Livelihood Adaptation, Transition, and Diversification: New Insights from High-Frequency Data*

Farnaz Safari†

February 2025

Abstract

This paper examines the differential relationship between income diversification and intertemporal activity transitions on household well-being, addressing both intra-household and intertemporal aggregation problems. Using high-frequency monthly data, I disentangle genuine diversification strategies from mere activity transitions that are often conflated in conventional analyses due to infrequent data collection and extended recall periods. This approach mitigates measurement errors and intertemporal aggregation bias. Also, the existence of two cyclone experiences in our time frame allows us to identify factors correlated with each strategy and their association with household well-being. I document that households engaging in diversification and transition can have different livelihood profiles, which are often linked to external shocks and forced adjustments. Furthermore, the findings reveal that genuine real-time diversification is more strongly linked to improved well-being, whereas transitions without diversification may indicate vulnerability, and relying solely on annual data can misrepresent these transitions as diversification. These insights highlight the importance of high-frequency data in accurately capturing household livelihood dynamics, which offers critical implications for targeted policy interventions.

Keywords: activity transition, diversification, intra-household specialization, multitasking, high-frequency data, inter-temporal aggregation, Malawi

*I am grateful to Chris Barrett, Joanna Upton, and Adam Dearing for their valuable feedback. This working paper was made possible by the Rapid Feedback Monitoring System (RFMS) data collected by Catholic Relief Services (CRS) in collaboration with Cornell University and the World Bank, funded by USAID. The views expressed herein are solely those of the author.

†PhD student at Charles H. Dyson School of Applied Economics and Management, Cornell University. Email: fsf6@cornell.edu

Introduction

Households living under high economic and environmental uncertainties have developed tailored responses shaped by their prosperity, various constraints, risk tolerance, and future perceptions (Deaton et al., 1992; Reardon & Vosti, 1995; Zimmerman & Carter, 2003), including selling assets, relying on savings or borrowing, reducing consumption, shifting to cheaper food, and livelihood adaptation. Among various responses, livelihood adaptation stands out in low-income settings, where incomplete markets limit savings and borrowing, and selling productive assets or reducing food consumption is less desirable.

Adaptation is a continual process of adjusting livelihoods (Davies, Hossain, et al., 1997), involving long-term adjustments over time, capturing structural transformation on the macro level. While closely linked to diversification and transition, adaptation encompasses these concepts, with diversification and transition often emerging as its outcomes (Ellis, 2000a). *Transition* refers to short-term, periodic shifts in income-generating activities, such as moving from farming to piecework during lean seasons or switching between stable and temporary jobs on a seasonal or monthly basis. *Diversification* at the household level, on the other hand, is a static concept defined as engaging in multiple income-generating activities at a specific point in time[1].

Livelihood diversification received significant attention during the early 2000s. At the household level, research focused on defining and classifying the diversification by sector, function, and location across asset, income, and activities and pinpointing the prevalence of diversification behaviors in specific contexts and time (Reardon, 1997; Barrett & Reardon, 2000; Ellis, 2000b; Barrett, Reardon, & Webb, 2001a; Reardon, Berdegué, Barrett, & Stamoulis, 2007).

The effort continued by examining the underlying influential factors of adopting diversification strategies, including but not limited to asset endowment and financial access, activity

[1]Livelihood diversification" has varying definitions. This paper focuses on household diversification, which refers to strategies where households increase the number of income-generating activities, regardless of sector or location (Alobo Loison, 2015; Ellis, 2000a; Start, 2001).

payoff and labor market, seasonality and shocks, household demographics and structure, access to infrastructure (Reardon, Delgado, & Matlon, 1992; Ellis, 2000a; Barrett et al., 2001a; Abdulai & CroleRees, 2001; Dercon, 2002; Reardon et al., 2007) and the diversification welfare impacts on income, wealth, consumption, and food security, although the evidence remains mixed (Ellis, 1998; Reardon, 1997; Barrett et al., 2001a; Van Den Berg & Kumbi, 2006; Alobo Loison, 2015). Other key aspects include the distinction between survival-led and opportunity-led diversification (Ellis, 2000a; Reardon et al., 2007; Lay, Mahmoud, & M'Mukaria, 2008; R. D. Dimova & Sen, 2010) and the role of specialization (Haggblade, Hazell, & Reardon, 2005; Timmer et al., 2009; Losch, Fréguin-Gresh, & White, 2012; Davis, Di Giuseppe, & Zezza, 2014) in adaptation strategies.

Aiming to clarify the complex relationship between diversification and well-being, recent studies employed more recent econometric methods and panel data, including nearest-neighbor matching (Dedehouanou & McPeak, 2020), correlated random effects model (Tesfaye & Tirivayi, 2020), seemingly unrelated regression (Asfaw, Scognamillo, Di Caprera, Sitko, & Ignaciuk, 2019), instrumental variables-usually a climate shock (Asfaw et al., 2019; Antonelli, Coromaldi, & Pallante, 2022), panel multinomial endogenous switching regressions (Khan & Morrissey, 2023) to explore the causes and heterogeneous impacts of diversification on various well-being measures, as well as specialization (Bellon, Kotu, Azzarri, & Caracciolo, 2020).

Despite all of these remarkable advancements, three challenges remain to be addressed. Firstly, the lack of high-frequency data hampers the accurate depiction of seasonal transitions, often conflating transition with diversification. Existing literature on household livelihood management frequently relies on infrequent data to study diversification behaviors, overlooking the nuanced distinction between transition and diversification. Households transit between activities either to capitalize on emerging opportunities or to adjust involuntarily when opportunities vanish. Diversification, on the other hand, occurs when households engage in multiple imperfectly correlated activities simultaneously to reduce earnings

variability—either without (or willingly) sacrificing average earnings or increasing average earnings while maintaining the variability constant[2]. Unlike diversification, the primary goal of transitions is not typically to mitigate risk due to the existence of transition costs, and the two are unlikely to have the same impact on household well-being. Aggregating activity transitions, which may reflect desperation in some cases, over time create the illusion of diversification without its benefits. This *inter-temporal aggregation bias* poses a significant challenge when using infrequent data to study livelihood adaptation.

Second, in agrarian economies, where seasonality shapes rural life and opportunities, and activity returns change rapidly, livelihood decisions are rarely made on an annual basis, nor is household well-being a purely annual concept. Household decisions at each point in time influence future transition and diversification. Moreover, the predictability of seasonal patterns, even if the exact timing varies, will influence the current equilibrium of households' income-generating activities. Analyzing yearly snapshots often fails to capture the dynamic nature of transition and diversification, as well as fluctuations in well-being. A more granular data analysis can clarify both the short-term dynamics and long-term trajectories of household-level livelihood decisions and well-being.

Third, it is crucial to closely examine the activities involved in transition and diversification, distinguishing between low-return, generally desperation-led activities and high-return, opportunity-led ones. This disaggregation helps partially explain the seemingly contradictory findings on the impact of diversification, as well as the long-run low equilibrium state and negative adaptation trajectory due to the adoption of increasingly vulnerable livelihood systems over time (Davies, 2016). A few studies have been able to investigate the nature of diversification (Lay, Schüler, et al., 2008; Lay, Mahmoud, & M'Mukaria, 2008; R. Dimova, Halvorsen, Nyyssölä, & Sen, 2021), and the nature of transition behaviors remains an area yet to be fully explored, largely due to the unavailability of detailed, high-frequency data on income-generating activities.

[2]is a positive, opportunity-led type of diversification.

This study leverages high-frequency household-level data from Malawi to analyze the dynamics of income-generating activity transitions and diversification, providing a detailed understanding of livelihood decisions. By tracking monthly income sources for over 5,400 households, the research captures seasonal variations, household circumstances, and activity choices. Through the lens of the Dynamic Panel model, it rationalizes equilibrium behaviors and examines patterns of transition and diversification in response to macro-climatic and idiosyncratic shocks, alongside their implications for household well-being—measured proxied by real-time and future food insecurity. By addressing critical gaps in the literature, the study makes three key contributions to our understanding of livelihood adaptation:

First, it clarifies the distinction between transition and diversification. Leveraging high-frequency data mitigates inter-temporal aggregation bias—a common issue in studies using less frequent observations. Identifying both micro- and macro-level conditions that influence adaptation behaviors improves upon previous approaches, which often conflated diversification with transition and overlooked the distinct risk-mitigating benefits of true diversification. Second, it uses detailed data on activity choices to examine the nuances of desperation-led versus opportunity-led adaptation strategies. Similar behaviors can yield vastly different welfare outcomes, ranging from significant gains to negligible or even negative effects when households engage in multiple low-return activities. By disentangling the contexts in which these strategies occur, this research clarifies the mechanisms linking specific adaptation behaviors to improved welfare. Third, examining monthly household-level livelihood decisions, rather than relying on infrequent cross-sectional data, allows the study to leverage cross-time variation and better identify the influence of the underlying mechanisms like climate shocks and seasonality on livelihood behaviors. Accounting for unobserved heterogeneity and capturing lagged effects offers deeper insights into how past activity histories shape current decisions. This approach also distinguishes between household-level effects and broader macro trends, enabling a more granular understanding of adaptation strategies under varying conditions and their connection to welfare outcomes.

Specifically, exploring the following questions:

1. How does the use of high-frequency household-level data enhance our understanding of livelihood adaptation by distinguishing between short-term activity transitions and diversification, and how do less frequent observation intervals (e.g., annual surveys) bias estimates of their prevalence, determinants, and welfare associations?

2. Can high-frequency panel data approaches, controlling for both observed and unobserved time-invariant factors, provide more accurate estimates of relationships between adaptation strategies and welfare outcomes?

3. Can the heterogeneity within a household's chosen activity portfolio—encompassing varying levels of returns, stability, and risk profiles— clarify inconclusive results in the relationship between diversification and well-being outcomes, leaving out short-term transition?

4. How do household-level attributes (e.g., asset endowments, number of working people, credit access) and broader contextual factors (e.g., climate shocks, market conditions, seasonality) jointly influence the likelihood and type of transition and diversification chosen?

5. To what extent do past livelihood decisions (history dependence) shape current transition and diversification behaviors, and can we identify persistence or path dependence in either diversification or transition choices?

The analysis follows four steps. First, it defines the terminology, providing some stylized facts about the transition and diversification nature. Second, it demonstrates intera-household and inter-temporal aggregation. Third, it assesses the contributions of critical factors to different adaptation strategies using a dynamic panel model at the household

level. Fourth, it examines the relationship between specific strategies and well-being outcomes using two cyclone experiences as instruments.

Background & Data

Malawi, located in southeastern Africa, is a landlocked country known for its agricultural landscape. With over 70% of the residents living below the poverty line (povertydata.worldbank.org, 2023). According to the World Bank, the agriculture sector employs more than 60% of the workforce. While agriculture remains a primary source of household income with modest returns, income sources have diversified away from only agriculture to other sources like piecework. However, the reduction in reliance on farming as the sole income source for Malawians over time has had minimal impact on poverty reduction (Caruso & Cardona Sosa, 2022). There have been efforts to address the challenge of limited employment opportunities in the non-farm sector by intensifying government initiatives to support private-sector job creation, transitioning labor away from agriculture, and incentivizing rural-urban migration. However, the effects of these efforts remain inconclusive (Caruso & Cardona Sosa, 2022) (Beegle, Galasso, & Goldberg, 2017). Malawi is highly vulnerable to various climate shocks, which is reflected in its low ranking of 161 out of 181 in the ND-Global Adaptation Initiative Index. In early 2022, 23 Malawi faced weather shocks caused by Tropical Storms Ana and Freddy, which caused significant damage to the agricultural sector. Moreover, each district in Malawi faces shocks such as floods and fluctuations in food prices. Apart from natural disasters and complex economic challenges, limited human capital endowments have contributed to restricted opportunities for more productive economic activities in Malawi. This has led to concerning outcomes, as evidenced by the fact that for every three Malawians who lifted themselves out of poverty between 2010 and 2019, (Caruso & Cardona Sosa, 2022). The dataset used in this study is the Rapid Feedback Monitoring

System (RFMS)[3], which covers 12 districts out of the total 28 in Malawi. Conducted on a monthly basis, the data collection encompasses 5,400 households in rural areas. It captures a wide array of information, including household-level monthly data on various food security measures, experiences of shocks, realized consequences, household dynamics, demographics, crop cultivation details, migration patterns, and more. Additionally, every three months, detailed household-level data on different sources of income is collected, providing valuable insights into the economic dynamics of household livelihood management. This meticulous and comprehensive data collection approach enables a thorough examination of the multi-faceted factors influencing livelihood adaptation decisions and well-being in rural settings in Malawi.

The RFMS dataset offers a comprehensive perspective on income-generating activities, asset flows, crop diversification, ex-post shock responses, and individual-level data on piecework occupation and wages. The income-generating activities reported in the data set include:

Activities={*farming, fishing, livestock, piecework other sales, piecework farm wage, piecework other wage, piecework unspecified, salaried employment, business, migration*}

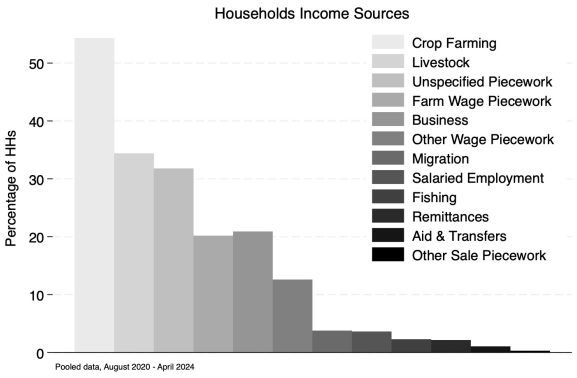


Figure 1: Households' Activities

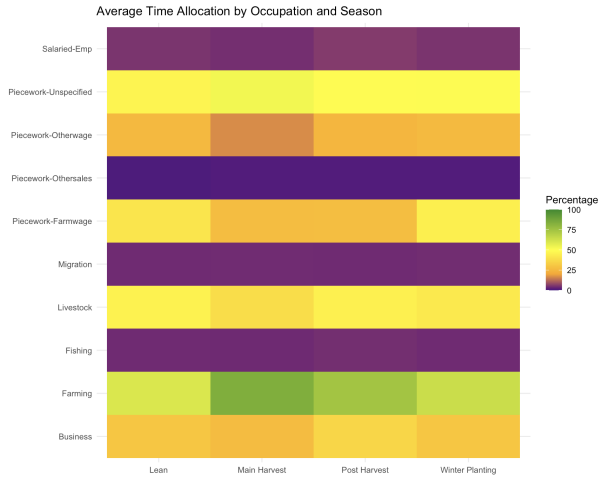


Figure 2: Seasonal Activities

[3]This collaborative effort, initiated in August 2020, involves a partnership between Cornell, Catholic Relief Service, and the World Bank.

The questionnaire collects information on income sources and livestock ownership quarterly, covering the past three months, and is supplemented by monthly data on home-produced consumption and piecework activities for more precise tracking of transitions and diversification. Farming activities are classified as active income sources if they are reported in the most recent quarterly survey, if the household consumes home-produced staples during a specific month, or if they report land cultivation. Livestock qualifies as an income source if it is reported or if the household owns livestock that remains alive. Similarly, migration is treated as an income source if remittances are reported. I developed a more granular, month-by-month measure of active income-generating activities by integrating quarterly and monthly data.

Terminology

Transition & Diversification

Activity transition refers to the inter-temporal occupation change at monthly or seasonal intervals. Any instances of the following are considered transition:

- Adding any activity—whether it is a new activity or one previously undertaken but later ceased—results in an increase in the number of different occupations from t to $t+1$, ceteris paribus.
- Withdrawing from an activity results in a decrease in the number of different occupations from t to $t+1$, ceteris paribus.
- Switching refers to discontinuing participation in one activity and beginning participation in another. This may result in the number of different occupations at time $t+1$ increasing, decreasing, or remaining the same compared to time t[4].

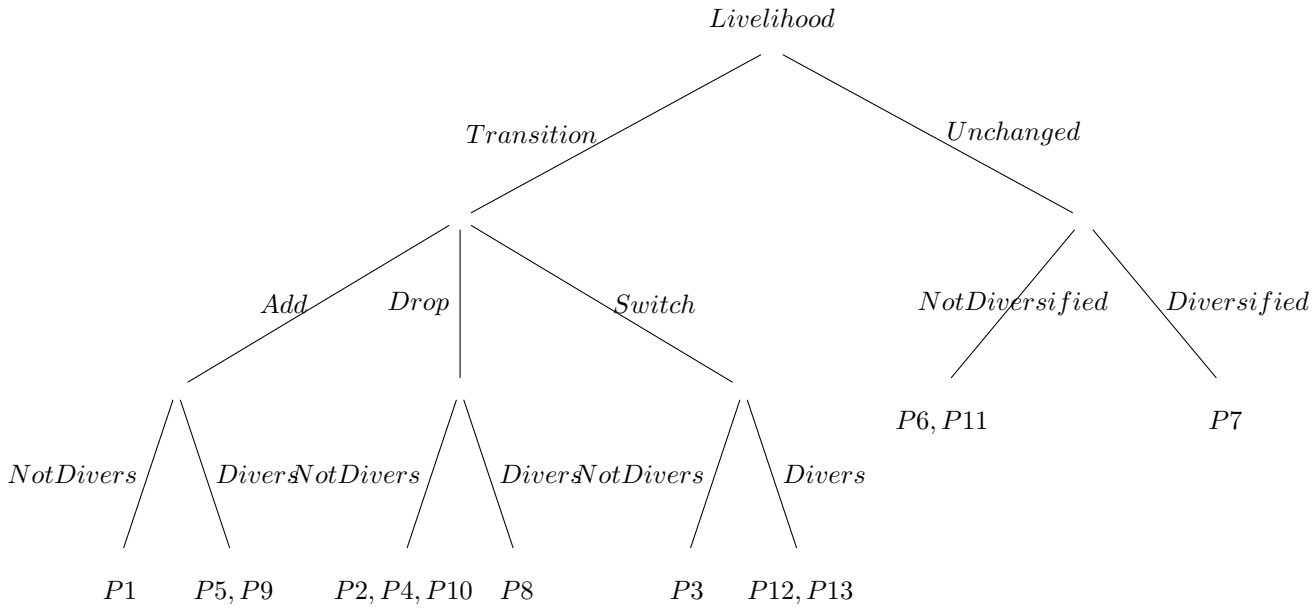
[4]In our data, the majority of switching instances involved no change in the total number of activities in time $t+1$.

Retaining the activity or activities from the previous period without any changes, indicating no transition.

Diversification, on the other hand, implies possessing multiple occupations simultaneously at a particular time. It can be measured with respect to assets, activities, or incomes. Although the majority of literature uses income for diversification measurement, none of the three variables is unequivocally superior, and they should ideally be employed to attain a nuanced understanding of the situation (Barrett, Reardon, & Webb, 2001b).

The RFMS dataset effectively tracks activity transition and represents diversification in a binary form—indicating whether multiple income sources are present at a given time—and in a discontinuous form, specifying the number of distinct income-generating activities at a particular moment. This diversification definition is distinguished from diversification measurements in other research. This measurement focuses on the extensive margin, not the intensive margin, as it does not indicate the proportion of income derived from specific activities during that time. Since the contribution of a specific activity to the total income might be minimal and insignificant, this limitation can hinder the precision of the measurement. However, at an extensive margin, the data's high-frequency nature allows for observing the dynamic changes in diversification, offering a nuanced perspective on the household decision-making process, the available options, and the feasibility of diversification. While RFMS data do not capture the income value from each activity, it effectively mitigates inter-temporal aggregation bias and distinguishes between activity transitions and diversification.

The following tree examines various possibilities for transition and diversification in livelihood decisions.



The following table represents the adaptation decisions in the RFMS data:

	t	$t+1$	Description	Freq.	Perc.
P1	o	d_j	Start activity after unemployment	887	0.41
P2	d_j	o	Lose the only income source	2,282	1.04
P3	d_j	d'_j	Switch activities	11,360	5.19
P4	d_j, d'_j	d_j	De-diversification through withdrawal	16,385	7.49
P5	d_j	d_j, d'_j	Diversification through adding	15,797	7.22
P6	d_j	d_j	Unchanged, undiversified	40,835	18.66
P7	d_j, d'_j	d_j, d'_j	Unchanged, diversified	67,973	31.06
P8	d_j, d'_j, d''_j	d_j, d'_j	De-diversified, still diversified	21,286	9.73
P9	o	d_j, d'_j	Start multiple activities after unemployment	316	0.14
P10	d_j, d'_j	o	De-diversification, becoming unemployed after	397	0.18
P11	o	o	Unchanged, remain unemployed	2.189	1.00
P12	d_j, d'_j	d_j, d''_j	Permanent activity plus temporary activities, diversified	37,153	16.98
P13	d_j, d'_j	d''_j, d'''_j	Switch activities, diversified	1,998	0.91
Total			Observations from 5,400 households over 50 months	218,858	100.00

Table 1: Transition and Diversification Possibilities between periods t and $t+1$ with Frequency and Percentage

The first column of the table indicates activities in time t, while the second column indicates activities in time t+1, allowing for thirteen mutually exclusive switching-diversification decision possibilities. These categories are determined by a household's initial activity portfolio at time t, the specific transition it undergoes, and whether its livelihood in the subsequent period is classified as diversified or undiversified—based on the number of distinct income-

generating activities in which the household engages. States at t and $t+1$ are determined by counting how many distinct income sources the household reports in each period.

The symbol $\mathbf{o}$ represents unemployment, indicating that the household has no active income source during the given period. The symbol $\mathbf{d_j}$ denotes that the household is engaged in exactly one income-generating activity j. Similarly, $\mathbf{d_j}, \mathbf{d'_j}$ indicates that the household is involved in exactly two distinct income-generating activities, j and j', and this pattern extends to cases with additional activities, which are represented accordingly. The precise definition of each adaptation possibility is provided in the Appendix .2.

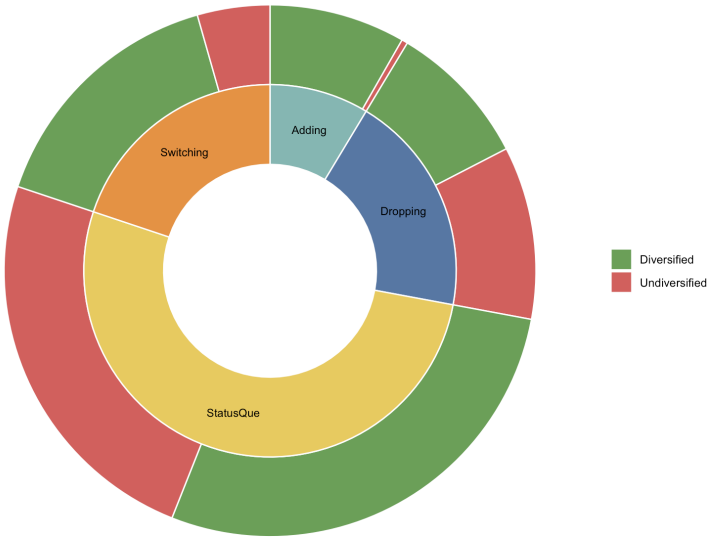


Figure 3: Households Transition and Diversification

Transition outcomes can be either diversified or undiversified. Nearly half of the sample exhibited no transition, classified as "Unchanged." Within this group, more than half remained diversified, while the rest remained undiversified. Among those who stayed undiversified, farming and unspecified piecework were the dominant activities, accounting for 43% and 24% of cases, respectively, with 1% remaining unemployed. A common livelihood strategy involves maintaining a permanent activity—such as crop farming, livestock rearing, or running a small business—while capitalizing on seasonal opportunities. The most prevalent seasonal activity associated with permanent occupations is other-wage piecework.

Identifying households with multiple adaptation modes and summarizing their frequency

of strategy occurrence suggests that maintaining the income source is a priority, especially when it comes to a diversified income-generating portfolio. The most sustained strategy was the unchanged-diversified mode, where sampled households maintained a diverse set of income-generating activities for an average of over 13 months in the past 50 months. Households, on average, remained undiversified for nearly 11 months. Another prevalent strategy involved combining permanent income with seasonal employment, which households implement for over eight months on average. These patterns suggest that households prefer to maintain stable livelihood structures instead of frequently adjusting their income portfolios, switching between activities in response to economic and environmental conditions [Fig 4]. This is in alignment with what (Roy, 1951) noted, that in the short term, households are unlikely to transition activities solely for the prospect of higher earnings. Instead, rational households will weigh the associated costs of making such a change, assessing the overall "net advantages" offered by different activities.

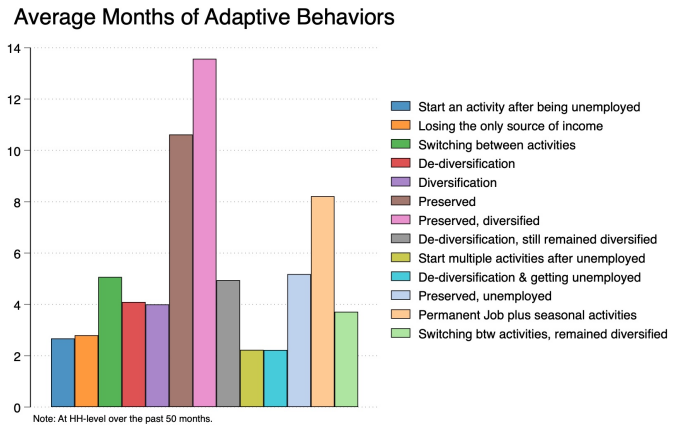


Figure 4: Average number of months implementing the specific strategy over the last 50 months.

Transition can disaggregated to different strategies: adding, dropping, and switching between activities. Not all transitions between activities are positive; some can lead to livelihood vulnerability, such as unemployment, while others result in a secure livelihood with permanent income and prosperous diversification. Adding and got diversified, at 6.47%, is the most common strategy. Contrary to expectations, diversification is not limited to the main harvest

and winter planting. Even during the lean season, there are opportunities to add another source of income to a household's portfolio. Farming, unspecified piecework, and farm-wage piecework were the most added activities across all planting seasons [Fig17].

It is unusual to start a new activity after a period of unemployment. While it is somewhat more common to start multiple activities during the main harvest, the likelihood remains low, indicating that while starting new activities after unemployment is relatively rare, when it does happen, diversification is often part of the strategy.

Interestingly, de-diversification trends align closely with getting diversified rates across seasons. The majority of 'dropping' strategies reflect a shift away from diversified income strategies, with a notable shift from a diversified portfolio to unemployment during both the lean season and the main harvest. This clearly discusses the seasonal nature of employment in the area of study and the occurrence of underemployment during lean season. The likelihood of losing the sole source of income during the lean season is nearly 3%, highlighting household vulnerability, as it indicates potential challenges due to limited income alternatives. Single activity turnover, following the 'seasonal activity switching while preserving permanent income' strategy, represents a second most prevalent form of switching strategies, in which the number of income sources remains constant over time. After crop farming, which strongly follows seasonal patterns, low-wage piecework experiences significant drops across different seasons, indicating that piecework is an inferior activity [Fig18]. The following graph (Fig 5), reflects a spectrum of adaptation strategies across planting seasons, where diversification, preservation, and activity-switching dominate.

Transition: Seasonal or Shock-Related

Household transition is influenced by *relative productivity*[5] and *available opportunities* that rationalize the transition observed in household behavior. Temporal fluctuations in relative productivity and labor demand (available opportunities) in agrarian economies are rooted

[5]Relative productivity leads to a sorting effect where households specialize in activities where they are most productive and activity opportunities.

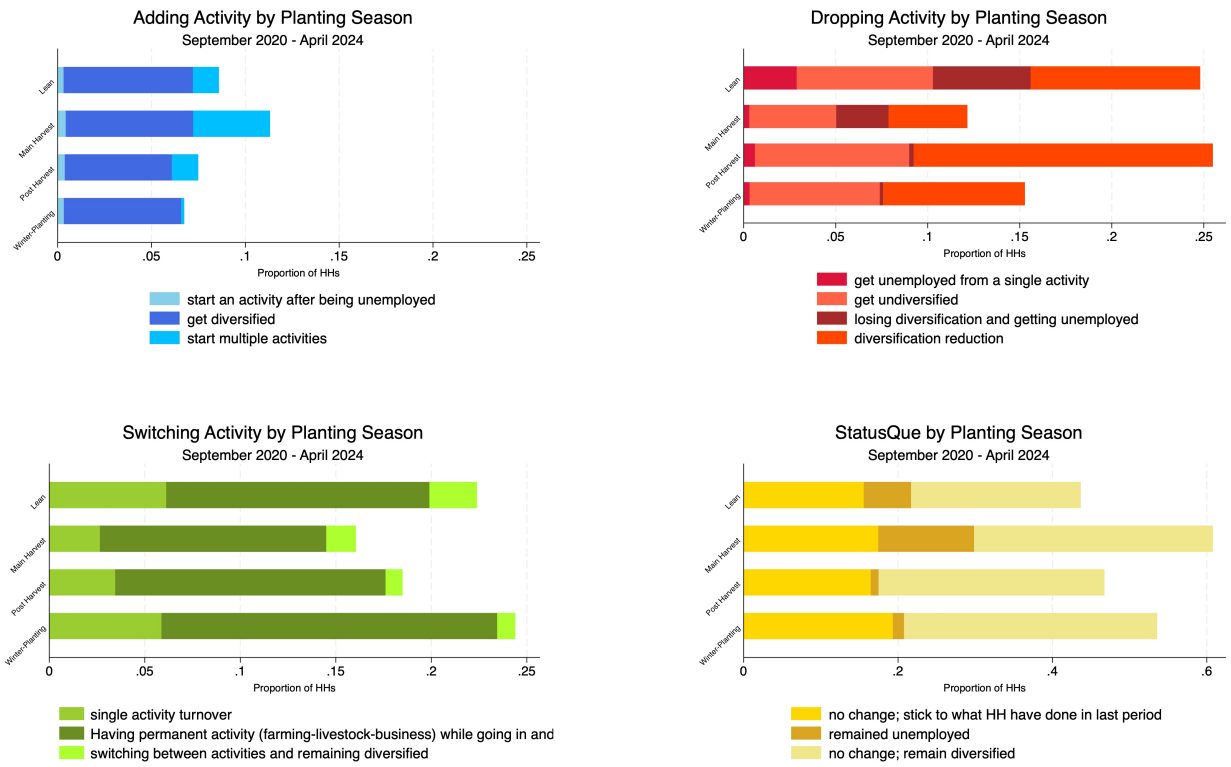


Figure 5: Disaggregation of Household Adaptation Strategies Over Planting Seasons

in seasonality and unexpected shock experiences. During the planting season, demand for agricultural workers rises, leading to decreased productivity within the agriculture activity; as additional workers, often less skilled, are drawn into agriculture wage work, the average productivity and wages decrease. Meanwhile, productivity in other activities, such as livestock or business, may relatively improve because the most skilled and specialized workers in those industries remain while less productive workers transition to agriculture (Roy, 1951). This emphasizes the importance of specialization in the household's income stability.

Transition —whether resulting in a diversified or not-diversified livelihood portfolio—can be seasonal-induced or shock-induced (non-seasonal). A seasonal transition occurs when a household adopts an activity that emerges during a specific season and ceases by the following season, recurring at approximately the same time each year. Seasonal transitions are temporary and follow a repeated, predictable pattern, consistently observed for consecutive years. If a household continues the adopted activity beyond the seasonal period or inte-

grates it into its year-round livelihood portfolio, the transition is classified as permanent. Conversely, if the activity emerges sporadically without a discernible seasonal pattern, it is considered temporary.

To analyze seasonal transitions, the percentage of time each income-generating activity is performed within a given season is calculated. This measure reflects the proportion of time a household engages in an activity relative to the entire agricultural season. For example, if a household reports engaging in farming for two months during a three-month main harvest period, its farming engagement rate for that season is 66%. Aggregating this measure across households at the season-year level provides insight into the intensity and role of specific activities in shaping community livelihoods.

It is also important to consider the broader context in shock-prone regions such as Malawi, where households have adapted to frequent shocks through anticipatory adjustments to their livelihood strategies. As a result, recurrent shocks are expected to have a minimal effect on long-term livelihood transitions. However, two sudden cyclones in January 2022 and March 2023 represent exogenous shocks that may help distinguish whether observed transitions are driven by seasonal patterns or shock-induced disruptions. The following graphs illustrate the seasonal distribution of income-generating activities over the past four years.

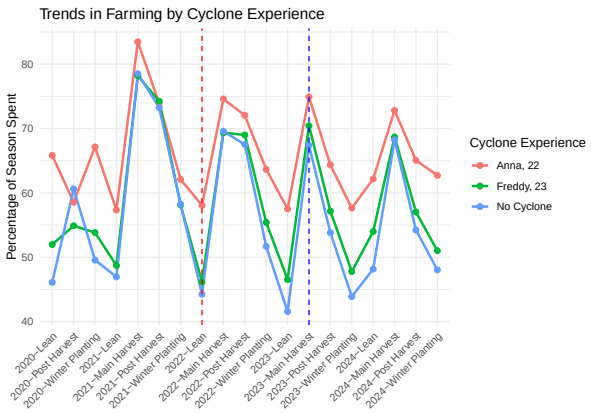


Figure 6: Crop Farming

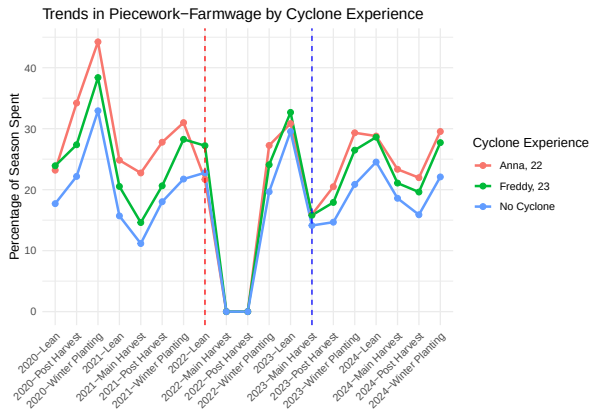


Figure 7: Farm Wage

As expected, changes in farming and farm wage patterns exhibit strong seasonal transitions and are largely unaffected by shocks. In contrast, livestock-related activities appear to

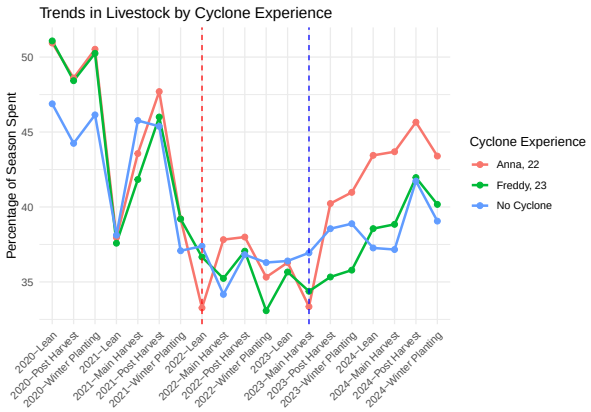


Figure 8: Livestock

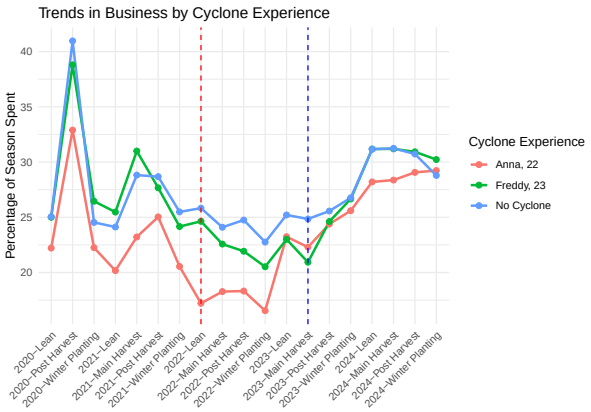


Figure 9: Business

be non-seasonal but responsive to the cyclones, while business activities display a combination of seasonal cycles and shock-induced fluctuations. Salaried employment and migration, which account for a smaller share of income-generating activities, remain stable across seasonal changes and large-scale weather shocks.

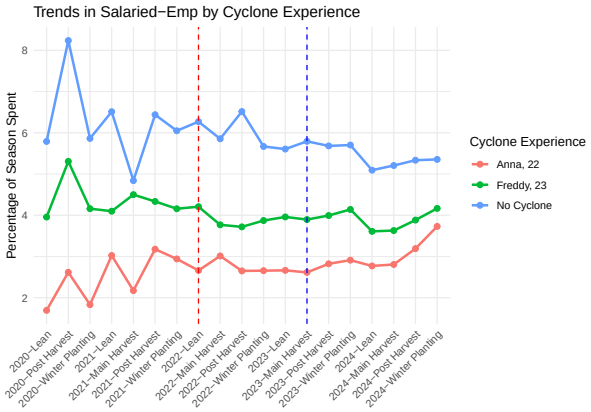


Figure 10: Salaried Employment

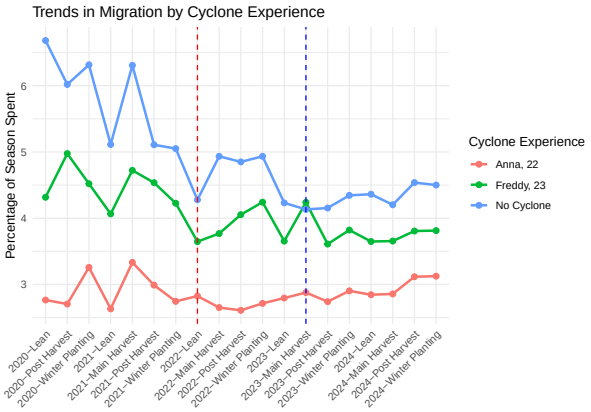


Figure 11: Migration

Unspecified and other wage piecework are inferior activities that generally require less skill, provide few prospects for growth, and yield lower returns, making them typically sensed as less desirable choices. Households often engage in these activities as a fallback or out of necessity when more desirable options are inaccessible. The piecework graphs demonstrate strong seasonal patterns and high sensitivity to shocks. Notably, in the aftermath of the cyclones, there is a significant and permanent-ish shift from other wage-based piecework

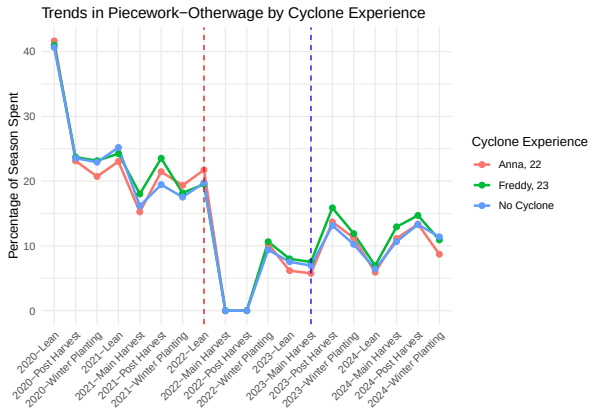


Figure 12: Other Wage Piecework

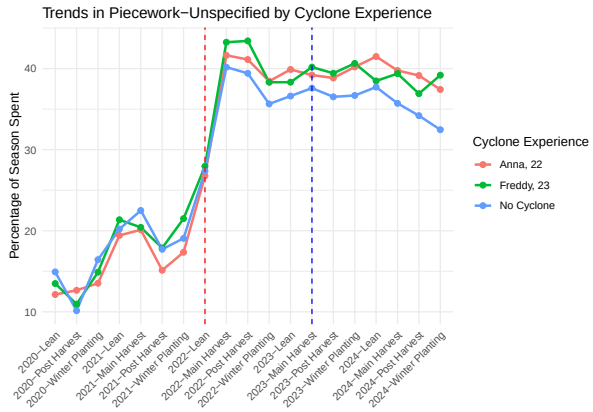


Figure 13: Unspecified Piecework

to unspecified piecework, which serves as evidence that these activities serve as key coping mechanisms for absorbing income shocks.

Transition Dynamics

Seasonal or shock-related transitions can lead to either livelihood security or vulnerability, depending on the activity transitioned into. Activities are often organized in a hierarchy based on payment, social status, and benefits relative to other available options [6], and detailed activity data can illuminate this nature of the transition and future trajectories.

I examine the likelihood of transitioning from one income-generating activity[7] to another over time by using a probability transition model. This approach helps us understand how previous activities influence the transition process and highlights the baseline capacity for future opportunities.

The diagonal entries in the transition matrix represent the probability of remaining in the same activity, indicating that people either have a strong preference to maintain their primary income source or face barriers that keep them stuck in their current activity.

Transitions from various activities to crop farming highlight the seasonal nature of

[6]This hierarchy varies across personal preferences and communities.

[7]The primary source of household income has been used to investigate activity transition, as specified in the questionnaire.

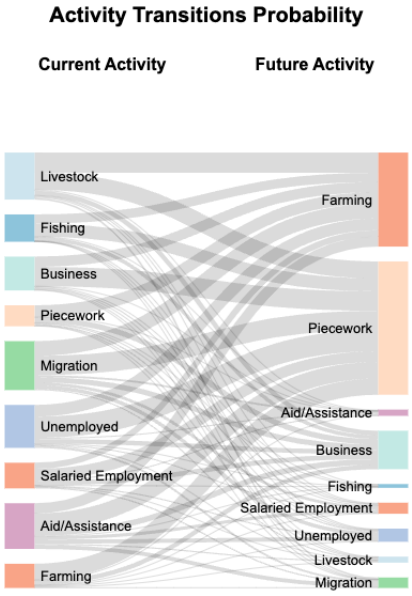
Table 2: HH-level Monthly Transition Matrix

	Next Period Activity								
Current Activity	Crop farm	Fishing	Livestock	Piecework	Salaried Empl.	Business	Migration	Aid/Assistance	Unemployed
Crop farm	90.12 (60672)	0.21 (143)	0.39 (264)	6.59 (4438)	0.21 (139)	1.82 (1226)	0.22 (148)	0.14 (95)	0.30 (199)
Fishing	3.76 (161)	88.86 (3805)	0.14 (6)	5.28 (226)	0.19 (8)	1.49 (64)	0.07 (3)	0.12 (5)	0.09 (4)
Livestock	8.24 (257)	0.22 (7)	80.82 (2520)	6.93 (216)	0.42 (13)	1.89 (59)	0.67 (21)	0.38 (12)	0.42 (13)
Piecework	4.71 (4407)	0.27 (250)	0.24 (229)	91.44 (85504)	0.30 (277)	2.21 (2063)	0.22 (209)	0.11 (100)	0.50 (468)
Salaried Empl.	2.51 (178)	0.03 (2)	0.13 (9)	4.38 (310)	89.55 (6340)	1.95 (138)	0.52 (37)	0.45 (32)	0.48 (34)
Business	4.16 (1214)	0.29 (84)	0.32 (93)	7.89 (2302)	0.45 (131)	86.21 (25144)	0.16 (47)	0.13 (38)	0.38 (112)
Migration	6.00 (184)	0.00 (0)	0.46 (14)	7.89 (242)	1.17 (36)	2.15 (66)	80.06 (2457)	0.78 (24)	1.50 (46)
Aid/Assistance	4.19 (77)	0.27 (5)	0.49 (9)	6.75 (124)	1.31 (24)	2.29 (42)	1.63 (30)	81.38 (1495)	1.69 (31)
Unemployed	4.78 (193)	0.25 (10)	0.27 (11)	8.64 (349)	0.45 (18)	1.88 (76)	0.79 (32)	0.45 (18)	82.49 (3331)

Note: Observation frequencies in the parentheses.

income-generating activities. For example, the probability of moving from livestock to crop farming is relatively high at 8.52%, whereas the likelihood of transitioning from crop farming to livestock is much lower at 0.37%. This suggests that entering livestock farming is challenging in the short run due to transition costs.

Piecework also shows a high level of transitions. Seasonal fluctuations drive many people to shift from other activities to piecework, making it a fallback occupation that absorbs seasonal underemployment. Additionally, the likelihood of moving from piecework to unemployment is notably higher compared to other occupations, reflecting its vulnerability to job instability. The graph below illustrates the intertemporal transition matrix:

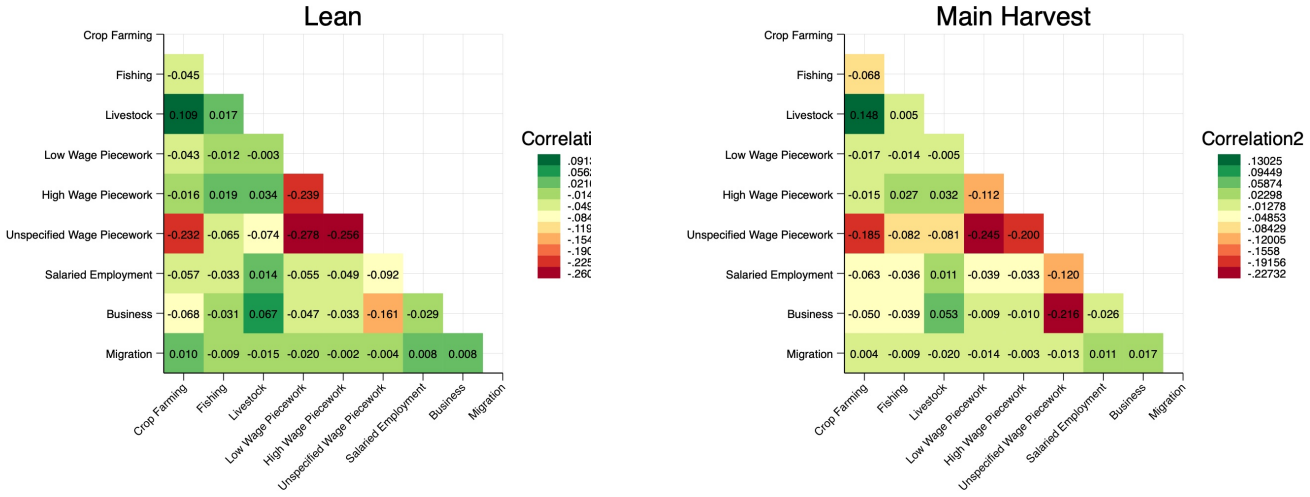


By examining the yearly transitional matrix, I found that the probabilities of moving from

one activity to another did not significantly change across the years 2021, 2022, and 2023. This could indicate that the transition is stationary, where the probability of transitions remains constant over time, and the dynamics of the system do not depend on the specific year but only on the current activity that a household is involved in (Appendix 12).

Diversification

While transition refers to the process of change, diversification in this study is measured statically to highlight the benefits of simultaneously holding different-uncorrelated- income-generating activities and specialization. The most common practice is to remain diversified and have a permanent job plus seasonal activities. Evidence from the pooled data suggests that maintaining income sources is a common strategy for households over time, among farmers, livestock owners, and businesses, as well as unspecified piecework and farm wages that provide lower returns relative to farming, livestock, and business. The following graphs show that certain activities tend to be grouped together.



Farming, livestock, and business often go hand in hand. Farm-wage and unspecified piecework are often performed together. These distinct patterns of diversification remain relatively consistent across different harvesting seasons. This finding provides evidence of the two classes of diversification: one among higher-return activities (farming, livestock,

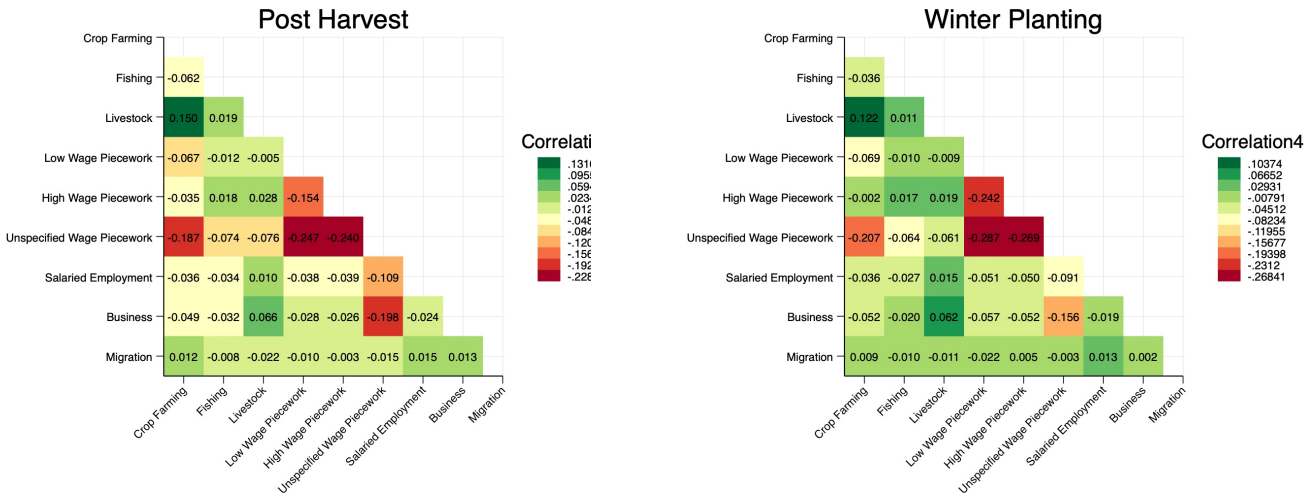


Figure 14: The Lean season (Dec–Feb) is marked by food scarcity and reliance on reserves. The Main Harvest (Mar-May) brings peak agricultural yields. The Post-Harvest (Jun–Aug) involves food processing and market sales. The winter planting season (Sep–Nov) is when new crops are sown.

and business) and another for low-return livelihoods (unspecified and farm-wage piecework), presumably driven by desperation.

Descriptive Evidence

Intra-household Aggregation: Specialization & Multi-tasking

Intra-household diversification has long been recognized, with "rural families increasingly resembling miniature, highly diversified conglomerates" (Cain & McNicholl, 1986). Households can achieve diversification in two primary ways: either by engaging all working members in multiple activities, thereby collectively spreading economic risk, or by having individuals specialize in specific activities, leading to household-level diversification through different areas of expertise. This distinction is critical, as specialization is typically associated with increased efficiency. Using RFMS data at the individual level, I analyze whether livelihood activities are evenly distributed among household members or strategically divided.

Member specialization is defined by the frequency of engaging in a specific activity for more than five months in a year, based on the member's primary source of income in the

RFMS data[8]. In contrast, multi-tasking is defined as a working member engaging in multiple livelihood activities simultaneously.

Households primarily specialize in crop farming (%8-%9), piecework (%3), and business (%2). Specialization patterns are relatively consistent across male and female workers, though female workers are more likely to specialize in crop farming, while salaried employment and fishing are more prevalent among men (Fig 20). Notably, engagement in various forms of piecework is significantly higher than other activities, but since piecework consists of low-skilled, low-wage labor, it does not constitute an area of expertise. This underscores the crucial role of piecework in mitigating underemployment throughout the year.

When examining different age groups, specialization in crop farming—defined as sustained participation in farming activities over a year—is relatively stable across small children (aged 4 to 15), youth (aged 15 to 20), and adults. However, adults are more likely to engage in unskilled piecework for extended periods compared to younger age groups. Youth also engage in piecework more frequently than small children, indicating that while crop farming remains a consistent livelihood activity for all age groups, piecework is not a stable activity among small children.

Another key observation is that as the number of specialized members in a household increases, reliance on low-return piecework declines. Additionally, households that have opportunities to specialize in activities such as crop farming or business are less dependent on piecework. Male-headed households tend to have a greater number of specialized members than female-headed households. Moreover, diversified households also exhibit a higher number of specialized members.

At the household level, specialization is quite common, occurring in %50 of cases, while multi-tasking is relatively rare (%2.2). The most prevalent patterns include strong special-

[8]The data provides detailed information on piecework. In this definition, we categorize piecework as specialization only when it involves farm-related tasks such as FarmWork/Harvesting or FarmWork/FieldPreparation. However, other forms of piecework—including Construction, Loading, Household Chores, Brick Molding, Sand Mining, Sales/Consignment, and miscellaneous activities—are excluded from specialization, as they represent low-skilled, temporary labor.

ization with minimal multi-tasking, as well as frequent short-term transitions in and out of occupations, where neither specialization nor multi-tasking activities are observed Table 3.

Table 3: Distribution of Multitasking and Specialized Households (Percentages)

	Specialized		**Total**
Multi-task	no	yes	
no	49.42%	48.36%	97.78%
yes	1.04%	1.16%	2.22%
Total	50.46%	49.54%	100%

Viewing the household as a cohesive unit, we find that in 85% of diversified households, no members are specialized, nor do they engage in multi-tasking to create a diversified portfolio, suggesting that many diversified households may lack the efficiency that comes with specialization. These households also include those who are diversified through having access to other income sources, such as aid and transfers. Instead, household-level diversification in the RFMS data arises from multiple members engaging in different single activities without specialization, leading to frequent transitions between occupations. In contrast, 14% of households achieve diversification through multiple specialized members, forming the most efficient portfolio. Very few households diversify through a single member engaging in multiple activities, and cases where both multi-tasking and specialization occur simultaneously are particularly rare.

Table 4: Distribution of Specialized and Multitasking Households (Diversified Only)

Specialized and Multitasking Status	**Frequency**	**Percent**
Not specialized, no multi-tasking	671,250	84.98%
Specialized only	113,239	14.34%
Multi-tasking only	3,110	0.39%
Specialized and multi-tasking	2,286	0.29%
Total	789,885	100.00%

The following figure (Figure 15) illustrates the percentage of households in the pooled sample that engage in multi-tasking versus those that specialize, within the context of diversification.

The highest vulnerability is expected among households that are neither diversified nor specialized, comprising 18% of our sample. Approximately 15% of households rely on a single

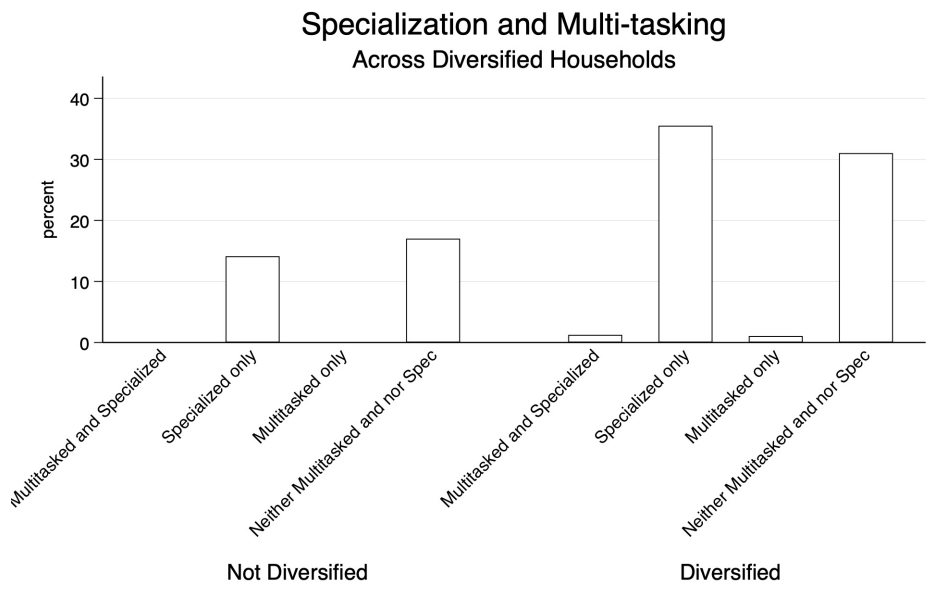


Figure 15: Household-Level Engagement in Multi-Tasking and Specialization within Diversification

specialized member (left side of the Figure 15). Multi-tasking is uncommon among members of both diversified and non-diversified households.

Inter-temporal Aggregation

Livelihood diversification and intertemporal activity transition are fundamentally different strategies that potentially have distinct implications for household well-being. With infrequent data collection, these two phenomena are often conflated and may lead to misinterpretations. The differential impacts on household well-being stem from the distinct nature of these strategies. A transition may signal vulnerability or forced adjustment. Conversely, diversification may reflect a deliberate effort to enhance stability and resilience. If these two are not distinguished, their unique impacts on well-being may be obscured, resulting in biased or ambiguous conclusions. Monthly high-frequency data play a critical role in this differentiation by offering enhanced resolution that allows us to pinpoint the exact timing of diversification versus transitions. This precise timing helps us identify whether changes in livelihood composition occurred as part of a gradual transition or as a discrete diversification

event. Moreover, high-frequency data yield more reliable measures of income sources and activity changes by reducing the aggregation of data over extended periods and minimizing recall errors associated with long recall periods.

The following graph (16) depicts a kernel density plot showing how long (in months) households have implemented particular strategies from August 2020 to October 2024 on 5,400 households in 50 months.—specifically, whether they have been "diversified," in "transition with no diversification," in "transition regardless of diversification," or exhibiting "aggregated (biased) diversification." The horizontal axis represents the duration (from 0 to 50 months), and the vertical axis is the estimated density of observations in each category, where the height of each curve at a given point on the horizontal axis reflects the relative concentration of households reporting that particular duration of strategy implementation.

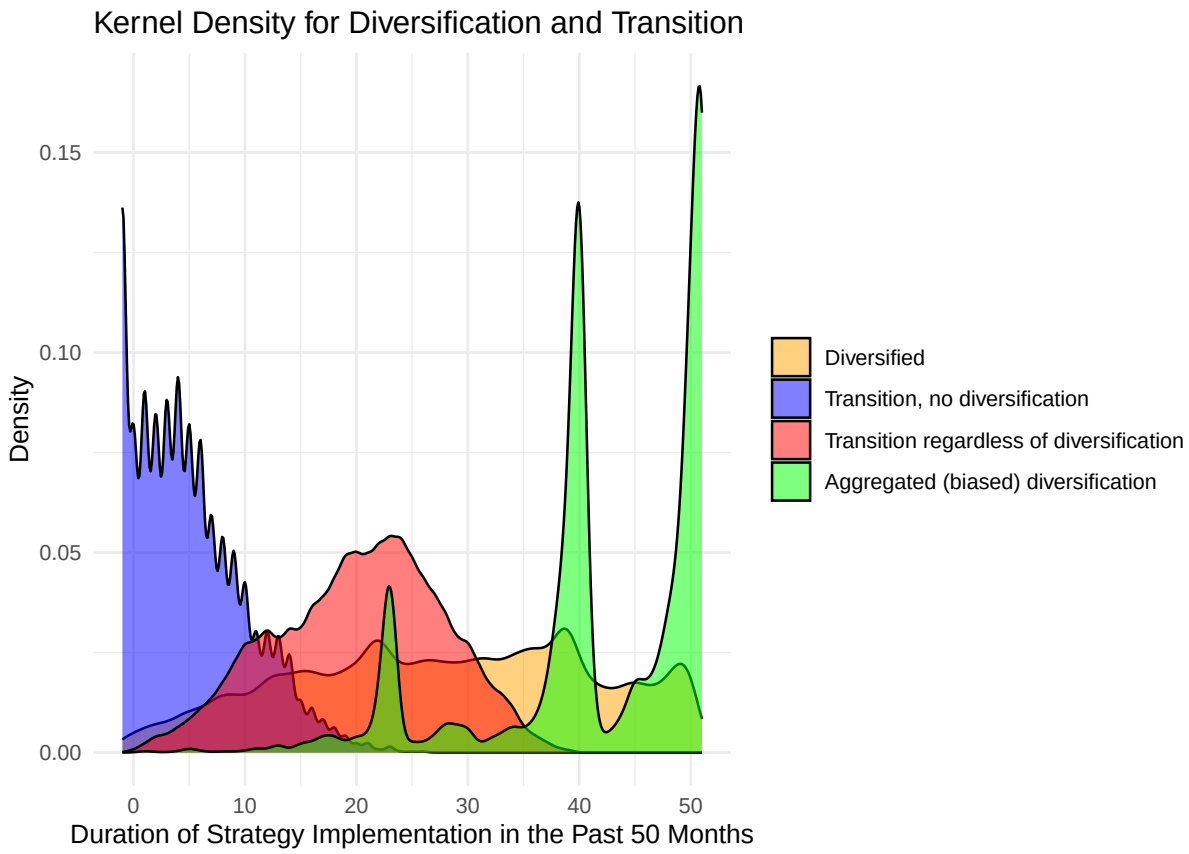


Figure 16: Distribution of Adaptation Strategies

Transition without diversification effort density (blue) accumulated on the left-hand side

of the graph, meaning transition to different activities without having a diversified income portfolio happens less frequently among the study population.

The single peak at a mid-range of adaptation months in the "transition, regardless of diversification" category (red) indicates a modal adaptation duration, meaning that households, irrespective of diversification status, converge on a similar adaptation duration of 20 months. It spread widely over the range of 0-35, indicating a blend of both short-term and extended adaptation efforts. The unimodal distribution of this behavior implies that transitions, regardless of diversification, are consistent adaptation strategies across households, with less heterogeneity in durations within this category.

The bimodal distribution of "diversified" (yellow) denotes two distinct clusters of durations, implying heterogeneity in diversification behavior, the existence of two sub-groups within diversified households: one adopting short-term diversification and the other engaging in longer-term diversification, which could reflect heterogeneous levels of diversification options available that shaped different diversification lengths.

The green curve has three large spikes, two toward the higher durations. When "transition" and "diversification" are lumped together (aggregated), it can artificially inflate the appearance that households have been "diversified" for longer periods. Essentially, transitions and diversification get merged into one measure, creating a biased picture of how long households truly remain diversified.

The key takeaway is that combining transition and diversification into a single measure over time (green) produces a very different pattern than when each is tracked separately. This underlines the importance of distinguishing between genuine diversification (yellow) and transition (blue or red) to avoid masking the proper timing and nature of households' livelihood strategies.

Selection into Livelihood Adaptation

Livelihood transitions and diversification are driven by two main factors: choice limitations—when some activities are temporarily unavailable—and changes in expected returns from activities [9]. Various grounds, motivations, and restrictions shape livelihood transitions and diversification behaviors, which can differ across individuals and households at a particular time. These reasons can also shift over time for the same households. According to Ellis (2000) (Ellis, 2000a), seasonality, risk strategies (voluntary adaptations), labor and credit markets, asset strategies, and coping strategies (involuntary adaptations to shocks) are the main six factors influencing diversification (and livelihood transition) by either restricting or expanding the available choices or making shifts in the (expected) returns of activities.

seasonality plays a significant role in shaping patterns of livelihood adaptation in rural household incomes, particularly concerning on-farm and off-farm agricultural wage earnings (Ellis, 2000a) (Turin & Valdivia, 2013). It leads to transitions in activities as labor time shifts from lower to higher return activities. It also motivates diversification and labor allocation within a household to stabilize income, mitigate risks associated with agricultural cycles, and take advantage of higher-return activities that occasionally appear in different seasons. In addition to affecting available activities, seasonality can negatively impact assets and sometimes the feasibility of adaptation. This is because households cannot fully leverage the predictability of seasonality due to market incompleteness (Sahn, 1989).

Risk, Coping, and Asset Strategies are three other motives for livelihood adaptation. The term *risk management strategy* refers to any ex-ante risk management. On the other hand, *coping strategies* refer to undesirable actions such as transitioning into a lower-return occupation or taking on unwanted activities due to starvation. Coping strategies such as forced asset sales, drawing down on savings, using up food stocks, or selling livestock can permanently change a household's future income and living conditions. So, it is also important to

[9] Another reason is job status. The activity is available, but some people don't participate due to low employment status. I will not consider this pathway in this study.

look at different coping strategies when considering diversification and transition.

The concept of *asset strategies* is based on the idea of achieving growth or securing income for the future. Households diversify and take on some risky transitions to build up natural, physical, human, financial, and social capital, aiming to create a better future. Lack of access to productive assets such as land and livestock, households are stuck with an inferior activity that is perceived as less desirable, either because it offers lower pay, lower social status, or fewer benefits compared to outside options, including different forms of piecework. The last two factors are *labor markets and credit markets*. Navigating a sustainable livelihood amidst seasonal variations and potential shocks occurs through labor markets offering agricultural and non-agricultural opportunities based on location, skills, education, etc. A well-functioning labor market motivates both positive diversification and transition into higher-return occupations. On the other hand, a malfunctioning credit market can lead to negative diversification and a shift into lower-paying jobs as households lack a buffer to cope with seasonal income fluctuations and climate/economic shocks. Living in areas with poor connectivity, incomplete markets, seasonal fluctuations, and varying strategic assets can significantly limit the options for households' livelihood adaptation planning for inter-temporal optimization.

In addition to the factors mentioned earlier, household-specific internal factors and specialization also play a significant role in shaping livelihood adaptation behaviors. The *internal factors* include household beliefs about future earnings and expenses, uncertainty, and the utility they want to maximize. *specialization* is also an important motivation.

According to Adam Smith, dividing labor within a household based on the comparative advantages of its members leads to the most significant improvements in labor productivity. Labor specialization can also occur over time based on comparative advantages. These comparative advantages vary over time based on the number of working-age adults, skills, available assets, underlying market, and ecological conditions resulting in activity switching and diversification behavior. Given the highly time-variant nature of these factors, utilizing

high-frequency data is crucial in studying household livelihood decisions.

Other important factors influencing household adaptation decisions include *idiosyncratic and covariate shocks*(Günther & Harttgen, 2009). Experiences of shocks, whether unique to specific households or affecting entire communities, coupled with seasonal patterns, introduce daily challenges for vulnerable households that shape different decisions regarding income-generating activities. Foreseeable shocks fuel precautionary activities or ex-ante responses, while unforeseen shocks alter a household's livelihood ex-post.

The RFMS data captures a comprehensive vector of variables that contribute to the selection of adaptation strategies. By defining the percentage changes in adaptive behavior, we account for seasonality. Credit market conditions are controlled by examining saving and credit availability at the household level throughout the seasons. Asset strategies are addressed by including a variable for selling productive assets, while coping strategies are measured by instances of implementing severe tactics, such as reducing meal sizes. In this analysis, I also controlled for the number of specialized members in the household, as well as self-reported shocks[10]. The level of productive assets, including the Tropical Livestock Unit, agricultural land ownership, productive assets index using (PCA), and household characteristics such as household size, head age, gender, education, dependency Ratio, and the number of working-age male and females are also controlled. However, the data falls short of capturing measures related to risk strategies and labor market conditions.

Empirical Strategy

In my analysis, I utilize the Arellano-Bond estimator (Arellano & Bond, 1991) to address the dynamic panel nature of the data. This estimator is helpful because the previous state of the household influences future decisions. Therefore, it is necessary to include a lagged de-

[10]The RFMS data includes monthly, self-reported shocks at the household level. While perceptions of shocks may differ from actual experiences, using self-reported shocks is appropriate for studying adaptation behaviors, as people make decisions based on their perceptions of reality rather than the objective reality itself. *ShocksReported*= {*Drought, Flood, Crop disease, Fall crop prices, Rise food price, HH death, HH breakup, Illness in HH, Epidemic, Theft, Strong wind, Fire damage*}

pendent variable, which introduces endogeneity. The Arellano–Bond estimator instruments the lagged dependent variable using its past values, mitigating the bias arising from the correlation between the lagged dependent variable and the error term. It handles unobserved heterogeneity using first-differencing the data by eliminating time-invariant individual effects. It controls the endogeneity arising in dynamic panel data models (lagged dependent variable) by internal instruments (lagged levels and differences), meaning it uses past values of the endogenous regressors as instruments, assuming these lagged values are uncorrelated with the current error term (i.e., exogenous) and can therefore give us consistent estimates.

My model uses two sudden cyclones in January 2022 (Anna) and March 2023 (Freddy) as instrumental variables. They serve as a valid source of exogenous variation as they are naturally occurring events exogenous to household-level decision-making. Their occurrence is also plausibly unrelated to unobserved factors that affect household livelihood transitions. Using these two cyclones as instruments, I tried to isolate the exogenous component of the variation in our endogenous nature of decisions and enhance the credibility of our inference.

The estimated regression takes the following form:

$$\mathrm{Y}_{it} = \alpha + \beta_1 \,\mathrm{Reaction}_{i,t-1} + \gamma \,\mathbf{X}_{it} + \delta \,\mathrm{Cyclone}_{it} + \varepsilon_{it},$$

where Y_{it} measures the percentages of adopting a specific strategy during a specific season for household i at time t. It includes general transition (e.g., adding, dropping, switching, and unchanged) and their respective mutually exclusive possibilities. $\mathrm{Y}_{i,t-1}$ is the lagged dependent variable. $\mathbf{X}_{it}$ is a vector of control variables, such as household size, head's age, head's gender, total livestock units, and other relevant shocks that help account for observed heterogeneity across households that might influence their decisions. $\mathrm{Cyclone}_{it}$ represents the cyclone experience, used as an exogenous instrument. I placed greater emphasis on the Hansen test results rather than the Sargan test for instrument validity as it does not require the assumption of homoscedastic errors, making it more reliable in heteroskedasticity.

Results

Table 5 reports GMM estimates for four different **adding** outcomes. I focus on the models with validated instruments based on the Hansen test (i.e., those with Hansen p-values above 0.05) that allows us to identify variations in adaptation strategies over time, and uncover key patterns in their decision equilibria. Consider the "Start of New Activity" (Column 2; Hansen $p = 0.232$) and "Multiple Activity Start" (Column 4; Hansen $p = 0.671$) outcomes, the lagged dependent variable, (L.New Activity Start), has a significant coefficient of 0.533, indicating that households who started a new activity in the previous period are more likely to do so again in the current period. Several household characteristics significantly influence this outcome. Specifically, households with specialized members and greater livestock ownership (TLU) are associated with lower probabilities of starting a new activity. This association is positive for female-headed households. Credit access also shows a significant negative effect, suggesting that households with credit are less likely to initiate new activities, potentially due to better financial stability or targeted investments. This result highlights that while the general trend is negative, the relationship is not uniform and may depend on unique household circumstances or loan utilization. For the "Multiple Activity Start", only credit has a significant negative association, meaning credit access reduces the likelihood of starting multiple activities.

For the **dropping** transition (Table 6), we focus on the models for "Get Unemployed" (Column 2), "De-diversification" (Column 3), and "De-diversification, Unemployed" (Column 5), where the Hansen test supports instrument validity. The model exhibits strong persistence, as evidenced by the significant positive coefficient on the lagged variable (L.Get Unemployed $= 1.166^{**}$). None of the household characteristics (e.g., Specialized member, Head age, Head female, Dependency Ratio, TLU, Severe coping strategies, Saving, and Credit) significantly affect the likelihood of becoming unemployed. This suggests that past unemployment status is the primary predictor of current unemployment among those dropping activities.

Table 5: Adding

	(1) Adding	(2) New Activity Start	(3) Diversification via Adding	(4) Multiple Activity Start
L.Adding	0.498***			
	(0.148)			
Specialized Member	-0.183***	-0.0456**	-0.120***	-0.00460
	(0.0404)	(0.0219)	(0.0284)	(0.0102)
Head age	-0.00295	0.00934*	-0.0130***	0.00148
	(0.00292)	(0.00493)	(0.00472)	(0.00253)
Head female	0.689***	0.107*	0.457**	0.0337
	(0.237)	(0.0630)	(0.191)	(0.0782)
Dependency Ratio	-0.0168	0.181	-0.218	0.00222
	(0.277)	(0.112)	(0.251)	(0.0469)
TLU	-1.871***	-0.231**	-1.359**	-0.0245
	(0.677)	(0.108)	(0.639)	(0.0681)
Severe coping strategies	0.392*	0.0350	0.355*	0.0143
	(0.205)	(0.0498)	(0.204)	(0.0308)
Saving	-1.132***	-0.0306	-1.104***	-0.00567
	(0.188)	(0.0475)	(0.189)	(0.0311)
Credit	-1.146***	-0.108**	-0.977***	-0.0733**
	(0.219)	(0.0512)	(0.218)	(0.0374)
L.New Activity Start		0.533**		
		(0.247)		
L.Diversification via Adding			0.565***	
			(0.155)	
L.Multiple Activity Start				0.574
				(0.707)
Constant	5.745***	-0.0245	5.152***	0.0347
	(1.290)	(0.0586)	(1.363)	(0.0337)
Obs	71549	71549	71549	71549
Groups	5333	5333	5333	5333
AR1_p	0.000	0.000	0.000	0.190
AR2_p	0.000	0.072	0.000	0.513
Hansen_p	0.037	0.232	0.034	0.671
Sargan_p	0.026	0.002	0.045	0.016

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

In de-diversification (Column 3) the lagged dependent variable (L.De-diversification $= 0.886^{***}$) is highly significant, indicating strong persistence in the de-diversification process. In addition, the coefficient on credit is significantly negative (-0.819^{***}), implying that households with access to credit are less likely to de-diversify.

Table 6: Dropping

	(1) Dropping	(2) Get Unemployed	(3) De-diversification	(4) Diversification Reduction	(5) De-diversification, Unemployed
L.Dropping	0.0182				
	(0.0651)				
Specialized Member	0.293***	0.0161	0.0237	0.480***	-0.00181
	(0.0405)	(0.0429)	(0.0653)	(0.0478)	(0.00674)
Head age	-0.0165***	-0.00183	-0.00166	-0.00944**	0.000977
	(0.00575)	(0.00834)	(0.00811)	(0.00442)	(0.00205)
Head female	0.0719	-0.0153	0.199	-0.729**	0.0178
	(0.193)	(0.107)	(0.293)	(0.323)	(0.0507)
Dependency Ratio	-0.648	-0.0182	0.191	-1.593***	-0.0658
	(0.447)	(0.186)	(0.252)	(0.378)	(0.0487)
TLU	2.591***	-0.0401	0.0760	5.806***	0.0417
	(0.496)	(0.187)	(1.258)	(0.622)	(0.0691)
Severe coping strategies	0.337	0.0977	-0.0183	-0.805**	0.0135
	(0.292)	(0.0836)	(0.290)	(0.395)	(0.0299)
Saving	0.734***	-0.0902	0.174	0.929***	-0.0247
	(0.224)	(0.0684)	(0.287)	(0.270)	(0.0353)
Credit	-0.273	0.104	-0.819***	0.955***	-0.0666**
	(0.252)	(0.0996)	(0.276)	(0.236)	(0.0339)
L.Get Unemployed		1.166**			
		(0.487)			
L.De-diversification			0.886***		
			(0.296)		
L.Diversification Reduction				0.265**	
				(0.133)	
L.De-diversification, Unemployed					0.665
					(0.572)
Constant	14.80***	-0.0365	1.151	2.996**	0.0922*
	(1.262)	(0.0520)	(2.815)	(1.229)	(0.0478)
Obs	71549	71549	71549	71549	71549
Groups	5333	5333	5333	5333	5333
AR1_p	0.000	0.005	0.000	0.000	0.090
AR2_p	0.317	0.059	0.001	0.008	0.294
Hansen_p	0.000	0.402	0.283	0.000	0.220
Sargan_p	0.000	0.029	0.804	0.000	0.000

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

In de-diversification and becoming unemployed specification, while the lagged outcome is not significant, credit remains negatively associated with the outcome (-0.0666^{**}), suggesting that credit access reduces the probability of households falling into the combined state of de-diversification and unemployment. The results underscore that past behavior is a key driver of current outcomes in some cases (notably in unemployment and de-diversification), and access to credit consistently plays a mitigating role in dropping types of livelihood transition.

For the **switching** outcomes (Table 7, only the model for *Switched, Diversified* (Column 4) has validated instruments In this specification, the lagged dependent variable, *L.Switched, Diversified*, has a coefficient of 0.428 ($p < 0.01$), indicating that households that switched in the previous period are significantly more likely to switch in the current period. Household head age is negatively associated with switching (-0.00677, $p < 0.01$), implying that older household heads are less likely to switch. Female-headed households are also less likely to switch (-0.150, $p < 0.05$). Total livestock units (TLU) exert a negative effect (-0.376, $p < 0.05$), suggesting that households with more livestock are less inclined to switch. In contrast, severe coping strategies have a positive and significant association (0.215, $p < 0.01$), indicating that households engaging in severe coping measures are more likely to switch. Other controls, such as specialized member, dependency ratio, saving, and credit, do not affect this specification statistically significantly.

In the models for the "Unchanged" categories, both the Hansen and Sargan tests yield significant results, meaning that the hypothesis of valid instruments is rejected. This outcome suggests that for the "Unchanged" categories, the cyclone exposure (instruments) may not be entirely exogenous, casting doubt on the reliability of the estimated coefficients (Appendix Table 13).

Overall, these results highlight that dynamic behavior, past outcomes, and key household characteristics jointly shape livelihood transitions and diversification, with credit access emerging as a critical stabilizing factor.

Table 7: Switching

	(1) Switched	(2) Switched, Not-diversified	(3) Switched, Permanent, Diversified	(4) Switched, Diversified
L.Switched	0.666***			
	(0.0770)			
Specialized Member	0.200***	-0.148***	0.290***	0.00650
	(0.0740)	(0.0407)	(0.0691)	(0.0113)
Head age	-0.0615***	-0.0550***	-0.0339***	-0.00677***
	(0.0118)	(0.00697)	(0.00600)	(0.00236)
Head female	-0.509***	0.661***	-0.718***	-0.150**
	(0.166)	(0.202)	(0.178)	(0.0672)
Dependency Ratio	0.449	0.445	0.207	-0.0351
	(0.453)	(0.426)	(0.432)	(0.122)
TLU	-0.00193	-4.265***	2.423***	-0.376**
	(0.675)	(0.411)	(0.766)	(0.157)
Severe coping strategies	2.748***	1.719***	0.901***	0.215***
	(0.338)	(0.163)	(0.296)	(0.0730)
Saving	-0.449	-0.895***	-0.0500	-0.0500
	(0.340)	(0.169)	(0.314)	(0.0705)
Credit	-0.202	-0.868***	0.632	-0.0994
	(0.454)	(0.166)	(0.410)	(0.0745)
L.Switched, Not-diversified		0.197***		
		(0.0680)		
L.Switched, Permanent, Diversified			0.637***	
			(0.0574)	
L.Switched, Diversified				0.428***
				(0.152)
Constant	9.483***	7.369***	6.216***	0.901***
	(1.838)	(0.685)	(0.799)	(0.267)
Obs	71549	71549	71549	71549
Groups	5333	5333	5333	5333
AR1_p	0.000	0.000	0.000	0.000
AR2_p	0.000	0.619	0.000	0.051
Hansen_p	0.000	0.000	0.000	0.068
Sargan_p	0.000	0.000	0.000	0.049

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Adaptation Behaviors & Well-Being

In this section, I examine how shifts in adaptation strategies in response to external shocks correlate with different well-being metrics. Prior research has yielded mixed findings on the relationship between diversification and well-being, and I aim to explore whether high-frequency data can provide greater clarity. To begin, I will use adaptation fluctuation is response to cyclones to identify and gain deeper insights into this relationship.

My empirical strategy employs a two-stage least squares (2SLS) approach to estimate less biased estimated of livelihood adaptation and household well-being relationship. Specifically, we focus on three well-being measures: Food Consumption Score (FCS), and probability of being hungry in the next three month using Household Hunger Scale (HHS). In each regression, one endogenous adaptation measure is instrumented using two exogenous indicators of cyclone exposure, namely Anna and Freddy.

Cyclone exposure is considered a credible instrument based on previous Hansen test results. These tests provided evidence that cyclone events are exogenous shocks. This exogeneity assumption ensures that the variation in the adaptation measures driven by cyclones is orthogonal to unobserved factors affecting well-being.

In 2SLS framework, I run separate regressions for each well-being outcome and for each endogenous adaptation measure. For each equation, the model is overidentified because the number of instrument outreach the number of endogenous regressor. we use two instruments for one endogenous regressor.

The general regression specification is as follows:

$$Y = \alpha + \beta \,\text{Adaptation} + \gamma X + \varepsilon,$$

where Y denotes the well-being outcome, Adaptation represents one of the endogenous transition-diversification measures, and X is a vector of control variables. The control variables included in the model are the same as those used in the previous section.

Leveraging cyclone exposure as an instrument effectively addresses endogeneity concerns. In this section, I rely exclusively on those adaptation strategies for which cyclone exposures have been validated as credible instruments in the previous analysis, ensuring that our estimates of the impacts on well-being are both robust and consistent.

Dietary Diversity & Future Hunger

Start New Activity (Column 1), which is a form of transition without the presence of diversification, has a positive and statistically significant coefficient, indicating that households that initiate a new activity tend to have higher consumption scores. De-diversification (Column 3) is associated with a significant decrease in FCS, implying that households de-diversifying their activities tend to have lower food consumption. Start Multiple Activity (Column 4), which is an adding and diversification strategy, does not show a statistically significant effect on FCS. Switched, Diversified (Column 6) is positively and significantly related to FCS, suggesting that households that switch their livelihoods while maintaining diversification tend to achieve higher food consumption scores.

Finally, Get Unemployed (Column 2) shows a significant positive effect, suggesting that the experience of becoming unemployed is associated with higher FCS. It is the same for De-diversification and Unemployment (Column 5), which have a positive and marginally significant effect on improved FCS. These results require further interpretation.

Table 9 presents the IV estimates for Future Hunger using six different adaptation strategies as endogenous regressors. The results indicate that households initiating a new activity tend to experience a reduction in Future Hunger (Column 1). And the positive coefficient of Start Multiple Activity (Column 4) is not statistically significant, suggesting that initiating multiple activities does not have a clear impact on the household hunger scale. The positive coefficient of De-diversification (Column 3) indicates that households that de-diversify are more likely to experience higher hunger in the future. On the other hand, Switched, Diversified (Column 6) has a highly significant negative effect, implying that households that

Table 8: IV Estimates for Well-Being Outcome: FCS

	(1) FCS	(2) FCS	(3) FCS	(4) FCS	(5) FCS	(6) FCS
Start New Activity	22.08**					
	(9.636)					
Get Unemployed		12.73***				
		(3.652)				
De-diversification			-4.990**			
			(1.967)			
Start Multiple Activity				-151.2		
				(293.6)		
De-diversification, Unemployed					34.09*	
					(17.44)	
Switched, Diversified						4.173***
						(1.339)
Observations	82397	82397	82397	82397	82397	82397

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

switch strategies while maintaining diversification tend to have lower hunger in the next three months.

Finally, a significant negative effect of Get Unemployed (Column 2) indicates that households transitioning into unemployment are linked to lower future hunger. Similarly, the significant negative coefficient in De-diversification and Unemployment (Column 5) suggests that the combination of de-diversification and unemployment is associated with reduced future hunger, potentially emphasizing the role of social assistance mechanisms, and definitely needs more investigation.

All regressions reflect systematic differences in well-being linked to various adaptation strategies. For instance, de-diversification, which is negatively associated with the Food Consumption Score, may be overlooked when we extend the time frame and rely on infrequent (annual) data. This oversight can contribute to the mixed results observed in other research and clearly emphasize the important role of high-frequency data in investigating livelihood

diversification and transition.

Table 9: IV Estimates for Well-Being Outcome: Future Hunger

	(1) HHS	(2) HHS	(3) HHS	(4) HHS	(5) HHS	(6) HHS
Start New Activity	-0.761**					
	(0.331)					
Get Unemployed		-0.450***				
		(0.129)				
De-diversification			0.177**			
			(0.0711)			
Start Multiple Activity				4.298		
				(8.348)		
De-diversification, Unemployed					-1.158**	
					(0.556)	
Switched, Diversified						-0.255***
						(0.0771)
Observations	82399	82399	82399	82399	82399	82399

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

How do intra-household aggregation and inter-temporal aggregation affect the well-being results? Forthcoming.

Concluding Remarks

This research delves into the intricate distinction between diversification and activity transition, underscoring the importance of addressing inter-temporal aggregation bias in precisely defining adaptation behaviors, given that distinct motivations drive them. Transition and diversification are not simple choices but dynamic, complex decision-making processes that require detailed temporal and contextual analysis. The extent and manner in which households adapt are deeply connected to their changing motivations, baseline assets, and available options, all of which may fluctuate monthly and seasonally, adding to the complexity of the

topic.

Livelihood adaptation behaviors are shown to be intrinsically heterogeneous across time and among the members who implement them. Activity transition is different from diversification, and diversifying using low-return piecework differs from adding a permanent activity to the portfolio. Moreover, the distribution of diversified portfolios among members is important, as specialization is distinct from multi-tasking, which can burn out a specific member by handling multiple jobs. These fundamentally different reactions have different relationships with well-being outcomes and need to be dynamically investigated.

By using high-frequency data on monthly livelihood portfolios from 5,400 households in Malawi, this study disaggregated transition from diversification, identified 13 mutually exclusive strategies, and revealed the intra-household roles by distinguishing specialized members from multi-taskers. The analysis documents that households' equilibrium adaptation behaviors vary based on their assets, credit access, shock experiences, coping strategies, and previous adaptation decisions. Furthermore, through the analysis of two cyclone experiences, the research identifies the relationship between specific adaptation strategies and both the household food consumption score and the probability of hunger in the subsequent three months.

The Arellano-Bond estimates with validated instruments reveal that different transition and diversification decisions often exhibit persistence and are strongly influenced by financial factors such as credit and saving, the existence of specialized members in the household, severe coping strategies implemented, and productive assets. These results highlight that dynamic behavior, past outcomes, and key household characteristics jointly shape livelihood adaptation.

The efficacy of these adaptation strategies is of considerable interest to policymakers and is aimed at improving household well-being. However, due to data scarcity, the literature has often failed to capture the genuine and evolving picture of these strategies, leaving their impact on well-being controversial. Notably, not all types of transition between different

activities alone significantly improve well-being measures; its combination with diversification can positively impact well-being. This research, therefore, contributes to a more nuanced understanding of livelihood adaptation strategies, emphasizing the need for detailed, high-frequency analyses to inform targeted policy interventions.

References

Abdulai, A., & CroleRees, A. (2001). Determinants of income diversification amongst rural households in southern mali. *Food policy*, *26*(4), 437–452.

Alobo Loison, S. (2015). Rural livelihood diversification in sub-saharan africa: a literature review. *The Journal of Development Studies*, *51*(9), 1125–1138.

Antonelli, C., Coromaldi, M., & Pallante, G. (2022). Crop and income diversification for rural adaptation: Insights from ugandan panel data. *Ecological Economics*, *195*, 107390.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The review of economic studies*, *58*(2), 277–297.

Asfaw, S., Scognamillo, A., Di Caprera, G., Sitko, N., & Ignaciuk, A. (2019). Heterogeneous impact of livelihood diversification on household welfare: Cross-country evidence from sub-saharan africa. *World Development*, *117*, 278–295.

Barrett, C. B., & Reardon, T. (2000). Asset, activity, and income diversification among african agriculturalists: some practical issues. *Available at SSRN 257344*.

Barrett, C. B., Reardon, T., & Webb, P. (2001a). Nonfarm income diversification and household livelihood strategies in rural africa: concepts, dynamics, and policy implications. *Food policy*, *26*(4), 315–331.

Barrett, C. B., Reardon, T., & Webb, P. (2001b). Nonfarm income diversification and household livelihood strategies in rural africa: concepts, dynamics, and policy implications. *Food policy*, *26*(4), 315–331.

Beegle, K., Galasso, E., & Goldberg, J. (2017). Direct and indirect effects of malawi's public works program on food security. *Journal of Development Economics*, *128*, 1–23.

Bellon, M. R., Kotu, B. H., Azzarri, C., & Caracciolo, F. (2020). To diversify or not to diversify, that is the question. pursuing agricultural development for smallholder farmers in marginal areas of ghana. *World Development*, *125*, 104682.

Cain, M., & McNicholl, G. (1986). Population growth and agrarian outcomes.

Caruso, G. D., & Cardona Sosa, L. M. (2022). *Malawi poverty assessment: Poverty persistence in malawi - climate shocks, low agricultural productivity, and slow structural transformation* (Tech. Rep.). Washington, D.C.: World Bank Group. Retrieved from http://documents.worldbank.org/curated/en/099920006302215250/P174948072f3880690afb7

Davies, S. (2016). *Adaptable livelihoods: Coping with food insecurity in the malian sahel.* Springer.

Davies, S., Hossain, N., et al. (1997). *Livelihood adaptation, public action and civil society: a review of the literature.* Institute of Development Studies Brighton.

Davis, B., Di Giuseppe, S., & Zezza, A. (2014). Income diversification patterns in rural sub-saharan africa: reassessing the evidence. *World Bank Policy Research Working Paper*(7108).

Deaton, A., et al. (1992). *Saving and income smoothing in cote d'ivoire.* Research Program in Development Studies, Woodrow Wilson School, Princeton ....

Dedehouanou, S. F., & McPeak, J. (2020). Diversify more or less? household income generation strategies and food security in rural nigeria. *The Journal of Development Studies*, *56*(3), 560–577.

Dercon, S. (2002). Income risk, coping strategies, and safety nets. *The World Bank Research Observer*, *17*(2), 141–166.

Dimova, R., Halvorsen, S. K., Nyyssölä, M., & Sen, K. (2021). *Long-run rural livelihood diversification in kagera, tanzania* (Tech. Rep.). WIDER Working Paper.

Dimova, R. D., & Sen, K. (2010). Is household income diversification a means of survival or a means of accumulation? panel data evidence from tanzania. *Panel Data Evidence from Tanzania (April 6, 2010)*.

Ellis, F. (1998). Household strategies and rural livelihood diversification. *The journal of development studies*, *35*(1), 1–38.

Ellis, F. (2000a). The determinants of rural livelihood diversification in developing countries.

Journal of agricultural economics, *51*(2), 289–302.

Ellis, F. (2000b). *Rural livelihoods and diversity in developing countries*. Oxford university press.

Günther, I., & Harttgen, K. (2009). Estimating households vulnerability to idiosyncratic and covariate shocks: A novel method applied in madagascar. *World Development*, *37*(7), 1222–1234.

Haggblade, S., Hazell, P., & Reardon, T. (2005). The rural nonfarm economy: pathway out of poverty or pathway in. In *International food policy research institute. the future of small farms. proceedings of a research workshop, wye, uk* (pp. 151–178).

Khan, R., & Morrissey, O. (2023). Income diversification and household welfare in uganda 1992–2012. *Food Policy*, *116*, 102421.

Lay, J., Mahmoud, T. O., & M'Mukaria, G. M. (2008). Few opportunities, much desperation: The dichotomy of non-agricultural activities and inequality in western kenya. *World Development*, *36*(12), 2713–2732.

Lay, J., Schüler, D., et al. (2008). Income diversification and poverty in a growing agricultural economy: The case of ghana.

Losch, B., Fréguin-Gresh, S., & White, E. T. (2012). *Structural transformation and rural change revisited: challenges for late developing countries in a globalizing world*. World Bank Publications.

povertydata.worldbank.org. (2023). *Poverty equity brief malawi africa eastern southern april 2023* (Tech. Rep.). World Bank Group. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://databankfiles.worldbank $CB9F-4D93-AE8C-750588BF00QA/current/Global_POVEQ_MWI.pdf$

Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in africa. *World development*, *25*(5), 735–747.

Reardon, T., Berdegué, J., Barrett, C. B., & Stamoulis, K. (2007). Household income diversification into rural nonfarm activities. *Transforming the rural nonfarm economy:*

opportunities and threats in the developing world, 115–140.

Reardon, T., Delgado, C., & Matlon, P. (1992). Determinants and effects of income diversification amongst farm households in burkina faso. *The Journal of Development Studies*, *28*(2), 264–296.

Reardon, T., & Vosti, S. A. (1995). Links between rural poverty and the environment in developing countries: asset categories and investment poverty. *World development*, *23*(9), 1495–1506.

Roy, A. D. (1951). Some thoughts on the distribution of earnings. *Oxford economic papers*, *3*(2), 135–146.

Sahn, D. E. (1989). *Seasonal variability in third world agriculture: The consequences for food security*. The Johns Hopkins University Press.

Start, D. (2001). The rise and fall of the rural non-farm economy: Poverty impacts and policy options. *Development policy review*, *19*(4), 491–505.

Tesfaye, W., & Tirivayi, N. (2020). Crop diversity, household welfare and consumption smoothing under risk: Evidence from rural uganda. *World Development*, *125*, 104686.

Timmer, C. P., et al. (2009). *A world without agriculture: The structural transformation in historical perspective*. Aei Press Washington, DC.

Turin, C., & Valdivia, C. (2013). Off-farm work in the peruvian altiplano: seasonal and geographic considerations for agricultural and development policies. In *Seasonality, rural livelihoods and development* (pp. 145–160). Routledge.

Van Den Berg, M., & Kumbi, G. E. (2006). Poverty and the rural nonfarm economy in oromia, ethiopia. *Agricultural Economics*, *35*, 469–475.

Zimmerman, F. J., & Carter, M. R. (2003). Asset smoothing, consumption smoothing and the reproduction of inequality under risk and subsistence constraints. *Journal of Development Economics*, *71*(2), 233–260.

1 Appendix

.1 Questionnaire

The **RFMS questionnaire** includes questions on:

1. Household Income Sources: What are the various sources of income or livelihood of your household?
2. Primary Source of Income: What was your household's primary source of income in the past three months?
3. Who in the household engaged in this activity?
4. Secondary Source of Income: What was your household's Secondary source of income in the past three months?
5. Who in the household engaged in this activity?
6. Income Sufficiency: Which of the following is true? Your current income....
    - Allows you to build your savings
    - Allows you to save just a little
    - Only just meets your expenses
    - Is not sufficient, so you need to use savings to meet your expenses
    - Is really not sufficient, so you need to borrow to meet expenses

.2 Definitions of Each Adaptation

P1 $(o \to d_j)$ *Start activity after unemployment.*

The household was unemployed at time t and is engaged in exactly one activity at time $t+1$.

P2 $(d_j \to o)$ *Lose the only income source.*

The household had one activity at time t and becomes unemployed at time $t+1$.

P3 $(d_j \to d'_j)$ *Switch activities.*

The household was engaged in one specific activity j at time t, drops it, and adopts a different single activity j' at time $t+1$.

P4 $(d_j, d'_j \to d_j)$ *De-diversification through withdrawal.*

The household had two distinct activities at time t, but drops one, ending up with exactly one activity at $t+1$.

P5 $(d_j \to d_j, d'_j)$ *Diversification through adding.*

The household had one activity at time t and adds a new, second activity at time $t+1$.

P6 $(d_j \to d_j)$ *Unchanged, undiversified.*

The household had exactly one activity at time t and continues with the same single activity at $t+1$.

P7 $(d_j, d'_j \to d_j, d'_j)$ *Unchanged, diversified.*

The household had exactly two activities at t and keeps the same two at $t+1$.

P8 $(d_j, d'_j, d''_j \to d_j, d'_j)$ *De-diversified, still diversified.*

The household had three (multiple) distinct activities at t, drops at least one, but still ends up with two distinct activities at $t+1$.

P9 $(o \to d_j, d'_j)$ *Start multiple activities after unemployment.*

The household was unemployed at t and begins two distinct activities at $t+1$.

P10 $(d_j, d'_j \to o)$ *De-diversification, becoming unemployed.*

The household had two distinct activities at t and drops all sources, becoming unemployed at $t+1$.

P11 $(o \to o)$ *Unchanged, remain unemployed.*

The household was unemployed at t and stays unemployed at $t+1$.

P12 $(d_j, d'_j \to d_j, d''_j)$ *Permanent activity plus temporary activities, diversified.*

The household had two distinct activities at t. It continues with one of them (say d_j) and switches the other (from d'_j to d''_j) at $t+1$.

P13 $(d_j, d'_j \to d''_j, d'''_j)$ *Switch activities, diversified.*

The household had two distinct activities at t and switches out of both, adopting two new activities at $t+1$.

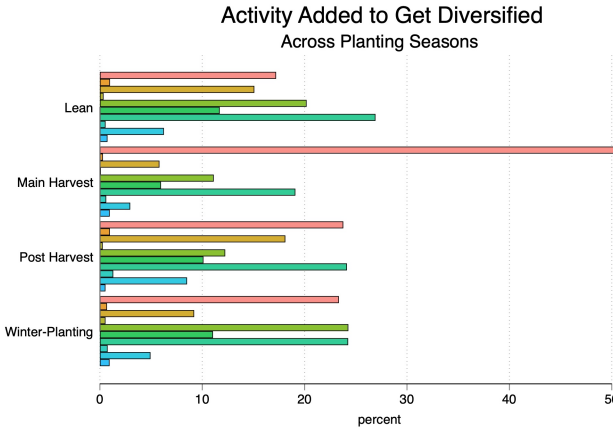


Figure 17: Activities Added, Got Diversified

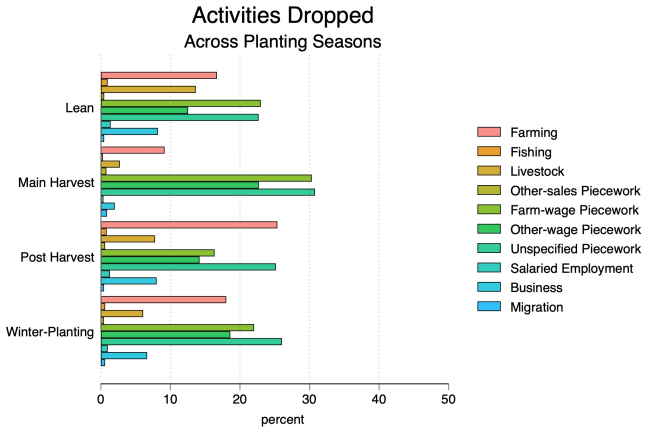


Figure 18: Activities Dropped

Is transition stationary:

	Next Period Activity								
Current Activity	**Crop farm**	**Fishing**	**Livestock**	**Piecework**	**Salaried Empl.**	**Business**	**Migration**	**Aid/Assistance**	**Unemployed**
Crop farm	87.54	0.19	0.51	8.63	0.21	2.36	0.24	0.30	0.02
Fishing	6.70	78.87	0.00	11.08	0.00	2.58	0.26	0.52	0.00
Livestock	10.44	0.00	77.65	7.83	0.33	2.61	0.65	0.33	0.16
Piecework	6.28	0.22	0.33	89.58	0.39	2.75	0.27	0.17	0.01
Salaried Empl.	3.09	0.00	0.08	5.84	87.31	2.50	0.58	0.33	0.25
Business	5.08	0.22	0.34	8.97	0.60	84.42	0.17	0.15	0.06
Migration	11.61	0.00	0.41	12.83	1.63	3.67	68.23	1.63	0.00
Aid/Assistance	5.90	0.00	0.25	8.11	0.49	0.98	1.23	83.05	0.00
Unemployed	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	80.00

Table 10: Transition Matrix 2021

	Next Period Activity								
Current Activity	**Crop farm**	**Fishing**	**Livestock**	**Piecework**	**Salaried Empl.**	**Business**	**Migration**	**Aid/Assistance**	**Unemployed**
Crop farm	90.68	0.28	0.32	6.24	0.21	1.58	0.16	0.11	0.42
Fishing	8.01	83.99	0.41	4.61	0.41	2.31	0.14	0.14	0.00
Livestock	9.57	0.16	80.86	5.58	0.80	1.91	0.16	0.16	0.80
Piecework	5.00	0.21	0.23	91.29	0.30	1.94	0.14	0.11	0.77
Salaried Empl.	2.47	0.00	0.12	4.32	90.19	1.30	0.80	0.37	0.43
Business	3.87	0.17	0.24	7.58	0.43	87.06	0.12	0.23	0.29
Migration	4.74	0.00	0.62	5.57	1.86	2.27	81.65	0.41	2.89
Aid/Assistance	4.41	0.00	0.00	5.51	1.84	1.84	0.74	83.46	2.21
Unemployed	6.15	0.21	0.34	8.89	0.55	1.71	0.68	0.55	80.93

Table 11: Transition Matrix 2022

	Next Period Activity								
Current Activity	**Crop farm**	**Fishing**	**Livestock**	**Piecework**	**Salaried Empl.**	**Business**	**Migration**	**Aid/Assistance**	**Unemployed**
Crop farm	95.30	0.06	0.20	3.12	0.10	0.74	0.16	0.05	0.27
Fishing	0.90	96.27	0.00	1.86	0.14	0.55	0.07	0.07	0.14
Livestock	3.35	0.13	91.82	2.82	0.13	0.67	0.67	0.27	0.13
Piecework	1.08	0.08	0.06	97.39	0.08	0.69	0.11	0.06	0.45
Salaried Empl.	0.56	0.06	0.00	1.67	96.39	0.61	0.06	0.33	0.33
Business	1.23	0.08	0.08	3.15	0.06	95.09	0.10	0.04	0.17
Migration	0.60	0.00	0.00	1.56	0.24	0.72	95.57	0.12	1.20
Aid/Assistance	1.01	0.20	0.20	1.21	0.80	0.40	0.80	94.57	0.80
Unemployed	1.79	0.10	0.05	6.05	0.10	0.72	0.20	0.20	90.78

Table 12: Transition Matrix 2023

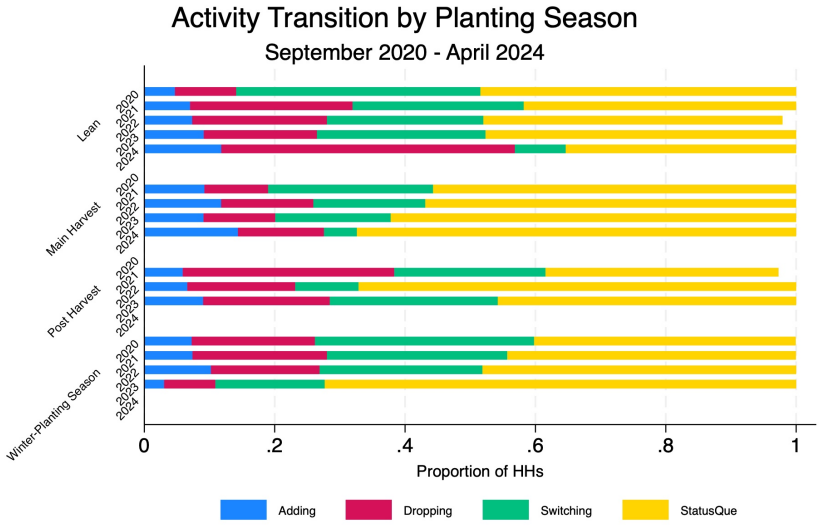


Figure 19: Adaptation Over Time

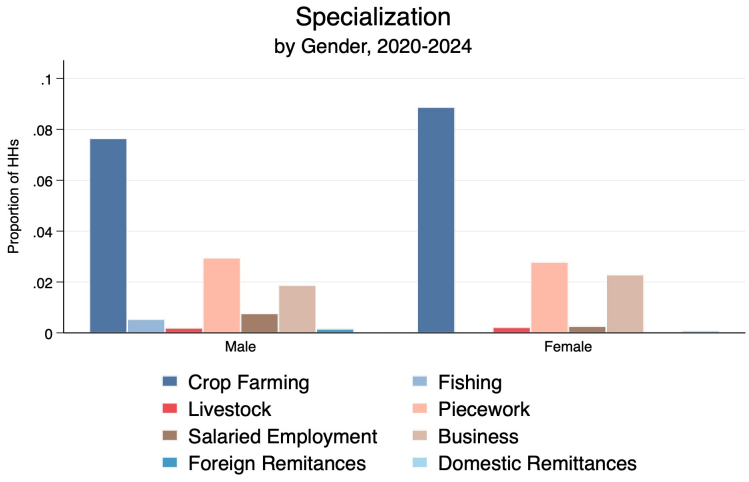


Figure 20: Specialization by Gender

Table 13: Not Changed

	(1) Unchanged	(2) Unchanged, Undiversified	(3) Unchanged, Diversified	(4) Unchanged, Unemployed
L.Unchanged	-0.202			
	(0.155)			
Specialized Member	-0.838***	-1.090***	0.601***	-0.210***
	(0.128)	(0.0905)	(0.0950)	(0.0294)
Head age	0.211***	0.0231*	0.0680***	0.0385***
	(0.0307)	(0.0137)	(0.0131)	(0.00525)
Head female	-0.486	2.307***	-2.923***	0.297***
	(0.527)	(0.456)	(0.420)	(0.107)
Dependency Ratio	-0.416	2.130**	-2.045**	1.014***
	(1.252)	(0.992)	(0.942)	(0.326)
TLU	1.444	-14.72***	12.79***	-0.744***
	(1.524)	(0.746)	(1.176)	(0.124)
Severe coping strategies	-4.675***	-0.285	-2.254***	0.00629
	(0.741)	(0.290)	(0.344)	(0.0725)
Saving	0.219	-2.027***	2.860***	-0.167**
	(0.411)	(0.306)	(0.369)	(0.0664)
Credit	-0.843	-1.667***	2.171***	-0.156**
	(0.524)	(0.326)	(0.394)	(0.0618)
L.Unchanged, Undiversified		0.220***		
		(0.0212)		
L.Unchanged, Diversified			0.285***	
			(0.0355)	
L.Unchanged, Unemployed				0.333***
				(0.0587)
Constant	59.34***	20.72***	17.16***	-0.182
	(7.410)	(0.956)	(1.077)	(0.165)
Obs	71549	71549	71549	71549
Groups	5333	5333	5333	5333
AR1_p	0.031	0.000	0.000	0.000
AR2_p	0.229	0.000	0.005	0.000
Hansen_p	0.000	0.000	0.000	0.001
Sargan_p	0.000	0.000	0.000	0.000

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01