). Education of household members was found to be important characteristics when researching migration behaviour on an individual level, higher education levels of individual increased migration (Anh et al., 2012; Coxhead et al., 2015; Pimhidzai, 2018; The World Bank, 2019). There is, however, a difference in the education level of the household head, a higher level of education of the household head decreases the likelihood of participating in migration (Cuong & Linh, 2018).

In terms of non-household characteristics that can influence migration, communal characteristics also play a role, as mentioned previously, out and in-migration of the commune can determine the likelihood of migrating. In relation to the Classic Migration Theory, social, or migration, network on a commune level is also a characteristic that can have a positive influence on the migration decision. Coxhead et al. (2019) defines migration network as the share of out migrated in the commune in relation to the number of residence, and it is believed that social/migration network can help migrants to find jobs in the migration locations (Coxhead et al., 2019; Dang, 2019; GSO & UNFPA, 2016). Additional commune characteristics that can influence the likelihood of migrating is if the commune is poor, poorer communes can lack resources and non-farm job opportunities, which increase the likelihood of migrating to diversify income(Phuong et al., 2008).

As an end note, The World Bank (2019) also mentions that migration can cause lower productivity in regions with high out-migration rate due to those that do stay are often older, and are less productive

and lack education and knowledge regarding new adaptation techniques (Szabo et al., 2016; The World Bank, 2019).

The next section will regard literature in relation to the influence of environmental changes and migration.

2.4. Migration due to environmental change

In terms of the impact of environmental changes on migration, or, environmentally induced migration, most research concludes a general difficulty in determining and establishing a conceptualized framework within the field (Bilsborrow & Henry, 2012; Cattaneo et al., 2019; Fussell et al., 2014; Kaczan & Orgill-Meyer, 2019). Even though a common framework is lacking, as discussed in Section 2.1 there is a general view that household and individual characteristics play an important role in the migration decisions, and therefore a model that can incorporate these characteristics should be used, either on an individual or household level (Bilsborrow & Henry, 2012; Cattaneo et al., 2019; Warner et al., 2010).

Regarding environmental change and migration in the Mekong Delta, most research has focused on fast-onset changes (flooding and rainfall), compared to slow-onset environmental changes (droughts, sea-level rise and erosion). Migration due to that fast-onset environmental changes is more commonly associated with temporary migration, where household return to their original residency after the event is over (Cattaneo et al., 2019; Dun, 2011; Gray & Bilsborrow, 2013; Warner et al., 2010).

The view of slow-onset environmental changes and its impacts on migration does differ between authors, some authors discuss that due to the longer impact time, the household has time to adapt to the changes and thus, migration will decrease in the future (Entzinger & Scholten, 2016; Koubi et al., 2016). Some authors argue the opposite, due to slow-onset changes, households that reside in areas affected by droughts might not have the financial needs to migrate due to the changes affecting crops and other income sources over a longer period, creating the notion of *trapped households*, households that want to migrate but lack financial resources (Cattaneo et al., 2019; Kaczan & Orgill-Meyer, 2019; Koubi et al., 2016; Tacoli & Mabala, 2010). *Forced migration* is another term that is discussed in both the literature of fast-onset environmental change and slow-onset environmental change, households are forced away from their residency due to dangerous conditions of the destruction of land, and cannot stay even if they wish to do so (Cattaneo et al., 2019; Kaczan & Orgill-Meyer, 2019; Koubi et al., 2016; Tacoli & Mabala, 2010). Slow-onset changes can, as mentioned at the beginning of this section, also result in more households being able to save to cover the cost of migration (Kaczan & Orgill-Meyer, 2019).

Cattaneo et al. (2019) researched human migration and environmental change on a larger scale by conducting a literature review over current articles relating to environmentally induced migration and finds that, in general, there are two views on the impact of slow-onset environmental changes. On one

hand, slow-onset environmental changes could help households to adapt over a longer period since the changes are gradual, on the other hand, slow-onset changes can also result in loss of livelihood over a longer time, which can result in households being trapped in their location due to lack of income (Cattaneo et al., 2019).

Another study of the empirical literature, conducted by Kaczan and Orgill-Meyer (2019), finds that slow-onset climatic changes result in increased migration in comparison with fast-onset changes, mainly due to fast-onset changes being associated with temporary movement rather than permanent. Additionally, fast-onset changes can cause instant destruction of livelihood, and therefore, result in households not being able to invest in migration over longer distances. On the other hand, slow-onset changes can result in more household being able to migrate due to having the option to gather resources to engage in migration, and thus the migration will increase (Kaczan & Orgill-Meyer, 2019).

Entzinger and Scholten (2016) researched adaptation to climate change through migration in the Mekong Delta through interviews with 1232 households, 65 percent of these had at least one migrant. They found that the main reason for migration was not environmental reasons, but economic ones. Environmental reason did, however, have some influence in the migration decision. The households who did indicate that climate change was the main reason for migrating pointed towards more fast-onset environmental changes, rather than slow-onset environmental changes, as their primary motive for migrating. Households engaged in migration were found to have lower income compared to households that did not engage in migration. Lower quality of housing does also increase the chance of participating in migration, which relating to the findings of Coxhead et al. (2019). Remittance did not seem to have a large effect, and out of those migrant household surveyed, 911 households did not receive any remittance, but migrants did, however, experience higher income in the destination cities. These remittance findings tend to differ from other studies, where remittance has been of importance for households, in particular in the case of migration for income-diversification (Cuong & Linh, 2018; Liu & Dang, 2019).

Bastakoti et al. (2014) researched climatic and environmental changes on a farm level in the Mekong Delta and finds that salinity levels (in canals) are particularly high during the droughts, which is when farmers are dependent on canals as their main source of water, enabling them to irrigate their crops, however if the water is saline farmers cannot use the water. According to Bastakoti et al. (2014) survey, 77 percent out of the 150 households interviewed indicated an increase in drought within the last 20 years, and 67 percent indicated problems related to salinity intrusion. Diversification of income and crops amongst farmers are increasing as a strategy for changing environment, changing crops during droughts is still the most common way to adapt, but can be limited to wealthy households. Observations were made that indicated that local authorities provided help at the starting stages of these diversification strategies, but the strategies and help vary between communes (Bastakoti et al., 2014).

Koubi et al. (2016) researched environmental stressors and migration in Vietnam with the help of self-conducted survey questions of 1200 individuals, half of which had migrated, and the other half had not. The study used a logistic regression model together with indicators from the survey regarding environmental changes. The survey indicates that slow-onset environmental changes did not affect the likelihood of participating in migration, however, fast-onset environmental changes did. Koubi et al. (2016) do acknowledge that the empirical literature finds that slow-onset environmental change should influence migration, but they could not find evidence of this in their survey-based research, instead, they argue that slow-onset environmental changes result in other adaptation techniques than migration.

To summarize, environmental changes are not the main reasons for engaging in migration in the Mekong Delta, however, environmental changes may cause economic stress due to loss in livelihood, which in turn increases migration, especially as environmental changes are expected to increase according to IPCC (2014).

In terms of analysing data, a common method to use in terms of environmentally induced migration are survey data which is analysed with the help of logistic regression models, either logit or probit models, which enabling research of differences between migrant and non-migrant households (Coxhead et al., 2015; Coxhead et al., 2019; Fussell et al., 2014; Koubi et al., 2016; Nguyen et al., 2015).

In the next section, the data collection and methods used to reach the aim of this thesis is discussed.

3. Data and methods

This thesis hypothesis that the drought of 2016 influenced migration in the Mekong Delta, resulting in a change in the likelihood of a household member participating in migration, which is based on the framework of Black et al. (2011) where the authors discussed that environmental events are a driver for migration. The main environmental event being studied are slow-onset environmental changes, in particular the 2016 drought, in comparison with fast-onset environmental changes such as floods. Characteristics of the household head, household and communes are believed to influence the behaviour of migration. To research differences in migration decisions, households with at least one migrant are compared to households without a migrant using both descriptive statistics and a logarithmic regression model.

The definition of a migrant has been adapted from the original data, instead of including all people over the age of 6 that has been away from the household for more than 6 months in a 12-month period only member over the age of 15 was considered a migrant since they can legally participate in the labour market. The definition of a migrant is

A person over the age of 15 that has been away from household for more than 6 months during a 12-month period to work to provide income

The main part of the analysis has used data collected by the General Statistical Office of Vietnam (GSO) and is a part of the bi-annual household and commune level survey in Vietnam (Vietnamese household livings standard survey (VHLSS) and was analysed using STATA-16. A total of 45 files (per year) was translated from Vietnamese to English with the help an English version of the VHLSS questioner in Microsoft Excel, and then data were merged to a single data file in STATA.

The VHLSS data covers the years 2014, 2016 and 2018 has been analysed to study recent migration choices before, during and after the drought in the Mekong Delta, Vietnam. The number of households found in the survey for the Mekong Delta region differed between years, in 2018 the sample size was 9300 households, in 2016 it was 9510 households and in 2014 a total of 9531 households were surveyed. Regarding communes that were surveyed, the response rate differs between 200-400 communes depending on the dataset, communes have been matched on a household level. Using the definition of a migrant as defined above resulted in a sample size of 1420 migrant household (15.3 percent) in 2018 , 1334 migrant household (14.1 percent) in 2016 and 1376 migrant households (14.3 percent) in 2014 where a household has at least one migrant and resides in the Mekong Delta.

As a proxy for environmental events, apart from information in the VHLSS data, data regarding mean salinity levels in the Mekong Delta has been provided by Maaike Van Aalst (from an article published by Eslami et al. (2019). Additionally, data regarding the percentage of poor households on a commune level was also provided from Maaike Van Aalst, this was added to the data analysis since the VHLSS data lacked information regarding poor households on a commune level, the data is from AgriCensus.

3.1. Answering the research questions

As presented in Section 1 *Introduction*, the research questions are related to which the typical household characteristics that influence migration in the Mekong Delta are, how the income distribution differ between households with a recent migrant and those without, and the potential change in the likelihood of migration after the 2016 drought.

To answer the research questions three different methods were applied. To summarize, the first question related to the typical characteristics of migrant households was answered using descriptive statistics on key household and commune characteristics, along with an overview of average salinity levels in coastal, inland and low mountainous regions which are displayed in section 3.1.1. The second research question referring to income distribution was answered using income percentiles and the method used is shown in Section 3.1.2. The last research question, which relates to estimation of the likelihood of participating in migration was answered using logistic regression models which makes it possible to estimate how different characteristics influence the likelihood of migration, and the workhorse model is presented in section 3.1.3.

3.1.1. Typical characteristics to determine the likelihood of participating in migration

In order to answer the first research question regarding typical characteristics that influence the migration decisions, information from the literature review was used to collect important characteristics and analysed from the VHLSS data by using descriptive statistics, a summarization of the included characteristics is provided in Table 1. In Appendix 1 a detailed description of the variables has been provided. The data was then compared between households with at least one migrant (migrant households) and households without a migrant (non-migrant households).

Table 1 Characteristics from previous literature that affect migration decisions

Category	Variables	Example of articles where characteristics, or similar ones, have been mentioned
Household head	Age	Anh et al. (2012), Coxhead et al. (2019), Kleemans (2015), Phuong et al. (2008)
	Female	Anh et al. (2012), Coxhead et al. (2019), Kleemans (2015), Phuong et al. (2008)
	Education level	Cuong and Linh (2018)
Household characteristics	Income from: Formal wage, informal wage, self-engagement in business, self-employment in agriculture, non-labour sources	Van Hoang et al. (2019)
	Minority ethnicity	Coxhead et al.(2019), Pimhidzai(2018),
	Permanent house	Coxhead et al. (2019), Entzinger and Scholten (2016)
	Household size	Coxhead et al. (2019) Phoung et al. (2008)
	Farm size (Small (<1 HA), Medium (1-2 HA) or large farm (>2 HA))	Coxhead et al. (2019), Khalil, Conforti, Ergin, and Gennari (2017) and Rapsomanikis (2015) defines farmers according to FAO definitions
	The household has borrowed money or has unpaid loans	Nguyen et al. (2015)
	Living standard changes	Kleemans (2015)
Commune characteristics	Percentage of poor households in the commune	Phuong et al. (2008)
	Migration Network	Coxhead et al. (2019)
	Distance in Kilometres to town/provincial city/major city	Coxhead et al. (2019)
	Mean value of salinity as an indicator of salinity intrusion	Entzinger and Scholten (2016), Koubi et al. (2016), Van Hoang et al. (2019)
	Droughts in commune within the last 3 years	Cuong and Linh (2018),Entzinger and Scholten (2016), Koubi et al. (2016),
	Commune have savings or lending options	Dung et al. (2017)
	Decrease in yield compared to 5 years ago	Van Hoang et al. (2019)

3.1.2. Methods to research the income distribution between households

To answer the second question regarding income distributions amongst the surveyed households in the Mekong Delta, different household characteristics such as being a female household head and the difference in income levels illustrate general income differences, followed by analysis of the income percentiles were used. The surveyed households were divided into six percentile groups depending on their total income (adjusted for inflation, see Equation 1); the lowest 10 percent of income earners, 10-25 percent of income earners, 25-50 percent of income earners, 50-75 percent of income earners, 75-90 percent of income earners and finally the top 10 percent of income earners. From the initial distribution of all households, the groups were separated into migrant and non-migrant households so the income differences could be analysed. To adjust for inflation, the consumer price index (CPI) was used, the base year is 2010 ($CPI_{2010} = 100$), and for the studied period the following CPI values were reported by The World Bank (2020); $CPI_{2014} = 143.644$, $CPI_{2016} = 148.407$, $CPI_{2018} = 159.07$

$$\frac{Total\ yearly\ income}{CPI-value} * 100 = Inflation\ adjusted\ value \quad (Eq.1)$$

3.1.3. Method to estimate characteristics that influence the likelihood of migration

To compare the likelihood of having a migrated household member (being a migrant household), a logistic regression model was used, where the dependent variable was whether or not the household has a migrant, modelled as a binary choice, 1 indicated a household with at least one migrant, and 0 indicated a non-migrant household. As of the expected change of the likelihood of participating in migration, displayed in Table 2, further details regarding the reasoning behind the expected sign can be found in Appendix 1 V*ariable description and expected effect.*

Table 2 Expected impacts of variables on the likelihood of participating in migration

Category	Variables
Household head characteristics	Age (+)
	Female (+)
	Education level three groups:
	1. no education (+)
	2. primary education (-),
	3. Secondary school or higher education (-)
Household characteristics	Minority ethnicity (-)
	Household size (+/-)
	Farmer size: small (+), medium(+/-), large(-)
	Income groups percentiles (< 10% (+), 10-25% (+), 25-50% (+/-), 75-90%(-), > 90% (-))
	Worsened living standard (+/-)
	Income from: formal sector (-), informal sector (+), self-employment in agriculture (+), self-engagement in business (-), non-labour sources (+)
	Household has borrowed money (+/-)
	Household has taken loans (+/-)
Commune characteristics	Percentage of poor households in the commune (+)
	Migration network (from 2 years previous) (+)
	Distances in kilometre to the closest town, province town and major city (+/-)
	Mean salinity value (+)
	Droughts in the commune within 3 years (+)
	If the commune has savings and lending options (formal or informal) (+/-)
	Decrease in yield compared to 5 years ago)(+)

Note: (+) represents a positive effect, (-) represents negative effects and (+/-) represents that influenced can depend on different circumstances. A more detailed description of the likelihood and the rationale behind the signs can be found in Appendix 1 *Variable description and expected effect.* The expected effects are derived from the literature

Using the logistic regression model presented in Equation 2 and 3 enables estimation of the potential impact of distinct characteristics on the likelihood of participating in migration. To control for how distinct characteristics influenced the results of the likelihood of migrating, 14 models were used, a summary of the models are displayed in Table 3.

$$P(y_{ijk} = 1|X) = F(\alpha + Household\ Head_{jk}\delta + Household_{ijk}\gamma + Commune_k\theta) \qquad \text{(Eq. 2)}$$

$$P(y = 1|X) = \frac{e^{X\beta}}{1 + (e^{X\beta})}$$

$$P(y_{ijk} = 0|X) = F(\alpha + Household\ Head_{jk}\delta + Household_{ijk}\gamma + Commune_k\theta) \qquad \text{(Eq. 3)}$$

$$P(y = 0|X) = \frac{e^{X\beta}}{1 + (e^{X\beta})}$$

$$X\beta = Household\ Head_{jk}\delta + Household_{ijk}\gamma + Commune_k\theta$$

y_{ijk} represents the dependent variable, if y_{ijk}=1 the household has a migrant (Equation 2) and if y_{ijk}= 0 if the household did not have a member migrate (Equation 3). j stands for household head characteristics, i represents household characteristics and k represents commune characteristics.

Table 3 Summary of the logistic regression models

Model	Variables included in the models
1	Age, Gender (female =1), education group (no education, primary school education, over primary school education).
2	Age, Gender (female =1), Household size, Minority ethnicity, living in Permanent House, Farm size(small, medium or large).
3	Age, Gender (female =1), Income percentile group.
4	Age, Gender (female =1), Income percentile group, living standard group (improved or worsened), Informal wage, self-employment in agriculture, Non-labour income sources, formal wage, self-engagement in business, household has taken loans, household has borrowed money.
5	Age, Gender (female =1), Informal wage, self-employment in agriculture, Non-labour income sources
6	Age, Gender (female =1), formal wage, self-engagement in business, taken loans, borrowed money
7	Age, Gender (female =1), Income percentile group, Informal wage, self-employment in agriculture, Non-labour income sources, formal wage, self-engagement in business
8	Kilometre distance to town, provincial town and major city
9	Migration network (2 years prior), a place to save money in the commune, formal borrowing options in the commune, informal borrowing option in the commune
10	Commune has a decrease in yield and mean salinity level in commune
11	Commune has experienced drought within the last 3 years (yes = 1)
12	All commune characteristics (model 8-10)
13	All household characteristics (model 1-7
14	Both household and commune characteristics (model 1-10)

4. Results

This section is divided into three different headlines where the result from each of the research questions has been presented in chronological order.

4.1. Descriptive statistics; changes over time

The full tables, including maximum and minimum values, and commune characteristics, can be found Appendix 2 *Differences between migrated and non-migrant households,* while a summary of non-migrant and migrant household observations, mean values and standard deviations can be found in Table 4 and Table 5 at the end of this section. The third section regards mean salinity levels over time for different geographical areas and is displayed in Table 6.

4.1.1. Differences in characteristics from surveyed households in the Mekong Delta

4.1.1.1. Household head and household characteristics

Like findings in previous literature, migrant households have, on average, *older* household heads, Table 4 and Table 5 indicates that, on average, migrant household heads are 2 years older than non-migrant households. Regarding the gender of the household head, it is more common to have a male household head, for all surveyed household. The share of *female household heads* is a few percent higher for a migrant household in comparison to non-migrant household, with the highest difference being 2 percent after the drought (29.1 percent in migrant households versus 27.2 percent in non-migrant households).

Concerning *education*, the descriptive statistics confirm the findings in the literature that migrant household head has, on average, lower education level. The share of migrant household heads *without education* is around 41 percent, while for non-migrant household the share is 31 percent, there has not been large variation in education level before and after the drought. Approximately 36 percent of all surveyed household head has *Primary school education,* while the share of *higher than primary school* education household head is around 10 percent higher for non-migrant households in comparison with migrant households (33 percent in non-migrant households versus 22 percent for migrant households).

Table 4 and Table 5 reports that a majority of households are of the *ethnic* majority, comparing non-migrant and migrant households, the latter of the two households has a higher share of *minority ethnicity* households (12 percent versus 7 percent), the share has not changed after the drought.

Regarding household characteristics, a majority of households lives in a house with *permanent housing structure,* in the studied period there has been an increase in the percentages of household living in these types of housing, for migrant households, there was an increase from 54 percent in 2014 to 62 percent in 2018, whilst for non-migrant households, the difference was from 60 percent in 2014 to 72 percent in 2018. The share of the surveyed households living in *permanent housing* increased with 2 percent for migrant households and 5 percent for non-migrant households after the drought.

The average *household size* is constant in the period, the average size for non-migrant households is 4 people per household, while for migrant household the average size is 3 people per household. On average, there are 1 person per household (1.4-1.45 people) that participate in migration in 2016-2018.

A majority of the households, both migrant households and non-migrant household, receive income from the *informal wage sector* in comparison to the *formal wage* one, the share is slightly higher for migrant households (70 percent), compared to non-migrant households (63 percent). It is more common to participate in *self-employment in agriculture* in comparison to self-engagement in business, the share of households engaging in self-employment in agriculture is around 55 percent for migrant households (decreased around 2 percent after the drought). For non-migrant households, the share of households in self-employment in agriculture after the drought was around 45 percent, a decrease of 4 percent in comparison to 2016 and 2014 values. The income from *self-engagement in business* is steady at 22 percent for non-migrant households and around 15 percent for migrant households. The share of migrated households that were *self-engagement in business* increase with around 2 percent in 2016, but later decreased to similar levels as 2014 (15 percent). Most of the household also receives *income from non-labour sources*, the percentage share is around 82 percent for non-migrant households and 96 percent for migrant households and has not changed before or after the 2016 drought.

There is a larger share of migrant households (38 - 43 percent) that has *unpaid loans* in comparison to non-migrant households (28-33 percent), the percentage share was around 5 percent higher in the year of the drought compared to after, this holds for both types of households. The share of households that *borrowed money* was higher in 2014 and 2016 in comparison to 2018 levels and is around 21 percent for the survey households.

There are between 60-65 percent of the surveyed households that owns agricultural land, the *average land size* is around 1 hectare (HA) and is slightly higher for non-migrant households in comparison to migrant households. It is more common for non-migrant households to own *larger land* areas (15 percent versus 10 percent). Regarding having *small land areas*, between 70-75 percent of migrated households had a small land plot, which is slightly lower for non-migrated households (65 percent). After the drought, there was a decrease in the number of migrated households that owned smaller plots of land (from 75 to 70 percent), while the share was stable at 65 percent for non-migrated households.

A majority of the households has indicated as having better *living standards*, however, in 2016 the share of migrant household indicating having better living standard decreased with around 1.5 percent in comparison to before the drought after the drought there was an increase with around 4 percent of households indicating better living standards. For non-migrant household 76 percent indicated better living standards in 2014 and 2016, in 2018 the share increased to 80 percent.

4.1.2. Commune characteristics

The first notable difference when comparing the commune characteristics varies in sample sizes, matching commune characteristics on a household level results in that not all households are covered, which is a limitation with the data. Apart from that, the *average distance* from different types of towns from the commune centre are quite similar, varying around 11 kilometres from a *major city*, 80-90 kilometres to a nearby *town* and 32 kilometres to the nearest *village centre* in the studied period. The percentage of poor households in the commune is steady at around 17 percent. All communes have a *place where households can save money*. Regarding *borrowing money*, it is more common to have an informal institution where the household can borrow money from in relation to formal instruction, the percentage share has not changed after the drought and is around 32 percent for informal institutions and 26 percent for formal institutions.

Regarding environmental factors, the VHLSS data contained some information that could be useful as a proxy, for example, the *decrease in yield compared to 5 years ago*, the tables in Appendix 2 indicates that there is around a 1 percent increase per year in communes that has reported a decrease in yield, the percentages were 8 percent in 2014 and 10 percent in 2018. The data also provide information regarding if the *commune has experienced natural disasters or droughts within the last 3 year*s, comparing the percentages, the value was highest in 2016. In 2014 the value was the lowest with less than 1 percent of communes indicated a drought, however, the sample size is relatively low which is related to the shortcomings of the data where not all communes are interviewed. In 2016, 23.5 percent of communes indicated being affected by droughts within the last 3 years, and in 2018 the value decreased to 19.4 percent. The data indicates an increased level of communes having experienced drought in the year of the 2016 drought which is in relation to what would be expected since it was in 2016 the worst drought in 90 years hit.

Table 4 Descriptive statistics for households without a migrant (non-migrant households)

Year	2014	Obs.	Total	2016	Obs.	Total	2018	Obs.	Total
Households		8,164 85.7%	9,540		8,176 85.9%	9,510		7,871 84.6%	9,300
Variable	Obs.	Mean 2014	Std.Dev	Obs.	Mean	Std.Dev	Obs	Mean	Std.Dev
Age of Household head	8,164	51.63	13.992	8,176	52.688	13.6	7,871	53.954	13.36
Female Household head	8,164	.276	.447	8,176	.272	.445	7,871	.274*	.446
No Education (household head)	7,583	.347	.476	7,605	.327	.469	5,900	.306	.461
Primary school education (household head)	7,583	.355	.479	7,605	.361	.48	5,900	.362	.481
Higher than primary school education (Household head)	7,583	.298	.457	7,605	.312	.463	5,900	.332	.471
Minority ethnicity	8,164	.08	.271	8,176	.071	.258	7,871	.071	.257
Household lives in permanent structure house	8,159	.604	.489	8170	.666	.472	7,868	.721	.449
Household size	8,164	3.89	1.565	8,176	3.841	1.574	7,871	3.752	1.601
Household has agricultural land	8,164	.492	.5	8,176	.607	.488	7,871	.603	.489
Income from Informal Wage	6,872	.628	.483	6837	.639	.48	6,475	.633	.482
Self-Employment in agriculture (Farm income)	8,164	.489	.5	8,176	.495	.5	7,871	.455	.498
Income from Non-labour income source	8,163	.861	.346	8175	.834	.373	7,871	.821	.383
Income from Formal Wage	6,872	.385	.487	6837	.378	.485	6,475	.383	.486
Income from Self Engagement in business (Non-farm income)	8,164	.223	.416	8,176	.223	.416	7,871	.222	.416
Household has unpaid loans	4,079	.311	.463	8,176	.327	.469	7,871	.279	.448
Household borrows money	4,079	.199	.4	8,176	.212	.409	7,871	.179	.383
Total Land Surface (HA)	4,016	1.076	1.451	4,966	1.14	1.576	4,745	1.19	2.507
Small farmer (< 1HA) (yes = 1)	4,016	.673	.469	4,966	.65	.477	4,745	.657	.475
Medium Farmer (1-2 HA) (yes = 1)	4,016	.183	.387	4,966	.198	.398	4,745	.189	.391
Larger Farmer (> 2 HA) (yes = 1)	4,016	.144	.351	4,966	.152	.359	4,745	.154	.361
Living standard improved compared to 5 years ago	4,071	.761	.427	8,166	.76	.427	7,856	.8	.4
Living standard did not improve compared to 5 years ago	4,071	.239	.427	8,166	.24	.427	7,856	.2	.4

Table 5 Descriptive statistics for households with a migrant (Migrant households)

Year	2014	Obs.	Total	2016	Obs.	Total	2018	Obs.	Total
Households		1,376 14.3%	9,540		1,334 14.1%	9510		1,429 15.4%	9300
Variable	Obs.	Mean 2014	Std.Dev	Obs.	Mean	Std.Dev	Obs	Mean	Std. Dev.
Age of Household head	1,376	54.756	11.252	1,334	55.084	10.934	1,429	56.36	11.434
Female Household head	1,376	.262	.44	1,334	.274	.446	1,429	.291	.454
No Education (household head)	1,254	.436	.496	1179	.409	.492	1,025	.413	.493
Primary school education (household head)	1,254	.36	.48	1179	.366	.482	1,025	.366	.482
Higher than primary school education (Household head)	1,254	.204	.403	1179	.225	.418	1,025	.221	.415
Minority ethnicity	1,376	.119	.324	1,334	.124	.33	1,429	.122	.328
Household lives in permanent structure house	1,375	.54	.499	1,334	.594	.491	1,429	.621	.485
Household size	1,376	3.339	1.514	1,334	3.157	1.419	1,429	3.115	1.44
Number of migrants	1,373	1.44	0.755	1,334	1.397	0.654	1,429	1.45	0.711
Household has agricultural land	1,376	.533	.499	1,334	.655	.475	1,429	.652	.476
Income from Informal Wage	1,139	.675	.469	1,124	.692	.462	1,150	.711	.453
Self-Employment in agriculture (Farm income)	1,376	.578	.494	1,334	.574	.495	1,429	.551	.498
Income from Non-labour income sources	1,376	.965	.184	1,334	.962	.192	1,429	.962	.191
Income from Formal Wage	1,139	.328	.47	1,124	.321	.467	1,150	.298	.458
Income from Self Engagement in business (Non-farm income)	1,376	.152	.359	1,334	.169	.375	1,429	.151	.358
Household has unpaid loans	703	.401	.49	1,334	.433	.496	1,429	.379	.485
Household borrows money	703	.23	.421	1,334	.244	.429	1,429	.225	.418
Total Land Surface (HA)	734	.837	1.068	874	.847	1.115	932	.936	1.587
Small farmer (< 1HA) (yes = 1)	734	.745	.436	874	.753	.432	932	.708	.455
Medium Farmer (1-2 HA) (yes = 1)	734	.173	.379	874	.166	.372	932	.188	.391
Larger Farmer (> 2 HA) (yes = 1)	734	.082	.274	874	.081	.273	932	.104	.306
Living standard improved compared to 5 years ago	703	.767	.423	1,333	.744	.436	1,428	.782	.413
Living standard did not improve compared to 5 years ago	703	.233	.423	1,333	.256	.436	1,428	.218	.413

4.1.3. Salinity in different regions

In Table 6, an overview of the mean salinity levels is provided. As the table indicates, only around 8 percent of the surveyed households in the Mekong Delta live in a coastal area. The average salinity level for coastal regions increased in 2016, communes in inland deltas reports a lower salinity level in 2016. After the drought (2018) the salinity levels were still higher for coastal communes in comparison with the average level in 2014. For inland deltas, the salinity level increased after the drought, and was higher compared to previous years.

Table 6 Mean salinity levels in different geographic regions of the Mekong Delta

	Percent of communes 2014	Mean 2014	Std. Dev. 2014	Percent of communes 2016	Mean 2016	Std. Dev. 2016	Percent of communes 2018	Mean 2018	Std. Dev. 2018
Coastal	8.21%	19.75	11.99	8.09%	21.57	11.05	8.21%	20.62	11.75
Inland delta	90.36%	4.28	8.96	91.59%	3.41	7.27	90.36%	4.72	9.58
Mountainous	1.43%	0	0	0.32%	0	0	1.43%	0	0
Total	100.00	5.50	10.15	100.00	4.83	9.06	100.00	4.25	9.12

Note: in 2018 the mean salinity levels of 2017 were used due to lack of data in 2018.
A value of 0 in the Mean column indicates that there has been no salinity intrusion.
Source: own calculations from salinity data was from the AgriCensus and combined with VHLSS data to estimate mean salinity levels, the ata was provide by Maaike Van Aalast and provides information of salinity levels for different communes in the Mekong Delta.

4.2. Income Distribution

4.2.1. Income differences between different household head characteristics

Table 7 regarding income (in 1000's VND) shows a trend that indicates that the average income level has increased, similar results as discussed below were found for migrant and non-migrant households, the main difference was that, overall, migrant household had lower income levels, see Appendix 3.

Table 7 indicates that *female household heads, minority ethnicities, household heads with lower education, smaller farmers* and households that have experienced *negative living standard changes* have lower income levels than their counterpart. Households that have indicated *negative living standard changes* earn almost 50 percent less income than households that have experienced positive living standard changes.

Table 7 Average income levels in (in 1000 VND) for surveyed households

Gender of household heads

	Freq. 2014	Mean 2014	Std. Dev.	Freq. 2016	Mean 2016	Std. Dev.	Freq. 2018	Mean 2018	Std. Dev.
Male	6,927	76,052	114,622	6,924	84,108	101,766	6,724	98,575	117,230
Female	2,613	64,224	115,710	2,586	68,831	85,802.	2,576	80,134	105,907
Total	9,540	72,812	115,036	9,510	79,953	97,915	9300	93,467	114,498

Farm size

	Freq. 2014	Mean 2014	Std. Dev.	Freq. 2016	Mean 2016	Std. Dev.	Freq. 2014	Mean 2014	Std. Dev.
Small (<1 HA)	3,251	59,434	54,993	3,888	67,773	64938	3,777	84,569	95,068
Medium(1-2HA)	861	82,412	62,961	1,128	84,282	78881	1,070	102,155	105,168
Large (>2 HA)	638	137,769	309,988	824	129,300	151361	830	137,244	142,251
Total	4,750	74,121	127,989	5,840	79,643	87,654	5,677	95,585	106,741

Ethnicity of households

	Freq. 2014	Mean 2014	Std. Dev.	Freq. 2016	Mean 2016	Std. Dev.	Freq. 2014	Mean 2014	Std. Dev.
Majority	8,724	74,348	119,003	8,760	81,579	100,525	8,564	95,444	117,770
Minority	816	56,389	54,912	750	60,970	56,149	736	70,472	60,819
Total	9,540	72,812	115,036	9,510	79,953	97,915	9,300	93,467	114,498

Living standard change

	Freq. 2014	Mean 2014	Std. Dev.	Freq. 2016	Mean 2016	Std. Dev.	Freq. 2014	Mean 2014	Std. Dev.
Positive	3,637	83,174	163,549	7,199	90,213	107,221	7,401	103,229	124,334
Negative	1,137	44,339	37,212	2,300	47,958	47,913	1,883	55,669	46,334
Total	4,774	73,925	144,844	9,499	79,982	97,958	9,284	93,583	114,561

Education level

	Freq. 2014	Mean 2014	Std. Dev.	Freq. 2016	Mean 2016	Std. Dev.	Freq. 2014	Mean 2014	Std. Dev.
No education	3,179	60,527	144,052	2,966	65,157	76,114	2,227	76,123	81,086
Primary school education	3,143	70,727	66,435	3,179	79,635	92,412	2,512	90,635	97,147
Higher than primary school	2,515	97,742	125,100	2,639	106,353	126,922	2,186	120,698	150,448
Total	8,837	74,746	117,109	8,784	82,773	100,795	6,925	95,458	114,057

4.2.2. Income distribution of migrant and non-migrant households

Comparing the income percentile groups between migrant households and non-migrant households, indicates that migrant household has, on average, lower income levels (see Table 8). A larger share of migrant households can be found in the lowest income groups[2], 64 percent versus 47.45 percent. Households in the *lowest 10 percentile group* earn 1.7 percent of all income, while the *top 10 percent of income earners* earn 31.7 percent of all income (see Coef. Column in Table 8). Overall, the average income levels have increased for all surveyed households between 2014 and 2018, with a large increase between 2016 and 2018.

Comparing the different percentile groups in Table 8 indicates that the average income level has increased more for the higher income groups in comparison to the lower income groups. The differences in the mean total income between surveyed migrated and non-migrant households has increased from 18 million VND in 2014 to 20 million VND in 2016 and around 25 million VND in 2018, the difference indicates that the income gap is growing over time. The difference in average income between the lowest 10 percentile group and the highest 10 percentile group for *All households* varies between 22.3 million VND in 2014 to 27.9 million VND in 2018, indicating that the income gap has grown bigger over time. Similar differences are found for *Migrant households* and *non-migrant households* when comparing the different groups within household types.

Investigating the difference in the *lowest 10 percentile group,* there is evidence that indicates that in 2014 and 2016 the average income level for this group was slightly higher for migrant households, however, in 2018 this changes that non-migrant household in the lowest 10 percent of income earners had higher income levels. Interestingly enough, the reverse can be found when looking at the *highest 10 percentile group,* the average value in 2014 and 2016 for migrant households in this group was lower in comparison to non-migrant households, however, in 2018 the average value was higher when comparing migrant household average income to non-migrant income.

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[2] Up until, and including, the *25-50 percentile group*

Table 8 Income distribution in form of percentile groups

All households	Obs 2014	Coef. 2014	Mean value of income	Obs. 2016	Coef. 2016	Mean value of income	Obs. 2018	Coef. 2018	Mean value of income
Lowest 10 percentile group	954 (10.00%)	0.018	13,013	951 (10.00%)	0.016	13,074	933 (10.03%)	0.017	16,082
10-25 percentile group	1,431 (15.00%)	0.055	26,509	1,426 (14.99%)	0.053	28,174	1,392 (14.97%)	0.055	34,383
25-50 percentile group	2,387 (25.02%)	0.148	43,058	2,379 (25.02%)	0.146	46,810	2,325 (25.00%)	0.151	56,286
50-75 percentile group	2,383 (24.98%)	0.236	68,690	2,377 (24.99%)	0.238	75,969	2,325 (25.00%)	0.240	89,760
75-90 percentile group	1,431 (15.00%)	0.220	106,619	1,426 (14.99%)	0.222	118,410	1,395 (15.00%)	0.220	137,386
90-100 percentile group	954 (10.00%)	0.324	236,100	951 (10.00%)	0.325	259,681	930 (10.00%)	0.317	295,882
Total	9,540 (100.00%)	1.00	72,812	9510 (100.00%)	1.00	79,953	9,300 (100.00%)	1.00	93,467

Non-migrant households	Obs 2014	Coef. 2014	Mean value of income	Obs. 2016	Coef. 2016	Mean value of income	Obs. 2018	Coef. 2018	Mean value of income
Lowest 10 percentile group	782 (9.58%)	0.018	12,969	783 (9.58%)	0.016	12,937	746 (9.48%)	0.017	16,112
10-25 percentile group	1,141 (13.98%)	0.054	26,535	1,155 (14.13%)	0.053	28,148	1,082 (13.75%)	0.055	34,423
25-50 percentile group	2,007 (24.58%)	0.148	43,103	1,986 (24.29%)	0.147	46,907	1,906 (24.22%)	0.151	56,375
50-75 percentile group	2,065 (25.29%)	0.236	68,829	2,082 (25.46%)	0.238	76,221	2,005 (25.47%)	0.241	89,882
75-90 percentile group	1,288 (15.78%)	0.219	106,695	1,287 (15.75%)	0.222	118,605	1,275 (16.20%)	0.220	137,427
90-100 percentile group	881 (10.79%)	0.326	237,770	883 (10.08%)	0.325	260,662	857 (10.89%)	0.315	295,614
Total	8,164 (100.00%)	1.00	75,448	8,176 (100.00%)	1.00	82,840	7,871 (100.00%)	1.00	97,254

Migrant households	Obs 2014	Coef. 2014	Mean value of income	Obs. 2016	Coef. 2016	Mean value of income	Obs. 2018	Coef. 2018	Mean value of income
Lowest 10 percentile group	172 (12.50%)	0.021	13,211	168 (12.59%)	0.020	13,712	187 (13.09%)	0.019	15,965
10-25 percentile group	290 (21.08%)	0.060	26,408	271 (20.31%)	0.059	28,285	310 (21.69%)	0.059	34,243
25-50 percentile group	380 (27.62%)	0.157	42,821	393 (29.46%)	0.156	46,322	419 (29.32%)	0.157	55,880
50-75 percentile group	318 (23.11%)	0.243	67,787	295 (22.11%)	0.239	74,189	320 (22.39%)	0.240	88,999
75-90 percentile group	143 (10.39%)	0.222	105,926	139 (10.42%)	0.223	116,604	120 (8.40%)	0.215	136,951
90-100 percentile group	73 (5.31%)	0.298	215,955	68 (5.10%)	0.304	246,943	73 (5.11%)	0.310	299,029
Total	1,376 (100.00%)	1.00	57,174	1,334 (100.00%)	1.00	62,263	1,429 (100.00%)	1.00	72,608

Note: income levels are in 1000´VND, the income percentile groups for migrated and non-migrated household are from the original distribution of All household income distribution.

4.3.Influences on the likelihood of migration

Herewith the logistic regression results are presented, the table for the logistic regression from 2014, 2016 and 2018 can be found in Appendix 4. There is a total of 14 models, which results are discussed in more detailed after section 4.3.1.

4.3.1. Summary of the logistic regression models

As Table 9 indicates, most variables had the expected signs, depending on the model used, the variables vary with significance. The variables with red text in the indicate the deviation of the expected influence of the likelihood of participating in migration given the literature review, while the blue text indicates the predicted value for characteristics that were expected as being either positive or negative depending on the situation in Table 2.

Table 9 Expected impacts of variables on the likelihood of participating in migration versus the predicted values

Category	Expected signs from Table 2	Model prediction
Household head characteristics	Age (+) Female (+) Education level three groups: 1. no education (+) 2. primary education (-), 3. Secondary school or higher education (-)	Age (+) Female (-) Education level three groups: 1. no education (+) 2. primary education (-), 3.Secondary school or higher education (-)
Household characteristics	Minority ethnicity (-) Household size (+/-) Farmer size: small (+), medium(+/-), large(-) Income groups percentiles (< 10% (+), 10-25% (+), 25-50% (+/-), 75-90%(-), > 90% (-)) Worsened living standard (+/-) Income from: formal sector (-), informal sector (+), self-employment in agriculture (+), self-engagement in business (-), non-labour sources (+) Household has borrowed money (+/-) Household has taken loans (+/-)	Minority ethnicity (+) Household size (-) Farmer size: Small (+), medium(+/-), large(-) Income groups percentiles (< 10% (+), 10-25% (+), 25-50% (+/-), 75-90%(+/-), > 90% (+/-)) Worsened living standard (-) Income from: formal sector (-), informal sector (+), self-employment in agriculture (+), self-engagement in business (-), non-labour sources (+) Households have borrowed money (+/-) Household has taken loans (+/-)
Commune characteristics	Percentage of poor households in the commune (+) Migration network (from 2 years previous) (+) Distances in kilometre to the closest town, province town and major city (+/-) Mean salinity value (+) Droughts in the commune within 3 years (+) If the commune has savings and lending options (formal or informal) (+/-) Decrease in yield compared to 5 years ago)(+)	Percentage of poor households in the commune (+) Migration network (from 2 years previous) (+/-) Distances in kilometre to the closest town (+), province town(+) and major city (-) Mean salinity value (-) Droughts in the commune within 3 years (+) If the commune has savings and lending options (formal or informal) (+/-) Decrease in yield compared to 5 years ago)(+/-)

Note: (+) represents a positive influence on the likelihood of migration, (-) represents negative influence on the likelihood of migration and (+/-) represents that the likelihood can depend on different circumstances.

Variables that were as expected

As previous literature indicates having an *older* household head, or if the household head has no *education* has a positive influence on the likelihood of participating in migration. Given that the reference group for *farm size* is small farmers, the likelihood of participation decreases if the household has a medium or large farm, which is in accordance with previous research. The *medium size* farmer is highlighted since it was expected that the value could be both positive or negative when investigating the likelihood of migration, in 2014 and 2016 the value was negative, while in 2018 the median size farmer indicated a higher likelihood of participating in migration.

The income variables, indicating where the households receive income from is in line with findings in the literature. The models indicate that households with *informal wage* or *wage from agriculture* have a higher chance of participating in migration, which was found in the models as well. Households receiving income from the *formal sector* and *self-engagement in business* had less likelihood of participating in migration. Household receiving income from *non-labour sources* had a higher likelihood of participating in migration which is in line with the literature.

Depending on which model is analysed, there is both a higher and a lower likelihood of participating in migration if the household either has a *loan* or *borrowed* money, which is in line with what the literature indicates, similar if the household has taken *loans.*

The variables indicating if the household had *borrowed money* and the likelihood of participating in migration depends on which model is used, it can both increase and decrease the likelihood of migrating.

If there are *poor households in the commune*, there is a higher likelihood of participating in migration. There was also an increase in the likelihood of participating in migration if the commune had experienced a *drought within the last 3 years,* which was the expected sign, this indicates that if there was a drought in the commune household had a higher likelihood of sending out a migrant.

If the commune had *savings* or *lending option* varied with the impact on the likelihood of migration. If the household lived in a commune where it was possible to borrow money (either formal or informal) the likelihood of participating in migration decreased in 2014 and 2016, however, in 2018 it indicated an increase in the likelihood of participating in migration. Having *savings* options in the commune increased the likelihood of participating in migration in 2016 but increased the likelihood of participating in migration in 2018, most of the values were, however, not significant.

Variables that were not as expected

The variables that deviated from the literature review were if the household head was *female*, which was expected to increase the likelihood of migration but instead decreased it. Being a *minority ethnicity* was expected to decrease the likelihood of migration, but the models indicated an increase in the likelihood of migration.

The *mean salinity level* variable is another variable whose coefficient did not have the expected sign, it would be expected that higher salinity level increased the likelihood of participating in migration, however, the model indicated a negative value meaning that being in an area with higher salinity levels decreased the likelihood of participating in migration.

Another commune-level characteristic that was not as expected was the *migration network* variable, most of the time it is positive, however, in 2018 there was a decrease in the likelihood of migrating relative to the number of people residing in the commune and those out-migrated (in 2016).

Variables that depends on the situation

The logistic regression models indicate that the *income percentile groups* mostly have the expected sign, lower income groups have a higher likelihood of participating in migration, compared to households with higher income. There is a small deviation from this in Model 13 and 14 when all commune and household characteristics are controlled for.

If the household has experienced *worse living standard* the models found a decrease in the likelihood of participating in migration in comparison to the groups that have experienced *positive living standards.* Another variable that decreased the likelihood of participating in migration is that of *household size,* the variable was indicated as depending on the situation, where a negative value could indicate that the household did not have any other member to send out, or that the migration costs were higher if the household had previously sent out a migrant.

A commune variable that was dependent on the situation was the distance to the city, the logistic regression models indicate that there was an increase in the likelihood of participating in migration if the commune were further away from a *town* or a *province town*, while if the commune was far away from a *major city* there was a lower likelihood of participating in migration. The final variable relating to if there had been a *decrease in yield compared to 5 years ago,* was indicated as being positive, however, the models showed that the likelihood dependent on the situation, and could be both positive or negative, however, none of the coefficients were significant.

A more detailed summary, and the logistic regression models, can be found in Appendix 4.

5. Discussion

5.1. Limitations with the data

As Phuong et al. (2008) mentioned, the main purpose of the VHLSS data is not to study migration, a similar argument can also be made regarding environmental changes, therefore, there is a possibility that the VHLSS does not give an accurate representation of reality, and it is, therefore, additional data sources has been added to try and incorporate environmental data. The VHLSS data enables research of the same area over time, unfortunately, the data does not cover the same households over time, and only includes permanently register households. Optimally a panel data study that covers the same household over time would have been used, but due to only 40 percent of households from a previous year being interviewed in the next year, it would greatly reduce the sample size, therefore the analysis is conducted to investigate changes of the population before, during and after an environmental event.

Further limitation is the definition of a migrant, and a migrant household, in the data it is only possible to control for migrants that have been away from the household for more than 6 months in a 12 month period, which is a relatively recent migration. It is, therefore, not possible to account for if the household have had other members migrate over a longer period.

Information regarding household characteristics might be skewed toward over or understating the true situation of the household, this is also discussed in Koubi et al. (2016) where they discuss the role that households might not want to share that they are not doing economically well. In this thesis, the main concern for such bias is the self-evaluating of livelihood standard change or other variables where the household head, or commune head, has to evaluate changes over a longer period. These biases might also be present on a commune level where commune representatives are interviewed.

On a similar note, the income levels in the VHLSS data does not seem to capture the really poor households, tabulating income for households being under the poverty line[3] (8,400,000 VND/year), indicates that 98 of the 9300 households surveyed in 2018 were considered to live under the poverty line, or 1.05 percent of the population. The percentage of household found in the VHLSS data is lower than the poverty rate indicated by the national statistics in the same year, which was 5.8 percent (General Statistical Office of Vietnam, 2020). This indicates that the poorest of households has not participated in the survey which can also skew the results.

Regarding commune characteristics, data for communes are available, but not straightforward to use due to lack of complete information on all communes in the survey. It is important to note that commune characteristics do limit the sample size.

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[3] According to the multi-dimensional poverty rate in Vietnam (General Statistical Office of Vietnam, 2020).

5.2. Discussion of the results

The typical characteristics that are found to influence the migration behaviour is found in Table 1 on page 15. In relation to the difference between migrated and non-migrated households, most of the findings were in accordance to the literature review, such as migrant household having *small land areas*, more often having a *female household head*, *lower income* and *education* level, along with income from *agricultural or informal work*. The variable of the higher percentage female household heads in migrant household could be an indicator that males in the household has migrated, unfortunately the data could not control for this.

In terms of findings that did not relate to the literature, the percent of households being in a *minority ethnicity* was expected to be smaller for migrant household in comparison to non-migrant household, however, this was not the case. An explanation of the slightly highly average level of minorities in migrant household could be the type of migration they participate in (short or long term), which was not controlled for. Minority household might participate in migration over a shorter period of time in relation to others, however, it is nothing that was controlled for in this thesis.

Indicators of a change in *income sources* were found in the year of the drought (2016), where *self-engagement in business* and the percent of households that took *loans* increased, which can indicate households looking for other sources of income rather than from agriculture, and thus try and diversify income in other ways than just migration. It could also be a shift towards that the household interviewed were wealthier.

Interestingly enough, it seems like the *living standard changes* has increased after the drought, both in terms of the people that lives in *permanent housing* and in terms of households that has indicated as having better living standards. There is also indicator of wealthier households when comparing the change in the type of farms household has, where there is an increase in *larger farmers* and a decrease in *smaller farmers* after the drought, indicating a possibility of higher income, or wealthier, households being interviewed in 2018, or, that poorer households has moved away and engaged in *survival migration* due to loss of income, as discussed in Kleemans (2015), however, future research is needed.

The second research question regarded income distribution and how it differs between migrated and non-migrated household found that migrant household has lower income on average. It is notable to mentions that there average income level of the lowest income group was higher for migrant household in comparison with non-migrant households in 2014 and 2016, however, in 2018 the level shifted so that non-migrant household had higher income levels in the *lowest 10 percentile group*. The income distribution also shows that there is a higher percentage of lower income households in the lower income groups in comparison with non-migrant households, which is in relation to findings in literature. regarding changes in income levels, according to Table 8 the average income level for migrant households in the *top 10 percentile group* is higher in comparison with the non-migrant households, which it has not been in previous years, this could indicate that wealthier households are engaging in

migration, or just that the general income level has increased. It is, however, difficult to show this since the income gap is so large between 2016 and 2018 levels, and future research would be needed.

In terms of the likelihood of participating in migration, which is the third, and final, research question. In general, there has not been a meaningful change in the likelihood of sending out a migrant between 2014, 2016 and 2018. The variable reflecting the likelihood of participate in migration if there has been a drought in the commune was not significant when controlling for age and gender of the household head, however, when controlling for all household and commune characteristics it was (for 2016 and 2018), there is unfortunately a likelihood that this variable is correlated with other commune and household variables which makes it unreliable to determine the actual effect, therefore it is necessary to further research how the drought affected household in the Mekong Delta. There is also a possibility that the two year time period is not enough to statistically determine the effect of the drought, it might be necessary to do a similar analysis with a logistic regression model of the 2020 or 2022 VHLSS analysis.

For those variables that were not as expected in the models of the logistic regression model in *Minority ethnicities,* it is expected that being a minority ethnicity decreases the likelihood of participating in migration, however, in the logistic model used in this data the value is positive. A possible explanation to this is that minorities might cover costs for shorter term migration (which is the only thing this thesis has looked at), while for more long term migration there might be a lower propensity due to the higher costs. Another explanation is the low sample size of minority households, in comparison to other literature which has looked at the migration in the whole country and not a specific region. The coefficient of *worse living standard* is negative, in comparison to *having improved living standard,* which results in a lower likelihood of participating in migration. Looking at the income distribution, these households also earns around 50 percent less than those with better living standards, the negative value could then indicate that these household might not be able to cover migration costs to participate in migration, or that there is a low sample size that does not accurately represent the true effect, but still needs to be research further.

This thesis hypothesised that the drought of 2016 influenced migration in the Mekong Delta, however, the analysis of the logistic regression models does not indicate large variation in the likelihood of migration between the years, resulting in inconclusive results, droughts were found to have a positive implication of migration, however, it is a possibility that correlation is a problem in the models where the results are significant. Future research would be needed to truly determine the effect of the drought (if any), where a survey based research would be necessary similar to Entzinger and Scholten (2016) and Koubi et al. (2016). Such study should cover areas that has been severely and areas that been less affected by droughts and a possible comparison between the likelihood of participating in migration between the areas could be made using a logistic regression models. Variables to include would be those suggested in this thesis, with addition of previous migration experiences, the migration length and the

migration distance, in this way, investment migration and survival migration strategies, as discussed in (Kleemans, 2015) article could possibly also be analysed to help understand possible future migration flows, and which type of migration that future households might participate in.

Even though this thesis has not found that much evidence that the 2016 drought affected the likelihood of households sending out a member for migration in the Mekong Delta, it has contributed to the field of migration research due to environmental changes by indicating the hardship of estimating the true effect of environmental changes and migration, in particular when changes within households cannot be observed over time and when the data is potentially incomplete, for example by not including the poorest households or uncompleted information on commune level characteristics. The research has also increased the understanding of income distribution in the form of different percentile groups, which can provide information for further studies concerning different income groups in the Mekong Delta and their adaptation to environmental changes.

6. Conclusion

This thesis investigated migration as a form of adaptation option by comparing household's likelihood of participating in migration in the Mekong Delta, before, during and after one of the worst droughts the region had experienced. The VHLSS data from the year 2014 indicates data before the drought, the year during the drought (2016) and the year 2018 after the drought.

Socio-economic characteristics at a household level influence the decision to migrate in the Mekong Delta, comparing descriptive statistics between households that have sent out a household member for migration and households that have not, indicates that income, occupation, age and education level are factors that can influence the decision to migrate. In terms of income distribution in the Mekong Delta, there is a large gap between average income levels of migrated and non-migrant households, both in the total income gap, but also between the highest income earning household and the lowest earing ones.

The likelihood of migrating has not had any major changes in the studied period, rejecting the hypothesis that the 2016 drought increased the likelihood of participating in migration. Regardless of that no concrete findings of the change in the likelihood of migration was found, the thesis has contributed to the field of migration in the Mekong Delta by proving that income is one of the major difference between migrated and non-migrated household, both in average level and between percentile groups. Additionally, the thesis provides evidence that further research within the field of migration and how environmental changes are affecting migration decisions, is still needed. Data collection for future research should, apart from the variables included in these analysis, include how households has been impacted by droughts and their previous migration experiences, along with estimates of migration costs and length of the migration period.

Environmental changes are expecting to increase, and become more severe, affecting millions of households, being able to predict migration flows and help households adapt in the area of residency, could prevent a mass flow from rural to urban cities and help to prevent economic losses, both on a household and national level.

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Appendix 1 Variable description and expected effect

Table 1 Variables and their description and expected effect on migration decisions

Household head characteristics	Description	Expected effect on migration decision
Age	The age of the household head (in years)	Positive effect of migration as age increases
Female	If the household head is female or not (Yes = 1)	Positive effect on migration, due to often lower income levels and productivity
Education level	Education level of the household head 1) No education 2) Completed primary school education 3) Secondary school or higher education	If the household head has lower education there is a higher propensity to participate in migration

Household characteristics	Description	Expected effect on migration decision
Minority ethnicity	If the household is a minority ethnicity (non-Kinh)	Minorities are found to have a decreased likelihood of participating in migration due to lack of resources.
Permanent housing structure	Yes = 1, have a house made of proper building material	Decrease the chance of migrating, since permanent housing indicates higher living standards
Household size	Total number of people in the household (not including migrants for migrant households)	Expect larger households to have higher likelihood of migrating, however, if the household already have sent out migrant it is possible that the likelihood decreases due to higher migration costs for other members, or not having more members to send out
Income group (Adjusted for inflation with 2010 as base year)	Different income groups are expected to have different strategies, the income groups are 1) Households earning the lowest 10% of all income. 2) Households earning between 10-25 % of all income 3) Households earning between 25-50% of all income 4) Household earning between 75-90% of all income 5) Household earning over 90% of all income	Assume that lower income groups will have an increased likelihood of migration compared to households with higher income levels
Living standard changes	How living standard has changed compared to 5 years ago, two groups. 1) Living standard has improved (either slightly or substantially) 2) Living standard has not changed or has become worse	Negative/no change in living standards are expected to increase the likelihood for migration, since there is a need to diversify income.
Income from Formal sector	Household head has income from other jobs than manual jobs, or employment with labour contract	Expected to decrease the likelihood of migration due to having a stable job and from other income than agriculture
Income from Informal sector	Household head has employment in manual labour (agriculture or manufacturing), or employment in another sector without labour contract	Expected to increase the likelihood of migration due to insecurity and lower paying job
Self-employment in agriculture	Household head has participated in the household production or services in planting, breeding, forestry or aquaculture	Expected to increase participation in migration due to having farm income, ad often has lower income levels.
Self-engagement in business	Household head has done trading or business for the household	Expected to decrease the likelihood of migration due to having non-farm income, ad often higher income levels.

Table continues on next page

Cont. Table 1 Variables and their description and expected effect on migration decisions

Household characteristics	Description	Expected effect on migration decision
Income from Non-labour sources	Household has received income from other sources such as income from remittance, interest rates, land rentals and other income	Positive, expected to increase likelihood of migrating, since the household can cover migration costs
Household has borrowed money	If the household has borrowed money or not within the last 12 months	Depends borrowing money can enable migration since it can cover migration costs but also decrease likelihood if the household owns a lot of money to others.
Household has loans to pay off	If the household has unpaid loans or not	Loans can enable sources of income that makes migration possible however, the interest rate can be high which can result in that the household cannot afford to pay it back, and go into debt, and cannot afford migration.
Small farmer	If the household has a total land area of less than 1 HA	Expected to increase likelihood of migrating
Medium farmer	If the household has a total land area of less than 2 HA, but more than 2 HA	Can either increase or decrease the likelihood of migration, depending on different circumstances
Large farmer	If the household has more than 2 HA of land	Expected to decrease likelihood of migrating, since large land can increase earning and diversification

Commune characteristics	Description	Expected effect on migration decision
Percentage of poor households in the commune	Measure the percentage of poor households in different communes, uses 2016 values so the unit of measurement is similar throughout the years, since classification has changed throughout the years.	Poor communes often lack income-diversification, so will likely increase migration.
Migration network	The total number of out-migrants in one commune/the total population of the commune, based on previous years values	Expected to increase migration (if there is enough observations)
Distance to town	Kilometer distance to the closest town	Depends, some household can transport to the town and back if they live close enough. While those further away might send out a migrant.
Distance to capital/province city	Kilometer distance to the capital/province city	Depends, some household can transport to the town and back if they live close enough. While those further away might send out a migrant.
Distance to major city	Kilometer distance to a major city (Ha Noi, Hai Phong, Da Nang, Can Tho, Ho Chi Minh City)	Depends, some household can transport to the town and back if they live close enough. While those further away might send out a migrant.
Mean value of salinity level	Used as indicator for salinity intrusion in the commune	Expected to increase the likelihood of migration since it can affect income levels
If the commune has experienced any droughts	If the commune has experienced a natural disaster within the last 3 years and it is drought	Expected to increase migration since drought can affect households' livelihoods
Savings and lending opportunities	If the residence in the commune has access to credit and savings. Either formal sector (banks or credit organizations) or informal sector (community groups, individuals, and friends)	Depends on the time frame, savings can enable households to save for future migration costs in the long run, but not in the short run, while loans can result in debt which decrease the likelihood.
Decrease in yield within the past 5 years	If the commune has indicated a decrease in yield compared to 5 years ago. Reasons can be weather/natural disasters, pest/infestation, change in cultivation techniques, land conversion, change in sources of fertilizer et centra.	Is expected to have a positive influence on the likelihood of participating in migration due to loss of yield affecting poorer households in the area.

1.1 Household head characteristics

It is expected that the *older* the household head is, the likelihood of participating in-migration increases. Regarding being a *female* household head, this is also expected to increase participation in a household member migrating. In the literature, this is due to lower productivity in these households. As household heads are getting older the productivity decreases and they might need extra income, which can be supplied via remittance from migrated household members.

As discussed in the literature review, even if higher *education* for the migrated household member increases migration, the higher the education level of the household head, the lower the probability of migrating. It is therefore assumed that there is a negative association with higher education and the likelihood of having a migrated household member.

1.2 Household characteristics

Being a *minority ethnicity* is associated with a negative likelihood of migration in the literature, due to these groups having, in general, lower-income levels which can disable minorities to participate in migration, even if it would provide additional income. The size of the household will depend since some research indicate that large *household size* has a higher propensity to migrate, whilst other research indicates that the likelihood of migrating will decrease if the household already has a migrant, due to the higher migration costs of sending out another family member, or not having any more people to send out.

Regarding the farm size, smallholder farmers are often poorer than larger farmers, therefore, the likelihood of migration will be positive for *smallholder farmers* since they require non-farm income sources to diversify income (which migration can help with). L*arger farmer*, on the other hand, might already have enough income to cover unexpected events and are therefore not in need of diversification of income via migration.

Income percentile groups will also result in different likelihoods of migration, as mentioned above, poorer households will have a larger incentive to participate in migration as income-diversification or other sources of income. It is expected that the lower-income groups will have a higher likelihood of participating in migration, compared to those with higher income.

Households that have experienced *negative living standard changes* are expected to have a higher likelihood of participating in migration due to the need of possible income-diversification.

Income from non-farm sources (*formal sector wage, self-engagement in business*) is expected to decrease the likelihood of participating in migration, while farm-sources (*informal sector wage, self-employment in agriculture*) are expected to have a positive impact on the likelihood of participating in migration. *Non-farm income* sources are expected to provide a wider range of income diversification compared to farm income. *Non-labour income sources* and the effect on migration might be different depending on which income bracket the household is in, higher-income earners will unlikely change

their behaviour, while for lower-income earners there has a positive effect since it can provide extra income to invest in sending out a migrant in order to earn income.

Borrowing money and *having loans* are expected to have varying effects, on one hand, loans and opportunity to borrow money can increase migration due to less financial constraints, on the other hand, borrowing money or having loans can decrease migration due to financial constraints when the household has to pay back the loaned amount.

1.3 Commune characteristic

A higher *percentage of poor households* in the commune can indicate a lack of income diversification; therefore, the likelihood of migration will be positive. Having residence that has previously migrated from the same commune (*Migration network*) are expected to have a positive influence on migration since there is a possibility that the household knows someone that has migrated previously.

Distances to towns (village, major towns or provincial towns) will depend on the distance, for example living closer to a town can enable households to commute for income, instead of migrating, which would decrease the likelihood of migration. If the household lives further away from these types of town, it can create the need to migrate for income diversification.

The expected sign of having a *decrease in yield within the past 5 years* is a positive value, this is due to decrease in yield is expected to negatively impact the livelihood of households that depend on farming, and therefore increase the likelihood of sending out a household member for migration.

Increased salinity intrusion is expected to increase migration of a household member since salinity influences crop production, which can result in that household might have to seek alternative ways of income. The expected sign is expected for drought, a *drought within the last 3 years* in a commune is also expected to increase migration since it can also affect income sources, particularly if there is a long drought.

If the commune has a *saving option* it can increase the likelihood of participating in migration since it will enable the household to save money in a secure way, which can enable saving for the migration cost. The ability to loan money in commune can both increase and decrease the rate of participation of migration, if the household has a large number of loans then it will affect the migration negatively due to not being able to pay for migration, but a loan of money can also enable the household to pay for the migration fee.

Appendix 2 Differences between migrated and non-migrant households

Table 2.1.1 Descriptive statistics of all households, including max and min and commune characteristics 2014

Variable 2014	Obs	Mean	Std. Dev.	Min	Max
Household has migrant	9,540	.144	.351	0	1
Age of Household head	9,540	52.081	13.674	12	102
Female Household head	9,540	.274	.446	0	1
No Education (household head)	8,837	.36	.48	0	1
Primary school education (household head)	8,837	.356	.479	0	1
Higher than primary school education (secondary school and above) (Household head)	8,837	.285	.451	0	1
Household Size	9,540	3.81	1.569	1	16
Number of migrants (for migrant households)	1,373	1.45	0.775	1	9
Minority ethnicity	9,540	.086	.28	0	1
Household lives in permanent structure house	9,534	.594	.491	0	1
Total land HA	4,750	1.03	1.40	0.002	24.8
Small farmer (< 1HA) (yes = 1)	4,750	.684	.465	0	1
Medium farmer (1-2 HA) (yes=1)	4,750	.181	.385	0	1
Larger Farmer (> 2 HA) (yes = 1)	4,750	.134	.341	0	1
Living standard improved compared to 5 years ago (Yes =1)	4,774	.762	.426	0	1
Living standard did not improve compared to 5 years ago (Yes=1)	4,774	.238	.426	0	1
Income from formal wage	8,011	.377	.485	0	1
Income from Self Engagement in business (Non-farm income)	9,540	.213	.409	0	1
Income from Informal Wage	8,011	.635	.481	0	1
Self-Employment in agriculture (Farm income)	9,540	.502	.5	0	1
Income from Non-labour income source	9,539	.876	.329	0	1
Household has unpaid loans	4,782	.324	.468	0	1
Household borrows money	4,782	.204	.403	0	1
Distance in kilometers to nearest major city from commune center	4,200	10.473	7.766	-2	60
Distance in kilometers to nearest town from commune center	4,200	94.704	75.628	-2	370
Distance in kilometers to nearest village center from commune center	4,200	33.83	21.695	-2	120
Percent of poor households in commune	7,170	.167	.108	.013	.658
Migration Network 2012	2,370	.01	.021	0	.12
Commune has a place where household can save money (yes = 1)	4,200	1	0	1	1
Commune has formal institution where household can borrow money(yes = 1)	4,200	.265	.441	0	1
Commune has informal institution where household can borrow money(yes = 1)	4,200	.333	.471	0	1
Commune has experienced decrease in yield in previous year compared to 5 years ago(yes = 1)	7,185	.083	.276	0	1
Mean value of salinity level (0 = no salinity)	9,360	4.144	8.743	0	35.262
Commune has experienced drought within past 3 years (yes = 1)	2,310	.007	.083	0	1

Table 2.1.2 Descriptive statistics of all households, including max and min and commune characteristics 2016

Variable 2016	Obs	Mean	Std. Dev.	Min	Max
Household has migrant	9,510	.14	.347	0	1
Age of Household head	9,510	53.024	13.284	17	99
Female Household head	9,510	.272	.445	0	1
No Education (household head)	8,784	.338	.473	0	1
Primary school education (household head)	8,784	.362	.481	0	1
Higher than primary school education (Household head)	8,784	.3	.458	0	1
Household Size	9,510	3.745	1.572	1	12
Number of migrants (for migrant households)	1,334	1.397	0.657	1	5
Minority ethnicity	9,510	.079	.27	0	1
Household lives in permanent structure house	9,504	.656	.475	0	1
Total land HA	5,840	1.09	1.51	0.001	38.35
Small farmer (< 1HA) (yes = 1)	5,840	.666	.472	0	1
Medium farmer (1-2 HA) (yes=1)	5,840	.193	.395	0	1
Larger Farmer (> 2 HA) (yes = 1)	5,840	.141	.348	0	1
Living standard improved compared to 5 years ago (Yes =1)	9,499	.758	.428	0	1
Living standard did not improve compared to 5 years ago (Yes=1)	9,499	.242	.428	0	1
Income from formal wage	7,961	.37	.483	0	1
Income from Self Engagement in business (Non-farm income)	9,510	.215	.411	0	1
Income from Informal Wage	7,961	.646	.478	0	1
Self-Employment in agriculture (Farm income)	9,510	.506	.5	0	1
Income from Non-labour income source	9,509	.851	.355	0	1
Household has unpaid loans	9,510	.342	.474	0	1
Household borrows money	9,510	.216	.412	0	1
Distance in kilometers to nearest major city from commune center	4,635	10.123	7.562	-2	35
Distance in kilometers to nearest town from commune center	4,635	85.511	69.563	-2	350
Distance in kilometers to nearest village center from commune center	4,635	31.343	20.923	-2	110
Percent of poor households in commune	7,095	.168	.109	.004	.658
Migration Network 2014	4,035	.009	.019	0	.154
Commune has a place where household can save money (yes = 1)	4,635	.994	.08	0	1
Commune has formal institution where household can borrow money (yes = 1)	4,635	.227	.419	0	1
Commune has informal institution where household can borrow money (yes = 1)	4,635	.336	.473	0	1
Commune has experienced decrease in yield in previous year compared to 5 years ago (yes = 1)	4,635	.095	.293	0	1
Mean value of salinity level (0 = no salinity)	9,270	4.177	8.802	0	35.262
Commune has experienced drought within past 3 years (yes = 1)	2,145	.235	.424	0	1

Table 2.1.3 Descriptive statistics of <u>all households</u>, including max and min and commune characteristics 2018

Variable 2018	Obs	Mean	Std. Dev.	Min	Max
Household has migrant	9,300	.154	.361	0	1
Age of Household head	9,300	54.323	13.111	13	100
Female Household head	9,300	.277	.448	0	1
No Education (household head)	6,925	.322	.467	0	1
Primary school education (household head)	6,925	.363	.481	0	1
Higher than primary school education (Household head)	6,925	.316	.465	0	1
Household Size	9,300	3.654	1.594	1	13
Number of migrants (for migrant households)	1,429	1.45	0.711	1	5
Minority ethnicity	9,300	.079	.27	0	1
Household lives in permanent structure house	9,297	.705	.456	0	1
Total land HA	5,677	1.148	2.32	0.0005	110
Small farmer (< 1HA) (yes = 1)	5,677	.665	.472	0	1
Medium farmer (1-2 HA) (yes=1)	5,677	.188	.391	0	1
Larger Farmer (> 2 HA) (yes = 1)	5,677	.146	.353	0	1
Living standard improved compared to 5 years ago (Yes =1)	9,284	.797	.402	0	1
Living standard did not improve compared to 5 years ago (Yes=1)	9,284	.203	.402	0	1
Income from formal wage	7,625	.37	.483	0	1
Income from Self Engagement in business (Non-farm income)	9,300	.211	.408	0	1
Income from Informal Wage	7,625	.644	.479	0	1
Self-Employment in agriculture (Farm income)	9,300	.47	.499	0	1
Income from Non-labour income source	9,300	.846	.364	0	1
Household has unpaid loans	9,300	.294	.456	0	1
Household borrows money	9,300	.186	.389	0	1
Distance in kilometers to nearest major city from commune center	6,315	10.659	8.022	-2	40
Distance in kilometers to nearest town from commune center	6,315	81.328	68.019	-2	300
Distance in kilometers to nearest village center from commune center	6,315	32.704	21.071	-2	105
Percent of poor households in commune	6,930	.169	.109	.004	.658
Migration Network 2016	4,440	.015	.053	0	.75
Commune has a place where household can save money (yes = 1)	6,315	.995	.069	0	1
Commune has formal institution where household can borrow money (yes = 1)	6,315	.268	.443	0	1
Commune has informal institution where household can borrow money (yes = 1)	6,315	.328	.47	0	1
Commune has experienced decrease in yield in previous year compared to 5 years ago (yes = 1)	6,315	.102	.302	0	1
Mean value of salinity level (0 = no salinity)	9,060	4.29	8.881	0	35.262
Commune has experienced drought within past 3 years (yes = 1)	3,120	.194	.395	0	1

Appendix 3 Income distribution

Table 3.1 Average income levels in (in 1000 VND) for non-migrated households

Gender of household heads

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Male	5911	78,534	121,643	5,911	87,072	106,695	5,711	102,042	113,658
Female	2253	67,350	123,057	2,253	71,492	86,035	2,160	84,596	113,439
Total	8164	75,448	122,130	8,164	82,840	101,731	7,871	97,254	113,857

Different farmer types

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Small	2,704	61,224	57,136	2,704	69,720	67,665	3,117	88,630	101,190
Medium	734	84,181	64,845	734	86,751	8,3053	895	105,324	111,845
Large	578	138,380	324,145	578	130,148	154,767	733	141,390	149,618
Total	4,016	76,525	137,056	4,016	82,254	91,782	4,745	99,929	113,543

Ethnicity of households

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Majority	7,512	76,781	126,025	7,592	84,261	104,100	7,310	99,929	113,543
Minority	652	60,094	59,400	584	64,368	60,408	561	74,113	62,371
Total	8,164	75,448	122,130	8,176	82,840	101,731	7,871	97,254	113,857

Living standard change

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Positive	3,098	86,505	175,477	6,207	93,451	111,294	6,284	107,291	123,150
Negative	973	45,005	37,712	1,959	49,337	49,589	1,572	57,831	47,707
Total	4,071	76,586	155,189	8,166	82,868	101,780	7,856	97,394	113,919

Education level

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
No education	2,632	63,121	157,208	2,848	67,610	79,736	1,804	80,334	87,172
Primary school education	2,692	72,295	66,076	2,747	82,018	96,269	2,137	93,334	10,1964
Higher than primary education	2,259	99,954	130,318	2,374	108,336	129,223	1,959	122,771	133,189
Total	7,583	77,350	124,157	7,605	85,528	104,431	5,900	99,133	110,820

Note: The living standard changes for household in 2014 was only available for a total of 4770 households, hence the smaller sample size

Table 3.2 Average income levels in (in 1000 VND) for Migrated households

Gender of household heads

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Male	1,016	61,607	56,979	969	65,889	60,502	1,013	79,032	134012
Female	360	44,662	44,466	365	52,639	82,653	416	56,967	44797
Total	1376	57,174	54,483	1,334	62,263	67,517	1,429	72,608	115807

Different farmer types

	Freq 2014	Mean 2014	Std Dev 2014	Freq 2016	Mean 2016	Std Dev 2016	Freq 2018	Mean 2018	Std Dev 2018
Small	547	50,585	41,790	658	58217	48335	660	65,392	54,071
Medium	217	72,188	49,717	145	67544	36536	175	85,943	57,988
Large	60	131,884	99,430	71	120304	109293	97	105,918	54,117
Total	734	60,968	55,095	874	64808	56751	932	73,469	56,437

Ethnicity of households

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Majority	1,212	59,273	56,900	1,168	64,146	70,740	1,254	74,536	121,851
Minority	164	41,659	26,676	166	49,016	35,117	175	58,797	54,084
Total	1,376	57,174	54,483	1,334	62,263	67,517	1,429	72,608	115,807

Living standard change

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
Positive	539	64,029	55,581	992	69,956	73,879	1,117	80,375	128,480
Negative	164	40,384	33,932	341	40,041	35,880	175	44,745	36,829
Total	703	58,513	52,297	1,333	62,303	67,527	1,429	72,615	115,847

Education level

	Freq. 2014	Mean 2014	Std. Dev. 2014	Freq. 2016	Mean 2016	Std. Dev. 2016	Freq. 2018	Mean 2018	Std. Dev. 2018
No education	547	48,045	38,759	482	52,513	51966	423	58,164	42,625
Primary school education	451	61,368	67,862	432	64,486	60471	375	75,255	60,880
Higher than primary school	256	78,224	59,026	265	88,581	102569	227	102,815	25,4536
Total	1254	58,997	56,102		65,007	70,621	1,025	74,306	129,188

Note: The living standard changes for household in 2014 was only available for a total of 4770 households, hence the smaller sample size

Appendix 4 Results from the logistic regression models

In this section, the result for the logistic regression models is presented, starting with a short overview from Table 2 which was introduced in Section 3.2, then the output for 2014, 2016 and 2018 are presented, followed by a detailed analysis of the significant value of each model.

Table 2 *Logistic regression model summary*	
Model	Variables included
1	Age, Gender (female =1), education group (no education, primary school education, over primary school education)
2	Age, Gender (female =1), Household Size Minority ethnicity, living in Permanent House, Farmer type(small, medium, large)
3	Age, Gender (female =1), Income percentile group
4	Age, Gender (female =1), Income percentile group, living standard group (improved or worsened), Informal wage, self-employment in agriculture, Non-labour income sources, formal wage, self-engagement in business, taken loans, borrowed money
5	Age, Gender (female =1), Informal wage, self-employment in agriculture, Non-labour income sources
6	Age, Gender (female =1), formal wage, self-engagement in business, taken loans, borrowed money
7	Age, Gender (female =1), Income percentile group, Informal wage, self-employment in agriculture, Non-labour income sources, formal wage, self-engagement in business
8	Kilometre distance to town, provincial town or municipality
9	Migration network (2 years prior), place to save money in commune, formal borrowing options in commune, informal borrowing option in commune
10	Commune has decreased in yield and mean salinity level
11	Commune has experienced drought
12	All commune characteristics (model 8-10)
13	All household characteristics (model 1-7)
14	Both household and commune characteristics (model 1-10)

Table 4.1 Influences on the likelihood of participating in migration in 2014

Logit model 2014	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Age	0.0162***	0.0177***	0.0175***	0.0326***	0.0289***	0.0325***	0.0296***						0.0214***	0.0616**
	(0.00234)	(0.00315)	(0.00216)	(0.00412)	(0.00285)	(0.00280)	(0.00288)						(0.00619)	(0.0247)
Female	-0.238***	-0.441***	-0.266***	-0.214*	-0.138*	-0.120	-0.204**						-0.318*	-0.115
	(0.0735)	(0.106)	(0.0696)	(0.122)	(0.0821)	(0.0813)	(0.0848)						(0.192)	(0.692)
Income groups (reference: Lowest 10 percentile)														
10-25 percentile			0.227**	0.00172			0.184						0.266	-1.571
			(0.109)	(0.183)			(0.130)						(0.271)	(1.013)
25-50 percentile			-0.0585	-0.313*			0.0332						0.249	-0.792
			(0.104)	(0.175)			(0.123)						(0.264)	(0.817)
50-75 percentile			-0.282***	-0.367**			-0.176						0.446	-0.557
			(0.107)	(0.178)			(0.126)						(0.277)	(0.808)
75-90 percentile			-0.622***	-0.789***			-0.584***						0.485	-0.410
			(0.125)	(0.206)			(0.145)						(0.321)	(1.044)
>90 percentile			-0.945***	-0.888***			-0.857***						0.698*	0.216
			(0.150)	(0.232)			(0.171)						(0.359)	(1.150)
Living standard changes (Reference: having improved living standard)														
No change or worsen living standard changes				-0.318***									-0.0312	-0.521
				(0.121)									(0.178)	(0.666)
Income sources														
Income from Informal wage				-0.104	0.174**		-0.777						-13.33	-10.46
				(0.541)	(0.0697)		(0.521)						(683.8)	(1,270)
Income from Self-employment in agriculture				0.210*	0.369***		0.265***						0.197	0.332
				(0.113)	(0.0725)		(0.0783)						(0.209)	(0.858)
Income from non-labour sources				1.375***	1.375***		1.359***						1.057***	2.085**
				(0.212)	(0.152)		(0.152)						(0.257)	(0.962)
Income from formal wage				-0.0779		-0.121*	-0.798						-13.21	-10.85
				(0.536)		(0.0717)	(0.518)						(683.8)	(1,270)
Income from Self-engagement in business				-0.338**		-0.363***	-0.187**						-0.462**	-0.147
				(0.137)		(0.0867)	(0.0949)						(0.212)	(0.970)
Household has unpaid loans				0.496***									0.642***	-1.538
				(0.124)									(0.174)	(1.173)
Household has borrowed money				-0.152									-0.282	2.358**
				(0.141)									(0.192)	(1.149)
Household Size		-0.296***											-0.358***	-0.587***
		(0.0294)											(0.0552)	(0.198)
Minority ethnicity		0.551***											0.215	-
		(0.134)											(0.237)	-
Lives in a permanent House		-0.102											-0.291**	-0.423
		(0.0842)											(0.139)	(0.529)
Farm size (reference group: small farmer)														
Medium farmer (1-2HA)		-0.0157											-0.156	-0.969
		(0.110)											(0.178)	(0.774)
Larger farmer (>2 HA)		-0.451***											-0.710***	-0.397
		(0.147)											(0.243)	(0.848)

Table continues on the next page

Cont. Table 4.1 Influences on the likelihood of participating in migration in 2014

Logit model 2014	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Education level (reference: no education)														
Completed primary school education	-0.143**												-0.291*	0.574
	(0.0714)												(0.157)	(0.640)
Completed higher than primary school education	-0.508***												-0.262	1.181*
	(0.0838)												(0.178)	(0.678)
Commune														
Distance to town(km)								-0.00273				0.00555		0.00569
								(0.00620)				(0.0123)		(0.0412)
Distance to major cities								-0.0016**				-0.00190		-0.000494
								(0.00064)				(0.00148)		(0.00453)
Distance to provincial town								-7.17e-05				-0.000704		-0.0275*
								(0.00226)				(0.00444)		(0.0145)
Percentage of poor households in commune								1.143***				1.755		6.052
								(0.385)				(1.376)		(4.399)
Migration Network (2 year previously)									1.404			1.696		5.433
									(2.774)			(4.228)		(13.06)
Place to save money commune (omitted due to all communes having a place to save)									-			-		-
Formal borrowing option									-0.383**			0.0214		-0.547
									(0.177)			(0.236)		(0.628)
Informal borrowing option									-0.111			-0.0953		-0.458
									(0.149)			(0.220)		(0.614)
Decrease in Yield compared to 5 years ago										0.101		0.157		-1.586
										(0.115)		(0.326)		(1.035)
Average salinity level										-0.010**		-0.0072		0.0279
										(0.00412)		(0.0109)		(0.0323)
Drought in commune within last 3 years											0.205	0.361	-	-
											(0.643)	(0.832)		
Constant	-2.418***	-1.403***	-2.437***	-4.330***	-4.837***	-3.291***	-3.675***	-1.705***	-1.680***	-1.650***	-1.671***	-1.820***	10.67	6.051
	(0.143)	(0.207)	(0.156)	(0.670)	(0.210)	(0.151)	(0.589)	(0.102)	(0.102)	(0.0369)	(0.0572)	(0.304)	(683.8)	(1,270)
Pseudo R^2	0.0457	0.0241	0.0703	0.0454	0.268	0.0595	0.0042	0.0034	0.0035	0.0013	0.000	0.0062	0.0872	0.2482
Observations	8,837	4,747	9,540	3,987	8,010	8,011	8,010	4,170	1,875	7,110	2,310	945	1,995	222

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.2 Influences on the likelihood of participating in migration in 2016

Logit model 2016	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Age	0.0106***	0.0102***	0.0127***	0.0257***	0.0235***	0.0271***	0.0239***						0.0189***	0.0151
	(0.00246)	(0.00297)	(0.00226)	(0.00301)	(0.00292)	(0.00287)	(0.00296)						(0.00401)	(0.00944)
Female	-0.154**	-0.310***	-0.140**	-0.153*	-0.101	-0.0656	-0.167**						-0.364***	0.0976
	(0.0747)	(0.0977)	(0.0693)	(0.0849)	(0.0822)	(0.0809)	(0.0846)						(0.122)	(0.265)
Income group (reference: Lowest 10 percentile)														
10-25 percentile			0.151	0.130			0.167						0.357**	-0.00791
			(0.110)	(0.133)			(0.131)						(0.178)	(0.355)
25-50 percentile			0.00784	0.0288			0.0880						0.527***	0.139
			(0.105)	(0.128)			(0.125)						(0.175)	(0.353)
50-75 percentile			-0.332***	-0.285**			-0.210						0.507***	0.0944
			(0.109)	(0.133)			(0.129)						(0.186)	(0.379)
75-90 percentile			-0.605***	-0.543***			-0.480***						0.605***	0.317
			(0.126)	(0.150)			(0.145)						(0.208)	(0.461)
>90 percentile			-0.967***	-0.903***			-0.824***						0.387	-0.195
			(0.154)	(0.177)			(0.172)						(0.242)	(0.553)
Living standard changes (Reference: having improved living standard)														
No change or worsen living standard changes				-0.291***									-0.356***	-0.531*
				(0.0850)									(0.119)	(0.280)
Income sources														
Income from Informal wage				0.270	0.253***		0.223						0.765	0.884
				(0.293)	(0.0710)		(0.292)						(0.488)	(1.196)
Income from Self-employment in agriculture				0.159**	0.276***		0.216***						0.00742	0.339
				(0.0795)	(0.0721)		(0.0786)						(0.134)	(0.354)
Income from non-labour sources				1.603***	1.583***		1.594***						1.735***	1.241***
				(0.152)	(0.152)		(0.152)						(0.200)	(0.381)
Income from formal wage				0.170		-0.151**	0.122						0.656	0.532
				(0.288)		(0.0730)	(0.287)						(0.484)	(1.160)
Income from Self-engagement in business				-0.0877		-0.285***	-0.0879						-0.214	0.187
				(0.0944)		(0.0854)	(0.0941)						(0.134)	(0.324)
Household has unpaid loans				0.520***									0.510***	0.830***
				(0.0895)									(0.116)	(0.269)
Household has borrowed money				-0.168*									-0.166	-0.428
				(0.101)									(0.128)	(0.288)
Household Size			-0.309***										-0.371***	-0.292***
			(0.0274)										(0.0355)	(0.0818)
Minority ethnicity			0.707***										0.711***	0.132
			(0.120)										(0.148)	(0.430)
Lives in a permanent House			-0.0867										-0.151	-0.318
			(0.0784)										(0.0938)	(0.228)
Farm size (reference group: small farmer)														
Medium farmer (1-2HA)			-0.220**										-0.197*	-0.201
			(0.101)										(0.115)	(0.267)
Larger farmer (>2 HA)			-0.553***										-0.503***	-0.662*
			(0.135)										(0.154)	(0.384)

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Cont. Table 4.2 Influences on the likelihood of participating in migration in 2016

Logit model 2016	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Education level (reference: no education)														
Completed primary school education	-0.170**												-0.0777	-0.249
	(0.0738)												(0.101)	(0.231)
Completed higher than primary school education	-0.491***												-0.206*	-0.172
	(0.0846)												(0.116)	(0.275)
Commune														
Distance to town(km)								0.000123				0.00916		0.00688
								(0.00625)				(0.0112)		(0.0162)
Distance to major cities								-0.00155**				0.000780		-0.000560
								(0.000688)				(0.00141)		(0.00199)
Distance to provincial town								0.00399*				0.00184		0.00375
								(0.00235)				(0.00435)		(0.00673)
Percentage of poor households in commune								1.805***				1.539**		0.597
								(0.377)				(0.659)		(1.019)
Migration Network (2 years previously)									11.43***			9.857***		12.19***
									(2.344)			(2.760)		(3.702)
Place to save money commune									0.876			1.104		1.189
									(0.737)			(0.748)		(1.080)
Formal borrowing option									-0.129			-0.247		-0.304
									(0.146)			(0.212)		(0.300)
Informal borrowing option									-0.130			-0.328**		-0.380*
									(0.122)			(0.165)		(0.221)
Decrease in yield compared to 5 years ago										0.0855		-0.0623		-0.266
										(0.140)		(0.239)		(0.311)
Average salinity level										-0.0253***		-0.0347***		-0.0346**
										(0.00567)		(0.0102)		(0.0152)
Drought in commune within last 3 years											0.0769	0.314*		0.424*
											(0.142)	(0.167)		(0.232)
Constant	-2.199***	-1.016***	-2.255***	-4.769***	-4.760***	-3.061***	-4.607***	-2.077***	-2.760***	-1.702***	-1.793***	-3.184***	-3.953***	-4.837**
	(0.151)	(0.196)	(0.163)	(0.407)	(0.214)	(0.156)	(0.402)	(0.0975)	(0.733)	(0.0485)	(0.0708)	(0.756)	(0.640)	(1.882)
Pseudo R²	0.0099	0.0469	0.0200	0.0638	0.0444	0.0181	0.0563	0.0078	0.0107	0.0061	0.0002	0.0394	0.0939	0.1292
Observations	8,784	5,839	9,510	7,955	7,961	7,961	7,961	4,620	2,970	4,575	2,145	1,620	4,916	1,023

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.3 Influences on the likelihood of participating in migration in 2018

Logit model 2018	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Age	0.0102***	0.0105***	0.0117***	0.0224***	0.0201***	0.0264***	0.0208***						0.0167***	0.0161*
	(0.00270)	(0.00300)	(0.0022)	(0.00311)	(0.00300)	(0.00294)	(0.00307)						(0.00462)	(0.00879)
Female	-0.0474	-0.278***	-0.0704	-0.00193	0.0379	0.0622	-0.0268						-0.128	0.389*
	(0.0784)	(0.0923)	(0.0663)	(0.0833)	(0.0804)	(0.0791)	(0.0829)						(0.132)	(0.233)
Income groups (reference: Lowest 10 percentile)														
10-25 percentile			0.204*	0.407***			0.464***						0.723***	0.711**
			(0.106)	(0.135)			(0.134)						(0.194)	(0.341)
25-50 percentile			-0.0339	0.160			0.245*						0.650***	0.597*
			(0.102)	(0.130)			(0.128)						(0.191)	(0.341)
50-75 percentile			-0.348***	-0.0731			0.00956						0.579***	0.879**
			(0.105)	(0.135)			(0.132)						(0.208)	(0.374)
75-90 percentile			-0.892***	-0.684***			-0.605***						0.280	0.525
			(0.129)	(0.159)			(0.155)						(0.240)	(0.438)
>90 percentile			-0.993***	-0.842***			-0.773***						0.356	1.128**
			(0.149)	(0.180)			(0.177)						(0.268)	(0.472)
Living standard changes (Reference: having improved living standard)														
No change or worsen living standard changes				-0.279***									-0.195	-0.449*
				(0.0887)									(0.131)	(0.259)
Income sources														
Income from Informal wage				0.0620	0.335***		-0.0230						-0.0318	0.106
				(0.336)	(0.0721)		(0.335)						(0.640)	(1.137)
Income from Self-employment in agriculture				0.367***	0.468***		0.425***						0.359**	0.331
				(0.0786)	(0.0721)		(0.0778)						(0.154)	(0.308)
Income from non-labour sources				1.745***	1.731***		1.747***						1.800***	1.468***
				(0.153)	(0.152)		(0.152)						(0.203)	(0.345)
Income from formal wage				-0.106		-0.241***	-0.180						-0.244	-0.475
				(0.331)		(0.0741)	(0.330)						(0.635)	(1.125)
Income from Self-engagement in business				-0.158*		-0.369***	-0.136						-0.484***	-0.612*
				(0.0956)		(0.0866)	(0.0951)						(0.164)	(0.332)
Household has unpaid loans				0.519***									0.411***	0.195
				(0.0932)									(0.139)	(0.290)
Household has borrowed money				-0.0802									0.141	0.438
				(0.106)									(0.152)	(0.309)
Household Size		-0.343***											-0.341***	-0.452***
		(0.0271)											(0.0399)	(0.0756)
Minority ethnicity		0.760***											0.784***	0.113
		(0.116)											(0.163)	(0.367)
Lives in a permanent House		-0.271***											-0.310***	-0.431**
		(0.0782)											(0.106)	(0.211)
Farm size (reference group: small farmer)														
Medium farmer (1-2HA)		0.0543											0.0458	0.475**
		(0.0961)											(0.125)	(0.233)
Larger farmer (>2 HA)		-0.209*											-0.186	0.0380
		(0.120)											(0.160)	(0.314)

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Cont, Table 4.3 Influences on the likelihood of participating in migration in 2018

Logit model 2018	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Education level (reference: no education)														
Completed primary school education	-0.230***												-0.0828	-0.0716
	(0.0802)												(0.115)	(0.217)
Completed higher than primary school education	-0.626***												-0.218*	0.00879
	(0.0920)												(0.129)	(0.245)
Commune														
Distance to town(km)								0.0101**				0.0208**		0.00326
								(0.00449)				(0.00891)		(0.0139)
Distance to major cities								-0.00167***				-0.0030***		-0.0035**
								(0.000541)				(0.00108)		(0.00168)
Distance to provincial town								0.00405**				0.00122		-0.000183
								(0.00169)				(0.00321)		(0.00568)
Percentage of poor households in commune								2.225***				1.634***		1.605*
								(0.282)				(0.515)		(0.832)
Migration Network (2 year previously)									-2.214*			-1.745		0.854
									(1.316)			(1.650)		(3.339)
Place to save money commune									-0.0417			-0.460		-1.204
									(0.493)			(0.563)		(0.837)
Formal borrowing option									0.00655			0.0293		0.230
									(0.109)			(0.156)		(0.245)
Informal borrowing option									0.166*			0.352***		0.346*
									(0.0974)			(0.134)		(0.200)
Decrease in Yield compared to 5 years ago										-0.151		0.0278		0.140
										(0.122)		(0.186)		(0.274)
Average salinity level										-0.020***		-0.0184**		-0.0188
										(0.00419)		(0.00781)		(0.0135)
Drought in commune within last 3 years											0.0968	0.306**		0.415*
											(0.119)	(0.144)		(0.231)
Constant	-2.040***	-0.810***	-2.088***	-4.720***	-4.855***	-2.958***	-4.548***	-2.099***	-1.675***	-1.495***	-1.549***	-1.521***	-3.467***	-2.042
	(0.170)	(0.201)	(0.165)	(0.441)	(0.217)	(0.163)	(0.436)	(0.0860)	(0.493)	(0.0381)	(0.0520)	(0.590)	(0.785)	(1.728)
Pseudo R²	0.0139	0.0523	0.0262	0.0839	0.0557	0.0207	0.0759	0.0148	0.0046	0.0050	0.0007	0.0282	0.1221	0.1570
Observations	6,925	5,676	9,300	7,616	7,625	7,625	7,625	6,300	4,260	6,240	3,120	2,160	3,742	1,123

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Household head characteristics

The coefficient of the *Age* of the household head is positive, indicating that the higher age the household head is the more likely the household is to send out a migrant. The coefficient is statistically significant from zero at a 99 percent confidence interval for most models, apart from model 14 in 2016 where the variable was insignificant and in model 14 for the year 2018 the coefficient is statistically significant from zero in a 90 percent confidence interval.

The *Female* variable (indicating that the household head is female), differs in significance levels, but an overall trend is that the value is negative, indicating that there is a lower likelihood of a female household head sending out a household member for migration, which is not the expected value. In 2018 the variable is only statistically significant from zero in two models (model 2 and 14) while in 2016 and 2015 the coefficient is significant from zero in most models at least in a 90 percent confidence interval.

Model 1

In Model 1, *Age, Female* and *Education* are controlled for. Investigating the education of the household head, where the reference group is *no education,* is of the expected sign. If the household head has *primary school education* compared to *no education,* there is a decrease in the likelihood of sending out a migrant, the coefficient is statistically significant from zero ($p < 0.05$) for the studied period. Regarding *higher than primary school education* the variable is also negative, and statistically significant from zero at a 99 percent confidence interval.

Household characteristics (Model 2-7)

Model 2

In the 2nd model *Age, female, household size, minority ethnicity, housing structure* and *farmer type* is controlled for. Having more household members indicates a lower chance of participating in migration and is statistically significant ($p < 0.01$) in the studied period. Another variable that has a negative influence on the participation in migration is living in a permanent house, the value is statistically significant from zero at a 99 percent confidence interval throughout the studied period in this model.

Being a *medium* or *large* farmer decreases the likelihood of participating in migration, in comparison to being a small farmer (reference group). The sign is as expected according to finding in previous literature; however, the medium size farmer coefficient is only statistically significant from zero in 2016 ($p < 0.05$). The coefficient for a large farmer is statistically significant from zero in at least a 90 percent confidence interval in the studied period.

Model 3

In Model 3, *Age, Female,* and *Income Percentile Groups* are controlled for. Regarding *Income percentile,* the reference group is households in the *lowest 10 percent* income bracket.

The *10-25 percentile group* has a positive value, indicating that there is a higher likelihood of migrating in comparison to being in the *lowest 10 percentile group*, the significance level of the coefficient varies,

in 2014 the significance level was 0.05, while in 2018 the coefficient was significant at a 0.1 significant level, in 2016 the coefficient was insignificant. The next income percentile group is the *25-50 percentile group* which is insignificant in the studied period. The *50-75 percentile group, 75-90 percentile group* and *over 90 percentile group* coefficients are negative, indicating that the likelihood of migration decreases for households being in these higher-income percentile groups, in comparison to being in the lowest 10 percentile group. This is following the literature since higher-earning has the income required to withstand sudden changes, the coefficients are statistically significant from zero at a 99 percent confidence interval for all years.

Model 4

Model 4 controls for the variables *Age, Female, income percentiles, living standard changes, different income sources (informal wage, self-employment in agriculture, self-engagement in businesses, non-labour sources, formal wage-earning), if the household has unpaid loans* and *household has borrowed money.*

The coefficients of having *formal wage* and *informal wage* are insignificant, likely due to interaction with each other and other variables. The coefficient *household has borrowed money* is only significant at a 0.1 significance level in 2016 and has a negative value, this indicates that if the household has borrowed money from a family member or a bank, there is a lower likelihood of participating in migration. When controlling for the variables mentioned above, the *10-25 percentile group* becomes insignificant in 2014 and 2016, however, in 2018 the coefficient is statistically significant from zero at a 99 percent confidence interval, and is positive, much like in the previous model. The *25-50 percentile group* is negative and significant at a 0.1 significant level in 2014, indicating that being in this income group decreases the chances of participating in migration, compared to being in the lowest 10 percentile group. The coefficient is insignificant from zero in 2016 and 2018.

If the household is in the *50-75 percentile group,* there is a lower likelihood of participating in migration, which is the expected sign, the coefficient is statistically significant from zero in at least a 95 percent confidence interval in 2014 and 2016, the coefficient is insignificant in 2018. The *75-90 percentile group* and *90 percentile group* indicates that there is a lower likelihood of participating migration, compared to the *lowest 10 percentile group*, and the coefficients are statistically significant from zero at a 99 percentile confidence interval in 2014, 2016 and 2018.

Having experienced *worse or no change in living standard* decreases the likelihood (in comparison with being in the group of having *better living standards*) of migration and is statistically significant from zero in all years ($p < 0.01$). *Income from self-employment in agriculture* indicates a positive coefficient for the studied period, indicating an increase in the likelihood of participating in migration, which is in line with previous literature. The value is statistically significant from zero at a 90 percent confidence interval in 2014, a 95 percent confidence interval in 2016 and a 99 percent confidence interval in 2018.

Income from non-labour sources has a positive value as well and is statistically significant from zero at a 99 percent confidence interval for the studied period, this indicates that income from other source such as remittances, increases the likelihood of participating in migration. The same conclusion can be made for the variable *household has unpaid loans.*

The coefficient of *Income from self-engagement in business* decreases the likelihood of participating in migration, which is the expected sign, and is following the literature, the significance value varies from statistically significant at a 99 percent confidence interval in 2018, to a 95 percent confidence interval in 2016, in 204 the value is insignificant.

Model 5

The 5th model controls for *Age, Female, informal wage, self-employment in agriculture and income from non-labour sources.*

In this model, households that receive income from *informal sources* have a higher likelihood of participating in migration, which is in relation to the literature. The coefficient is statistically significant from zero at a 99 percent confidence interval for 2016 and 2018, in 2014 the value is significant at a 95 percent confidence interval. *Self-employment in agriculture* and *income from non-labour sources* are also positive and statistically significant from zero at a 99 percent confidence interval, which holds for all years. According to literature self-employment in agriculture increases the chance of sending out a household member to migrate since there is often a lack of income-diversification and lower-income levels when households only participate in farm work.

Model 6

In Model 6 the following variables have been controlled for *Age, Female, Income from self-engagement in business* and *income from formal wage.* The coefficient for *Income from formal wage* and *Income from self-engagement in business* is expected to decrease the likelihood of participating in migration, the coefficient in Model 6 has a negative value, so the model is in accordance to the expected value. Both coefficients are statistically significant from zero, *income from formal wage* has a significant level of 0.1 in 2014, in 2016 the significance level is 0.05 and in 2018 the significance value is 0.01. For the coefficient of *income from self-engagement in business,* the value is statistically significant from zero at a 99 percent confidence interval, and this holds for all years.

Model 7

This model controls for all *income sources* as well as *Age* and *Female.* The coefficient for *informal wage and formal wage* are insignificant. *Self-employment in agriculture* is positive and is statistically significant from zero at a 99 percent confidence interval for all the studied years, similar results are finding for *non-labour income sources.* Indicating that self-employment in agriculture increases the likelihood of participating in migration. *Self-engagement in business* is not significant in 2018 and 2016. In 2014 the coefficient is negative, indicating a decreased likelihood in participating in migration, the coefficient is statistically significant from zero in a 99 percent confidence interval.

Model 8

Model 8 include commune characterises in form of *distances to the nearest town, cities,* and *provincial town*, and if the commune was poor or not. Much like the literature predicts, residing in a commune with *poorer households* increases the likelihood of migration, which is found to be statistically significant at a 99 percent confidence interval, in the whole studied period. Communal characteristics vary with significance. The *kilometre distance to a town* is only significant in 2018 (at a 0.05 significance level), where it indicates an increased likelihood in migration, the further away a person is from the town there is a higher likelihood of migrating. The *kilometre distance to a major town* has a negative value, indicating that the further away from a major city the household is, the lower is the likelihood of participating in migration (significant at a 0.05 significant value in 2014 and 2016, and a 0.01 significance value in 2018). The kilometre distance to a *provincial town* also decreases the likelihood of participating in migration and is statistically significant from zero in 2016 at a 90 percent confidence interval, in 2018 the coefficient is statistically significant from zero at a 99 percent confidence interval, in 2014 the coefficient is insignificant.

Model 9

Model 9 controls for *migration network, places to save money in the commune, informal borrowing places* and *formal borrowing places.* The *migration network* coefficient, is not significant in 2014, however, in 2016 the variable is positive and statistically significant from zero at a 99 percent confidence interval, indicating that migration in 2016 could be influenced by the commune of residency having migrants in 2014, this is in accordance to findings in the literature. On the other hand, in 2018, the *migration network* variable is negative and statistically significant from zero at a 90 percent confidence interval, which indicates that migration network from 2016 decreases the likelihood of migrating in 2018.

Having a *place to save money in the commune* is insignificant. Having a *formal borrowing option in the commune* decreased the likelihood of participating in migration (significant level 0.05) in 2014, in 2016 and 2018 the coefficient was insignificant. Having access to *informal borrowing option in the commune* is associated with a positive impact on the likelihood of migration, and significant at a 0.1 significance level in 2018, in 2014 and 2016 the coefficient is not statistically significant from zero.

Model 10

Model 10 controls for a *decrease in yield within the last 5 years*, and *mean salinity levels*. A *decrease in yield within the past 5 years* is not significant in any of the years. The *mean salinity level* of the given year (in 2018 the 2017 values was used), indicates a negative relationship between higher salinity levels and migration and is statistically significant from 0 at a 0.01 significance level in 2016 and 2018, in 2014 the significance level was 0.05. The coefficient indicates that higher salinity levels result in a reduced likelihood of participation in migration, which was not expected according to the hypothesis.

Model 11

Model 11 controls for if the commune has *experienced droughts within the last 5 years* or not. The coefficient is positive, but not statistically significant from zero in any of the years.

Model 12

Model 12 includes all commune characteristics. In 2014 all variables are insignificant, likely due to the low sample size. Those variables that were significant in this model had the same likelihood of participating in migration as indicated in previous models.

An interesting result for the year 2016 is that the variable *drought in the commune* is now statistically significant from zero in a 90 percent confidence interval, compared to being insignificant in Model 11. This indicates that drought in the commune had a positive impact of participating in migration in 2016. A similar finding is found in 2018 where the coefficient positive and statistically significant from zero at a 95 percent confidence interval.

Model 13

Model 13 controls for all household characteristics. The constant for this model is insignificant in 2014. In 2014 all significant coefficient had the same likelihood on migration as previous models, the significant variables were *Age, Female, income from non-labour source, income from self-engagement in business, the household has unpaid loans, household size, if the household lives in permanent housing,* if the household has a *large farm* and *having completed primary school education.*

In 2016 all the income percentiles variables are positive, and apart from the *90 percentiles group,* the values are statistically significant at a minimum of a 95 percent confidence interval, indicating that when controlling for all household characteristics most income groups has an increased likelihood of participating in migration, however, this could be due to interactions with other variables. In 2018 similar findings as relation to 2016 income groups are found, however, the coefficients are only statistically significant from zero at a 10-25 percentile group, 25-50 percentile group an 50-75 percentile group, at a 99 percent confidence interval.

Model 14

Model 14 controls for both household and commune characteristics, since there are many variables in this model, only those variables that differ from the other models will be discussed. The constant in this model is not significant for 2014 and 2018.

In 2014 the coefficient for *household has borrowed money* is positive and statistically significant from zero at a 95 percent confidence interval, previously the coefficient was insignificant. Another variable that has changed both value and significance value is that of if a household head has *completed higher than primary school education* which in model 14 increases the likelihood of participating in migration and is statistically significant from zero at a 90 percent confidence interval. The *Distance to provincial town* variable is negative and statistically significant from zero at a 90 percent confidence interval.

In 2016 all the significant coefficient has the same likelihood of influencing migration as previous models (including model 13), here the *drought in commune* variable is also positive and statistically significant from zero at a 90 percent confidence interval (and holds for 2018 as well).

In 2018 the female variable is positive and significant at a 90 percent confidence interval, indicating that being a female household head increases the likelihood of participating in migration, which is in relation to findings in the literature. Another variable that has gone from positive to negative is that of being in the *90 percentile group*. Model 14 indicates that this increases the chances of participating in migration and is statistically significant from zero at a 95 percent confidence interval.