Livelihood Asset versus Capabilities: Pillars for Sustainable Development in Rural Households of East Wallaga zone, Southwest Ethiopia

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Abstract

This study investigated the relationship between livelihood assets and capabilities in rural households of East Wallaga Zone, Southwest Ethiopia, to understand how they contribute to sustainable development. The analysis, using Structural Equation Modelling (SEM), examined factors such as social engagement, land size, education, animal ownership, irrigation, and household size as indicators of assets, while productivity, income diversification, service accessibility, and savings reflected capabilities. The findings revealed that access to irrigation, livestock ownership, and education significantly enhanced household capabilities, promoting sustainable development through increased income diversification and productivity. The study underscores the importance of targeted interventions to strengthen household capabilities and access to resources, which are vital for long-term growth and resilience in rural communities.

Key words: Structural Equation Model, assets, capability, livelihood, Diversification, sustainability

Introduction:

The sustainable livelihoods framework provides a holistic lens through which to analyze the multifaceted dimensions of household well-being amidst diverse challenges such as climate variability and conflict-induced shocks(H. Dereje, 2023)(Ellis & Freeman, 2004; Scoones, 1998). Within the dynamic context of the rural communities in the East Wallaga zone, these challenges intersect with socio-economic and environmental factors, shaping the livelihood trajectories of households in profound ways(Chambers & Conway, 1992; Natarajan et al., 2022a; Tora et al., 2022).

This study endeavors to undertake a comprehensive analysis of household resource assets and livelihood capabilities within the framework of sustainable development goals (SDGs) by 2030(Natarajan et al., 2022). By examining the impacts of climate variability and conflict-induced shocks on rural communities, we aim to shed light on the complex dynamics that influence household resilience and vulnerability.

Through a nuanced exploration of various livelihood assets, including natural, physical, financial, human, and social capital, we seek to uncover the adaptive strategies employed by households to navigate uncertain environments(Hendriks et al., 2022;Zakari et al., 2022). Furthermore, we aim to assess the extent to which these strategies align with the principles of sustainability outlined in the SDGs, particularly those related to poverty alleviation, food security, and environmental sustainability(Asfew et al., 2023; FAO, 2018; Hsieh & Yeh, 2024; Miola & Schiltz, 2019; Von Braun et al., 2021).

Utilizing a mixed-methods approach encompassing quantitative surveys, qualitative interviews, and participatory methodologies, this study seeks to generate actionable insights for policymakers, development practitioners, and local communities. By elucidating the interconnections between climate variability, conflict-induced shocks, and livelihood dynamics, our findings aim to inform targeted interventions aimed at enhancing resilience and fostering inclusive development in the rural communities of the East Wallaga zone.

In this introductory section, we outline the rationale, objectives, and scope of the study within the broader context of sustainable development and the imperative of achieving the SDGs by 2030. Through this lens, we set the stage for a detailed exploration of household resource assets and livelihood capabilities in response to climate variability and conflict-induced shocks in the rural communities of the East Wallaga zone.

Conceptual Framework

Understanding the dynamics of household resource assets and livelihood capabilities is crucial for developing effective poverty alleviation strategies and enhancing sustainable development in the East Wallaga zone. This conceptual framework integrates various theoretical perspectives and empirical approaches to analyze the complex interplay between household assets, livelihood strategies, and socioeconomic outcomes(Frediani, 2010).

Household resource assets encompass various forms of capital that are essential for sustaining livelihoods. Natural capital includes resources such as land, water, forests, and biodiversity. Physical capital refers to infrastructure, tools, and technology that facilitate productive activities. Human capital comprises the education, skills, health, and labor available to the household. Social capital involves social networks, relationships, and community participation that can provide support and opportunities. Finally, financial capital encompasses income, savings, credit, and other financial resources that enable households to invest, consume, and cope with uncertainties(Eddins & Cottrell, 2014; Natarajan et al., 2022b; Nunan et al., 2022).

The abilities of households to effectively utilize their resource assets to achieve desired livelihood outcomes. This encompasses the skills, strategies, and decision-making processes that influence their economic activities and well-being (Nunan et al., 2022).

In response to socioeconomic and environmental challenges, households often engage in livelihood diversification and adaptation strategies to secure their well-being. Livelihood diversification involves pursuing a mix of activities such as agricultural practices, non-farm employment, and migration to reduce risk and increase income sources. Adaptation strategies are actions taken to adjust to changing conditions, which may include adopting new agricultural

techniques, seeking alternative income opportunities, or relocating to more favorable environments. These strategies enhance the capability of households to manage uncertainties and improve their resilience against external shocks(Abebe et al., 2021; Dereje H., 2021; Ellis, 2000; Ellis & Freeman, 2004)

The ability to support oneself has a major impact on household resource assets, which in turn affects general well-being. Households are able to adopt more varied and efficient livelihood choices when they possess the capability, know-how, and means to make the most of their resources.(Burchi & De Muro, 2012; Sen, 1999b; Zhang et al., 2020). These capabilities enable households to optimize the use of their natural capital (e.g., land, water, and biodiversity), physical capital (e.g., infrastructure, tools, and technology), human capital (e.g., education, skills, health, and labor), social capital (e.g., social networks and community participation), and financial capital (e.g., income, savings, and credit).

Improved livelihood capabilities lead to better livelihood outcomes, including higher income levels, enhanced food security, improved health status, and a better overall quality of life(Sen, 1999b;Abebe et al., 2021). For instance, with better education and skills, household members can secure higher-paying jobs or improve agricultural productivity(Presha & Farrell, 2017). Access to credit and savings allows for investment in business opportunities or coping with financial shocks, further stabilizing household income(CHEN et al., 2021). Strong social networks can provide support during crises and open up new economic opportunities(Wang et al., 2021).

Moreover, effective livelihood strategies that stem from robust capabilities can ensure sustainable use and management of natural resources, enhancing environmental sustainability and long-term resource availability(Nunan et al., 2022). This integrated approach not only helps in achieving immediate economic gains but also builds resilience against future challenges, thereby ensuring sustained improvements in well-being(Frediani, 2010; Lienert & Burger, 2015; Liu et al., 2022; UNDP, 2017).

3. Analytical Framework

The analysis of household resource assets and livelihood capabilities in East Wallaga zone can be structured around the Sustainable Livelihoods Framework (SLF), which provides a comprehensive approach to understanding how households use their assets to pursue different livelihood strategies and achieve various outcomes(SLA, 1999;DFID, 1999).

The conceptual framework for analyzing household resource assets and livelihood capabilities in the East Wallaga zone integrates several key components. The vulnerability context includes external shocks, trends, and seasonality that influence household assets and livelihood strategies. Examples of these are climate change, economic fluctuations, and political instability, all of which can disrupt agricultural productivity, income stability, and access to resources(Chambers & Conway, 1992).

Household resource assets consist of five types of capital essential for sustaining livelihoods. Natural capital includes land, water, forests, and biodiversity, which are fundamental for agricultural activities and ecological balance. Physical capital refers to infrastructure, tools, and technology that facilitate productive activities and enhance efficiency. Human capital encompasses education, skills, health, and labor, which are critical for income generation and adaptive capacity. Social capital involves social networks, relationships, and community participation that provide support, information, and collective action. Financial capital includes income, savings, credit, and other financial resources that enable investment, consumption, and coping with uncertainties(Nunan et al., 2023).

The framework also considers policies, institutions, and processes, which refer to the formal and informal rules, regulations, institutions, and organizations that shape household access to resources and decision-making processes. This includes government policies affecting land ownership, agricultural support, education, healthcare, and social protection, market dynamics influencing the availability and prices of goods and services, cultural norms impacting household behavior and resource use, and institutional support from NGOs, cooperatives, and community organizations.

Livelihood strategies are the diverse activities and choices households engage in to achieve their livelihood goals. These include agricultural practices such as crop cultivation and livestock

rearing, income diversification through non-farm employment and small businesses, the use of technology to enhance productivity, and adaptive strategies to adjust to environmental and socioeconomic changes, such as altering cropping patterns, seeking new employment opportunities, or migrating.

Finally, livelihood outcomes refer to the impacts of these strategies on household well-being. Key indicators include income levels, food security, health status, educational attainment, and social inclusion. By examining these components, the framework provides a holistic understanding of how households manage their resources and strategies to improve their well-being, which can inform targeted interventions and policies to enhance livelihood capabilities and resilience against vulnerabilities in the East Wallaga zone.

Research Methods and Materials

Study Population and study area description

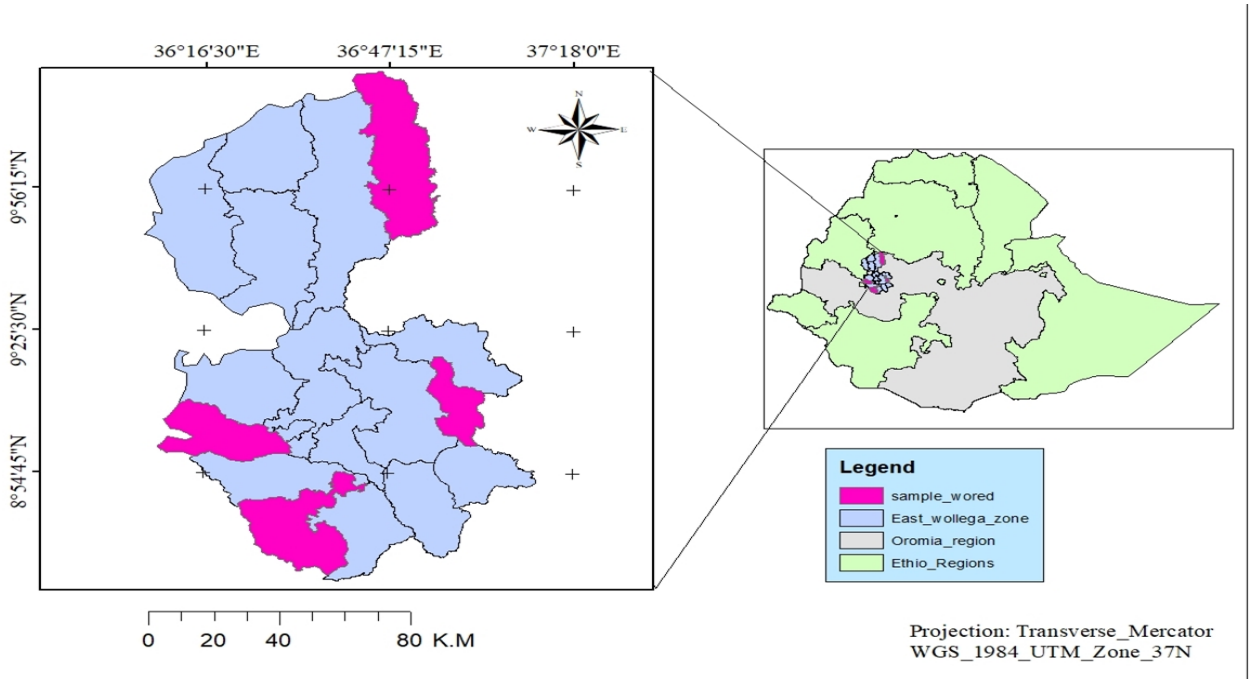
Description of the study area

The research was carried out in East Wallaga Zone. It is one of the Oromia National Regional State's Zones, which includes 17 rural districts and 289 rural kebeles. Nekemte, the capital of east Wallaga zone is 328 kilometers away west of Ethiopia's capital, Addis Ababa. The zone's entire land area is around 14,102.5km^2, accounting for about 3.88% of the Oromia National Regional State's overall area(Teka et al., 2022).

Location

East Wallaga Zone is found on 8^0 31'20"N to 10^0 22'30"N latitude and 36^o 06'00"E to 37^o 12'00"E longitude. It is bordered on the North by Amhara National Regional State, on the South by Jimma zone, on the East by Horo Guduru Wallaga and West Shewa zone, on the North-West by Benishangul Gumuz National Regional State, on the West direction by West Wallaga zone, and on the South-West by Buno Bedelle zone.

Fig 1 Location map of East wallaga zone and the study Districts



The topography of the studied zone exhibits variations in altitude, ranging from 718 to 3,163 meters above sea level. Predominantly characterized by a low plateau, the area also features isolated mountain ranges, particularly notable in the Jima Arjo district. The climate classification within the zone encompasses three primary types: highland (20.50%), midland (50.90%), and lowland (28.60%). Annual rainfall spans from 1419 to 2410 mm, with daily temperatures fluctuating between 15 to 27 °C. The peak of rainfall typically occurs during the months from June to September, with the climate exhibiting a pattern of long summer rainfall, short rainy seasons in March to April, and winter dry seasons from December to February(Teka et al., 2022). Notably, the primary rainy season aligns with the typical pattern observed in many highland areas of Ethiopia. According to Dereje& Eshetu, (2011), the classification of the agroecology is as 500-1500m asl is lowland (gammoojjii), 1500-2300m as midland(badda daree) and 2300- 3200 masl as highland(baddaa) agroecology.

Research Methods

To comprehensively investigate the impact of climate change and conflicts on household livelihood diversification and food security, it was imperative to employ a systematic and

representative sampling approach across the entire population. The sampling procedure adopted multistage random sampling techniques at distinct levels.

East Wollega Zone was chosen purposively due to its pronounced issues of conflicts, displacements, gradual climate change, accessibility, and diverse agro-ecology. From the 21 zones within the Oromia Regional State, East Wollega Zone was selected. Within this zone, the districts of Jimmaa Arjo, Diga, Kiremu, and Gobu Sayo were selected based on stratified random sampling, primarily considering their agro-ecologic characteristics.

The sampling strategy aligned with the geographical and socioeconomic features of the zone, involving stratification based on agro-ecology, woreda, and kebeles. East Wollega exhibited three agro-ecologic zones: high altitude (baddaa) ranging from 2000-3000 masl, middle altitude (badda daree) with an altitude of 1400-2000 masl, and low altitude (gammoojjii) with less than 1400 masl. Kebeles in the district were categorized into these three agro-ecologic zones based on their altitude. Stratified random sampling was then used to select kebeles.

Moving forward, eight peasant associations were chosen from the four districts using stratified random sampling (two from lower altitude, four from middle altitude, and two from highland) since a significant portion of the zone is classified as middle altitude or badda daree. This multistage sampling process continued to select samples from the three agro-ecologic characteristics of the eight kebeles from four districts through random sampling from each selected kebele.

Table 1:Agro-ecology and number of households in the study area

District	**Altitude (masl)**	**Sample taken from**	**No households (HH) in the study district**		
			Male HH	**Female HH**	**Total**
Jimma Arjo	1312- 2565	Baddaa(high altitude)	11,298	1,080	12,378
Kiremu	1500-2159	Badda Daree(mid altitude)	7,743	713	8,456
Gobu Sayo	1600-2430	Badda Daree(mid altitude)	5,471	659	6,130
Diga	1100-2300	Gammoojjii(low altitude)	10,668	1,299	11,967

Total	**35,180**	**3,751**	**38,931**

Source: E/W Zonal office of Agriculture,2022

The study employed a multistage sampling approach, with the smallholder farmer households (HH) serving as the analysis unit. Initially, districts and kebeles exhibiting diverse livelihood and food security statuses, as well as varying means of subsistence, were randomly identified and selected. Lists of households were obtained from the relevant office, such as the zonal Agriculture office, through a random selection process.

To calculate the sample size, the study utilized the formula provided by(KOTHARI, 2004), which is particularly suitable for a stratified sample of a finite population in the study area. This formula allowed for the determination of the required sample size from a finite population with a specific level of accuracy.

$$n = \frac{Z^2.p.q.N}{e^2\,(N-1) + Z^2.p.q} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where q = 1 - p; p = 0.50 was presumed to supply the maximum sample size so that q = 0.5; and z = represented the value of the standard variation at a specified confidence level. Z-score (1.96); n = sample size; e = intended margin of error, which is 5% (0.05); N = total population. The margin of error utilized was 5%. From the total of 7,526 houses across all Kebeles, 400 made up the necessary sample size. Based on the proportionality of each Kebele's household size, the sample size for each was chosen. Finally, household heads were selected for the questionnaire using a random sample procedure.

Accordingly, considering the security issues in the zone as a whole, the researcher prefers to select [1]Kebeles (*ganda*) following the highway near the woreda capital. So the following Kebeles are selected and also sample size is allotted.

Accordingly, taking into account the security concerns in the zone, the researcher preferred to collect the data through Development Agents (DAs) in each kebeles (ganda) that were known to

[1] Kebele (ganda) is the lowest administrative unit in Ethiopia administration system

both government bodies and rebel groups, which occasionally operate in the area. The DAs were informed that the data collection was legal and supported by institutional letter protocol. Consequently, the following kebeles were selected, and the sample size was allocated accordingly.

Table 2: Total households of Kebele(ganda) and sample size

No	District	Kebeles(Ganda)	Total Male HH	Total Female HH	Sample Male HH	Sample female HH	Total
1	Jimma Arjo	Haraa	930	420	50	22	72
		Hindhee	713	397	38	21	59
2	Kiremu	Burka Soruma	627	285	33	15	48
		Tokuma Kokofe	778	111	41	6	47
3	Diga	Arjo Q/bulaa	612	114	33	6	39
		Bikila	458	167	24	9	33
4	Gobbu Sayo	Ongobo Bakanisa	1003	255	53	14	67
		Sombo Kejo	510	124	27	8	35
Total				**N=7,526**	**299**	**101**	**n=400**

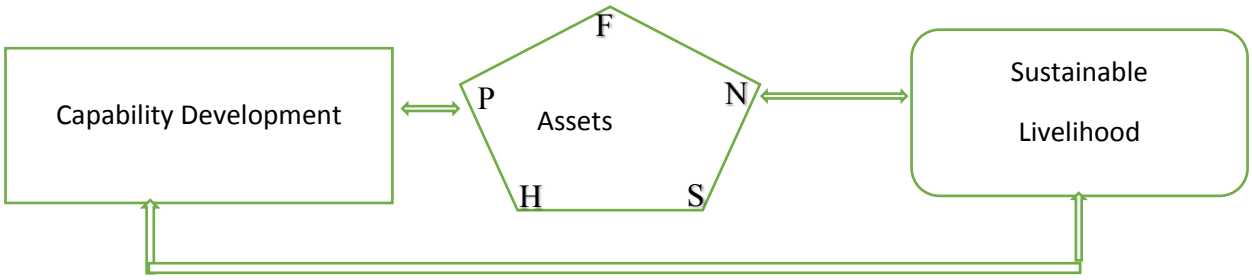
Source: (E/W/Z/Agricultural office, 2014) and own calculation for sample households (n)

3.3. Methods of data collection and analysis

The primary data was gathered through household surveys and key informant interviews. The household survey was made bystructured and semistructured questions uploaded on Kobotool box application to enhance the easy and simple method. Data enumerators were trained how to approach the respondents, and fill questions already on the kobo. Consents were made and official letters were collected from different government bodies for its legal and academic purposes. In-depth interviews were conducted with key informants such as village heads, elders, and government officials. Additionally, a cross-sectional survey research design was utilized to collect essential information about household characteristics and access to the five livelihood assets (natural, physical, financial, human, and social) using a structured questionnaire.

Secondary data was sourced from annual reports, journals, books, and both published and unpublished government reports. The main techniques for analyzing the quantitative data were descriptive and inferential statistics, managed using STATA software version 15 and Microsoft Excel 2016. Furthermore, to test the hypothesized structural equation model, STATA 15 version was used with maximum likelihood estimation to examine the proposed model. Qualitative data from open-ended questionnaires, interviews, and field observations were analyzed by triangulating with the quantitative data.

Analytical Framework



F financial asset. P Physical asset, H human asset, N natural asset and S social asset

Table 2. Selected latent and observed variables of livelihood assets and capabilities and their outcomes

Latent variable	Observed variable	Description	sign
Livelihood Asset (LA)	Farm_size	Continuous variable	+
	Age_1	Continuous variable	-
	educ	Continuous variable	+
	Land_1	Dummy variable with 1=yes, 0=No	+
	Land_size	Continuous variable	+
	irriga	Dummy variable with 1=yes, 0=No	+
	tlu	Continuous variable	+
	potablew	Dummy variable with 1=yes, 0=No	+

	coop	Dummy variable with 1=yes, 0=No	+
	social	Dummy variable with 1=yes, 0=No	+
	train	Dummy variable with 1=yes, 0=No	+
	credit	Dummy variable with 1=yes, 0=No	+
Livelihood Capability	house	Dummy , corrugated and cemented= 1 and 0 otherwise	+
	energy	Dummy variable 1=electricity and 0 otherwise	-
	lvstrd	Relative concepts of HH 1= good and 0 otherwise	+
	Productivity	The production the hh gains per plot	_
	Hdd_1	Food security status 1= secured and 0 otherwise	-
	Jobs_1	Different jobs other than agriculture	+
	savin	Dummy variable with 1=yes, 0=No	+
	incme	Additional income from diversification	+

Ethics Approval and Consent to Participate

This study was conducted following the ethical standards outlined in the Declaration of Helsinki. Ethical approval for the research was under approval number PADM11/2024 All participants were informed of the study's purpose, procedures, and their right to withdraw at any time without penalty. Written informed consent was obtained from each participant before data collection. Additionally, participants were assured that their responses would be treated with strict confidentiality and used solely for the purposes of this research.

Literature Review

2.2 Theoretical Framework

Chambers and Conway defined sustainable livelihood in comprehensive and inclusive way which embraces the concepts and the attributes that have become the dominant principle for most development researchers and agents. They defined sustainable livelihood by modifying WCED definition as: " a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for next generation; and which contributes net benefits to other livelihoods at local and global levels and in the short and long term"(Chambers & Conway, 1992)

This definition is more comprehensive and holistic in the development endeavors of individuals, households, and communities. It incorporates the role of the present generation and the share of the future. The essential elements in the concept are surprisingly both the means and the end of livelihood. Capabilities was first pointed out as an important concept by Sen 1999 in his work entitled "*commodities and capability*" (Sen, 1999a). According to Sen, capability is viewed as a moral framework. It proposes that social arrangements should be primarily evaluated according to the extent of freedom people have to promote or achieve the functioning they value.(Sen, 1999a)

In this concept, it is noticeably clear that people deserve certain values which they can achieve or aspire to achieve in their lifetime. To do so, they must have the freedom to exercise the capability they owned or acquired through different means to reach their destiny. In this context, for sustainable livelihood to be achieved, the people should possess the capability which help them to embrace the necessity and beyond throughout consistently and constantly.

An "extended livelihoods approach" is proposed by (Scoones, 1998c, 2009, 2015) to enable analysis of the political economy of livelihoods. The Sustainable Livelihoods Approach (SLA) and Sustainable Livelihoods Framework (SLF) developed by the UK Department for International Development (DFID) and inspired by the work of Ian Scoones (1998, 2009, 2015) and others at the Institute of Development Studies (IDS) in the UK have become the concepts most strongly associated with and attached to the concept of livelihood today.(Nunan et al., 2022)

2.2.1 Sustainable Livelihood

At the global level, sustainability has been given special attention because it matters for the safety and continuity of life on earth. To sustain development, there are numerous interrelated elements to exist mutually and independently. After the concept of sustainability was ignited at the world summit, it has been widened and advocated by many stakeholders because the idea is much more inclusive and vibrant.

In their concept of livelihood, Chambers & Conway, (1992) demonstrated that in order to live in safety, one needs sustainable capacities, assets, and activities.(Chambers & Conway, 1992). In contrast to previous definitions associated with the notion, sustainability has received specific attention in the definition. (Scoones, 1998b, 2009, 2009, 2015) Sen also explained the relationship and distinction between money deprivation and capability. Poor capability automatically results in bad performance, which leads to poverty. Poverty is the result of numerous factors that do not operate as they should. In a nutshell, lack of aptitude causes poverty and vice versa. He used the human development index (HDI) in his work to increase capability. Income poverty will undoubtedly change whenever competence is increased(Sen, 1999b).

Sustainable livelihoods are a way to help people escape the cycle of poverty. In order to alleviate and end poverty traps, systemic and strategic measures must be implemented to apply the application of coordinating capabilities, assets (both material and human), and activities (Chamber et al., 1992; Scoones, 1998).

2.2.2 Livelihood as capability

Amartya Sen forwarded the Capabilities approach in an effort to improve the standard of living for the underprivileged. (Amartya Sen, 1999b) In his approach, Sen demonstrated a broad normative framework in evaluating individual wellbeing and social arrangements, the design of policies, and proposals about social change in society. The capacity approach is a pro-poor approach to change the poverty in developing countries by enabling and exercising freedom (Amartya Sen, 1999; Robeyns, 2003). He stated that "capacity deprivation" is what poverty is. The capabilities approach has made it possible to grasp the complexity of poverty within the context of this concept. In development thought, the capability approach is frequently used to assess a wide

range of factors of people's wellbeing, inequality, and poverty (A. Sen, 1981,1999; Robeyns, 2003) The capability method is more intriguing since it concentrates on what people are actually capable of doing and being, or their capabilities. This is theoretically related to happiness and the satisfaction of human desires, but it is also purely hypothetical because it revolves around the spending of money, consumption, or the satisfaction of basic requirements(Robeyns, 2003;Taylor & Lybbert, 2020).

According to this strategy, three items are viewed as essential components that drive efforts to eradicate or reduce poverty. They are agents (the capacity to pursue goals one wants and has good reason to appreciate), functioning (the variety of things a person may value doing or being), and capability (the flexibility to enjoy diverse functioning) (Taylor & Lybbert, 2020; Nunan et al., 2022)

The capability approach in UNDP principle is viewed as the human development discourse conceptually underpinned by Sen's capability approach. It is applied at two distinct levels of evaluation: assessment of an individual's wellbeing and the goodness of a social action or a social arrangement in terms of its attributes such as justice at any point in time or progress over time (Taylor & Lybbert, 2020;UNDP, 2017;Nunan et al., 2022)

In capability framework analysis there have been two arguments on basic capabilities between Amartya Sen and Martha Nussbaum(Robeyns, 2003). According to Sen, basic capabilities will be important for poverty analysis and more in general for studying the well-being of most people in developing countries, while in wealthy countries well-being analysis would often focus on capabilities which are less necessary for physical survival. However, Nussbaum view basic capabilities are natural and innate capacities, or talents, and have little to do with the cut off point for poverty or deprivation analysis(Robeyns, 2003).

Capability plays a significant role in holistic development in mobilizing the natural physical, financial, human, and social assets toward empowering the people to actively participate to win the poverty trend and patterns of vicious poverty cycle in the community.

2.2.3 Livelihood as entitlement

Sen claimed that starvation results from a person's inability to access any commodity bundle that contains enough food. According to Sen, 1981 entitlement refers to a person's entitlement to commodity bundles including food. That is, the sustainability need is linked to the right to own resources at a lower stage of the poverty reduction process. There are various components that are necessary for living within a bundle. Sen (1981) defined entitlement as "the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces" (Sen, 1981).

The successful operation of the agents depends greatly on rights in the sustainable livelihood framework (Natarajan et al., 2022a; Scoones, 1998b).Hence, having assets and having the right entitlements leads to the goal of production and raising household income. Nonetheless, the unequal distribution of resources among the population has an impact on their standard of living. (Scoones, 1998; Nunan et al., 2022). Equity and equality among the people are important in order to realize the potential for fair development and the eradication of poverty. (Amartya Sen, 1999b). Sen wrote about the equality of people in his well-known essay "Development as Freedom," which also covered the exercise of democratic rights and resource sharing. Freedom opens the way for sustainable development and livelihood (Amartya Sen, 1999b).

According to the entitlement thesis, legal rights rather than moral principles or human rights are the source of entitlements. He emphasized in his opinion that people are starving because they do not have a right to food. The law and constitution should support the poor's right to food and essential resources for their livelihoods and act as a barrier between the availability of food and this right(Devereux, 2001; Natarajan et al., 2022a; Sen, 1999a; Tiwari, 2007).

Amartya Sen (1999) contends that a person's endowment determines the validity of their claim. The ownership bundle and the entitlement mapping for exchange transactions are likewise held by the person who owns endowment. The ownership bundle of a person is here defined as including their skills (both productive/technical and human in terms of coping and survival tactics),

education, attitudes, knowledge, physical health, and human capital, in addition to their land, tools, and cattle (A. Sen, 1981; 1999).

2.2.4 Livelihood assets and strategy

In the framework for sustainable livelihoods, the five capitals of natural, social, financial, human, and physical capital form a pentagonal shape (Alobo Loison, 2015; Ellis, 2000; Scoones, 1998c; Chamber et al., 1992). These are crucial resources that help one maintain a sustainable way of life. Natural capital, which includes stocks of natural capital like land, water, and forests that people have access to and can use, represents the SLF's rural roots. Social capital refers to the social resources that people can call on, such as families, networks, and associations. Money assets such as cash, credit/debit cards, savings, and other economic assets are referred to as financial capital. Human capital is the term used to describe people's knowledge, skills, health, and physical ability as they are influenced by their education and healthcare access. Finally, physical capital describes the infrastructure that is in place, such as the roads, transportation, housing, electricity, and communication systems (Chambers & Conway, 1992; Scoones, 2009; UNDP, 2017;Nunan et al., 2022) .

Following the pursuit of livelihood strategies, with varied degrees of choice in what those strategies are given an individual's or household's resources and how their use is mediated by a variety of policies, institutions, and processes. Methods for making a living can alter throughout time and even across the seasons of the year. Crops, livestock, temporary employment, and remittances are a few examples of many sources of income and nourishment that can be included in livelihood strategies. As a result of these sources of income, employment, culture, and identity for households and individuals, there are an increasing number of livelihood-related activities. According to Ellis (1998), there are two types of motivations for households to diversify their sources of income: push and pull considerations (Alobo Loison, 2015).

Involuntary necessity or push factors force people and households to look for alternate sources of income and life options. Natural disasters, changes in legislation, and seasonal variations are a few examples of factors that may have an impact on agricultural output. Commercialization of agriculture, better infrastructure, and access to technology are examples of choice or pull influences (Alobo Loison, 2015; Ellis, 2000) "Transforming structures and processes" refers to a

broad range of policies, norms, and institutions that mediate how people can use and benefit from their assets. Whether by necessity or choice, these structures and processes have an impact on the opportunities and procedures for diversifying livelihoods. While policies, norms, and institutions frequently have varying effects on people based on their age, gender, and ethnicity, the potential for and experiences of diversification vary within and within households**.**

2.2.5 Livelihood Framework

Many academics, particularly those in impoverished regions, have dedicated their lives to combating poverty. Across the globe, millions of individuals endure extreme suffering due to poverty, resulting in a dearth of nutritious food, quality education, and access to healthcare. Poverty is defined as the state in which a person, family, or community lacks the essential requirements for a basic standard of living. This deprivation can be measured through a lack of resources, such as money or property, or a deficiency in capabilities, including knowledge, skills, or technology. The United Nations introduced the Multidimensional Poverty Index (MDPI) to comprehensively address and understand poverty from various perspectives. For instance, the UNDP characterizes poverty as the absence of opportunities for democratic participation, control over resources, and access to healthcare and education. In contrast, Amartya Sen views poverty as a deficiency in capabilities. As a result, the Human Development Index (HDI) incorporates three primary factors: life expectancy, educational attainment, and living conditions, acknowledging that poverty is more intricate than merely a lack of income (IRP, 2015; Osman-elasha et al., 2006; UNDP, 2017b, 2017a).

To grasp the essence of poverty and establish systematic mechanisms for addressing livelihood challenges, numerous frameworks have been proposed. These frameworks include the approaches of the United Nations Development Program (UNDP), CARE, and the Department for International Development (DFID).

DFID, with the goal of eradicating poverty, commits to policies and actions that promote sustainable livelihoods. DFID adopts the Sustainable Livelihoods (SL) definition developed by the Institute of Development Studies (IDS), which is a modified version of the Chambers and Conway framework (Krantz, 2001). DFID's SL approach aims to enhance the agency's effectiveness in

poverty reduction through people-centered, responsive, participatory, multi-level, partnership-based, sustainable, and dynamic development schemes. Additionally, it adopts a holistic perspective in programming support activities to address issues directly relevant to improving the livelihoods of impoverished individuals (Krantz, 2001).

In conclusion, all livelihood enhancement frameworks have their respective strengths and limitations, and a comprehensive discussion of these is beyond the scope of this proposal. In our context, the DFID framework appears to be the most applicable for implementing and mobilizing pentagonal assets to improve sustainable livelihoods in developing countries.

4. Results and Discussions

4.1 Assessing Livelihood Conditions, Capabilities, and Asset Distribution in the Study Area

The East Wallaga Zone in Ethiopia has had major difficulties throughout the last 40 years, which have had a major influence on the rural communities' means of subsistence(Gemechu, 2021; Dereje, 2023). This region is vulnerable to the negative consequences of climate variability and socio-political dynamics, just like many other regions in sub-Saharan Africa(Tolera, Megersa, 2023). These two problems have made the already unstable circumstances in which rural communities struggle to make ends meet worse.

The majority of people in East Wallaga depend on agriculture for their primary source of income, but agricultural output has been severely impacted by climate variability, which is characterized by irregular rainfall patterns, protracted droughts, and unseasonal weather events(Teka Bekuma Abdisa et al., 2022). Crop failures, lower yields, and the degradation of vital natural resources like water and fertile soil have resulted from the unpredictable environment(Chimdi, 2014). These environmental stresses have not only undermined food security but have also increased the vulnerability of households to poverty and malnutrition.

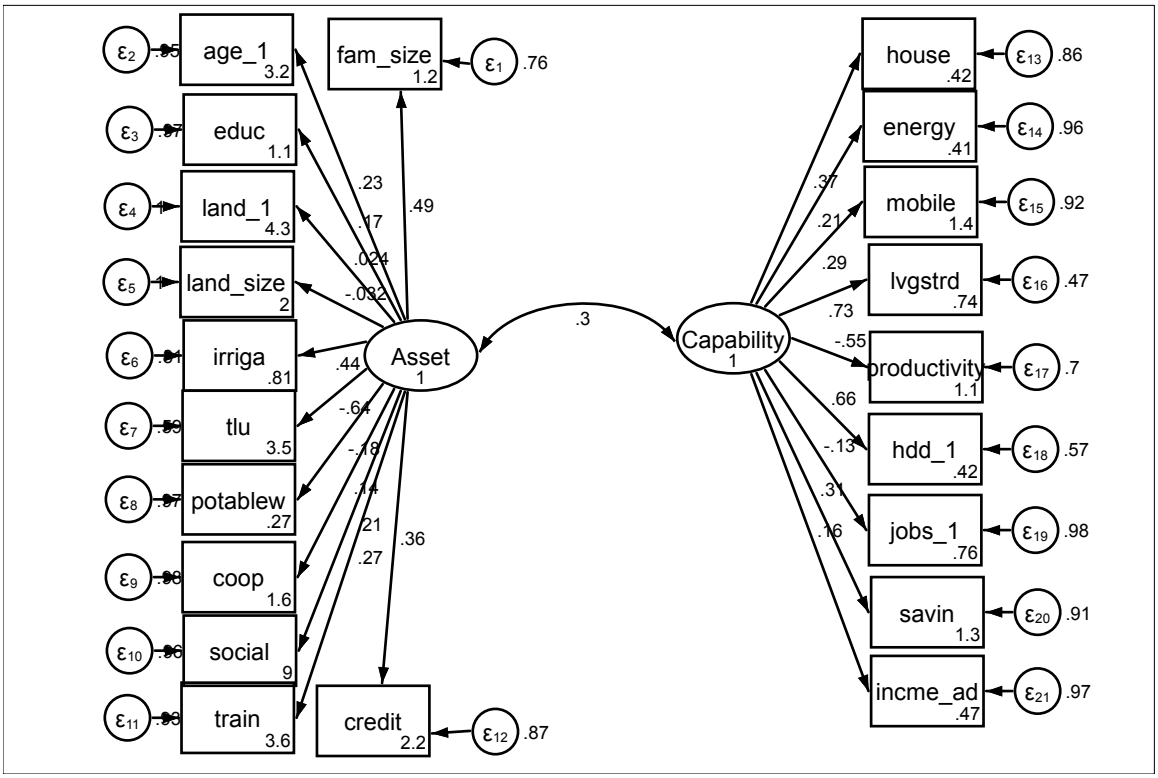
In parallel, the region has been beset by intermittent conflicts, mainly politically driven and resource competition, which have further destabilized rural communities(Dereje, H., 2023) ;Tolera, Megersa, 2023). These conflicts have led to the displacement of populations, destruction of property, and loss of life. The resulting insecurity has hindered access to markets, education,

and health services, compounding the difficulties faced by rural households in improving their livelihoods(Tolera, M., 2023).

This study aims to assess the current conditions of livelihood capabilities and the distribution of assets among rural households in the East Wallaga Zone. Considering the climate variability and conflict are the determinant factors for asset access and capability enhancemet, this research seeks to provide a comprehensive understanding of the factors influencing rural livelihoods. The findings are intended to inform policy interventions and strategies that can enhance resilience and promote sustainable development in the region.

Understanding how rural households have coped with and adapted to these challenging conditions is crucial for developing effective support mechanisms. This study will explore the adaptive strategies employed by households, the role of local institutions, and the effectiveness of external aid in mitigating the impacts of climate variability and conflict. Ultimately, the goal is to contribute to a more nuanced understanding of rural livelihood dynamics in the East Wallaga Zone, providing insights that can help to foster stability and prosperity in this vulnerable region.

Fig 2 Structural Equation Model (SEM) output of the data



In structural equation modeling (SEM), the relationships between latent variables and their observed indicators, as well as between the latent variables themselves, are often evaluated through p-values associated with standardized regression coefficients, also known as factor loadings. Typically, a p-value of less than 0.05 ($p < 0.05$) is considered significant, indicating that the relationship being tested is statistically valid. This method helps in determining the extent to which these relationships contribute to the overall model structure and explains the variables involved.

For the Asset latent variable, several key observed indicators were identified: land_1, age_1, training (train), and Tropical Livestock Units (TLU). These indicators exhibited high standardized loadings of 4.3, 3.2, 3.6, and 3.5, respectively, which were all statistically significant ($p < 0.05$). These high loadings suggest that each of these variables plays a critical role in defining the asset construct. Specifically, land ownership (land_1), with the highest loading, underscores its fundamental importance in rural households' ability to secure financial stability. The age of the

household head (age_1) is also a significant indicator, reflecting the impact of experience and social capital on the accumulation of assets over time. Similarly, both livestock holdings (TLU) and educational training (train) emerge as important factors, highlighting their contributions to household asset development. Although other indicators, such as access to irrigation and potable water, showed lower loadings, they may still be statistically significant if their p-values are below 0.05. However, their overall contribution to the asset construct would be less pronounced compared to the stronger indicators mentioned above.

The Capability latent variable was represented by key indicators, including productivity, savings (savin), and mobile phone ownership (mobile), which had standardized loadings of 1.1, 1.3, and 1.4, respectively. These indicators are particularly important as they reflect the household's ability to maintain financial stability and access essential services. Savings and mobile phone ownership were especially significant, underlining their roles in supporting economic resilience and access to critical information and services. Productivity, with a loading of 1.1, is a crucial aspect of household capability, representing how effectively a household can use its assets to generate economic output. Even though other indicators, such as housing and energy, had lower loadings (0.42 and 0.41), they still contribute to the overall capability construct, albeit to a lesser extent.

The relationship between the Asset and Capability latent variables was also examined, with a reported path coefficient of 0.3. If this coefficient is statistically significant ($p < 0.05$), it suggests a positive relationship between the two variables. This implies that an increase in household assets leads to a significant improvement in household capability. Such a finding supports the theoretical framework, which posits that asset acquisition is crucial for enhancing a household's capacity to generate income and improve well-being.

The overall goodness-of-fit of the structural equation model was assessed using various fit metrics, including variance components and R-squared values. These measures help to evaluate how well the model's predictions align with the actual data. The variance components were divided into three categories: fitted variance, predicted variance, and residual variance. Fitted variance reflects how much of the total variance in the dependent variables is explained by the model, with higher

fitted variance indicating better model performance. Predicted variance refers to the variability within the model's predictions, while residual variance represents the unexplained variance in the dependent variable. A high residual variance suggests that the model is not fully capturing the relationships between variables.

R-squared values, which indicate the proportion of variance in the dependent variables explained by the model, were calculated for several variables. For example, the R-squared value for family size (fam_size) was 0.239, meaning the model explains 23.9% of the variance in family size, indicating a reasonable fit. However, for age of the household head (age_1), the R-squared was 0.052, which shows that the model only accounts for 5.2% of the variance in this variable, suggesting a poor fit. Similarly, the R-squared for education status of the household head (educ) was 0.028, explaining only 2.8% of the variance, which indicates a weak fit for this variable. On the other hand, variables like Tropical Livestock Units (TLU) and Livelihood Standards **(lvgstrd)** showed stronger R-squared values of 0.406 and 0.534, respectively, demonstrating that the model performs well in predicting these outcomes.

In addition to R-squared, the Multiple Correlation Coefficient (mc) was used to assess the strength of the relationships between the observed and predicted values of each dependent variable. For example, the mc value for family size was 0.489, with an mc^2 of 0.239, indicating a moderate correlation and a reasonable fit. For age of the household head, the mc value was lower at 0.229, suggesting a weak correlation, which aligns with the low R-squared of 0.052. Conversely, the mc value for TLU was 0.638, with an mc^2 of 0.406, reflecting a good fit between the observed and predicted values. Livelihood standards had a strong mc value of 0.731, showing that the model explains more than half of the variance in this variable.

The overall model fit, as indicated by an R-squared value of 0.896, suggests that the model explains 89.6% of the variance in the dependent variables, indicating a strong overall fit. However, the variation in R-squared values across different variables points to areas where the model could be improved. Variables such as education and land ownership, which have lower explanatory power, may require additional predictors or adjustments to the model structure to improve their fit.

The regression coefficients provide further insight into the relationships between the independent and dependent variables, indicating the strength and direction of these relationships. Variables like family size, Tropical Livestock Units, and livelihood standards not only have high R-squared values but also significant regression coefficients, suggesting that changes in these variables have a substantial impact on the dependent variables. In contrast, variables such as age, education, and land ownership have lower regression coefficients and higher p-values, indicating that they do not significantly contribute to the explained variance. This suggests that the model may need to be adjusted to improve its explanatory power for these variables.

In conclusion, the analysis highlights the importance of certain variables, such as land ownership, productivity, and livestock holdings, in explaining household assets and capabilities. While the overall model fit is strong, there are areas, particularly in variables like education and land ownership, where further refinement is needed to improve the model's predictive accuracy. The high overall R-squared value suggests that the model is effective in capturing the key relationships within the data, but additional improvements could enhance its performance in specific areas.

Summary and Conclusion

Summary

Structural Equation Modelling (SEM) was utilized in this work to examine the connections between different assets, capability, and results in the setting of rural livelihood. Important factors that were examined included family size, age, education, land ownership, tropical livestock units (TLU), irrigation, and methods of subsistence.

Understanding how well the model could account for the variance in these dependent variables was possible. Across the variables, the R-squared values varied significantly, showing varying degrees of explanatory power. The model appears to adequately capture the factors impacting these outcomes, as evidenced by the relatively high R-squared values of variables including family size, tropical livestock units, and livelihood methods. In contrast, low R-squared values were found for

variables including age, education, and land ownership, indicating that the model was unable to adequately explain these characteristics.

These conclusions were further supported by the multiple correlation coefficients (mc) and their squared values (mc^2), where certain variables showed substantial relationships between observed and predicted values while others did not. With an overall R-squared value of 0.896, the model showed an excellent fit overall and could explain nearly 90% of the variance in all dependent variables.

The degree and direction of the correlations between the independent and dependent variables were further clarified by the regression coefficients. The dependent variables showed a substantial correlation with the significant predictors, which were livelihood methods and tropical livestock units. However, the model struggled to significantly predict variables such as age and education, as reflected in their lower regression coefficients and higher p-values.

Conclusion

The results of the SEM study highlighted how crucial specific resources and abilities are in influencing the course of rural lives. Particularly, it has been found that livelihood strategies and tropical livestock units are important factors that influence productivity and economic stability in rural communities. These factors appear to be crucial for effective rural livelihoods, based on their significant predictive power. Families that are able to invest in cattle and diversify their sources of income are better able to weather economic downturns and maintain their standard of living.

The research did, however, also point out serious shortcomings in the model's capacity to adequately represent the complexities of rural living. Age, education, and land ownership had limited explanatory power, suggesting that the existing model falls short of explaining the multifaceted nature of these factors.

This result raised the possibility that more research is necessary to find new factors that could affect various facets of rural livelihoods or to improve the current model's ability to represent their complexity. Future studies could examine how these characteristics are influenced by external shocks like climate change, social capital, or market accessibility, for instance.

In summary, the SEM model offers insightful information on the dynamics of rural livelihoods, but it also highlights the need for a more sophisticated strategy that takes into consideration the whole spectrum of variables influencing these communities. The study's main determinants, which include livelihood strategies and tropical livestock units, provide a strong basis for crafting focused policy interventions that aim to improve rural livelihoods. Supporting livestock ownership, encouraging income source diversification, and enhancing access to tools and training that help households adopt more resilient livelihood options could be the main focusses of these interventions.

In the end, the study emphasized how critical it is to comprehend the variety of resources and skills that support rural life. Policymakers and development professionals may better assist rural people in attaining resilient and sustainable livelihoods in the face of persistent environmental and economic difficulties by building on these results.

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Structural equation model Number of obs = 314
Estimation method = ml
Log likelihood = -4463.42

(1) [fam_size]Asset = 1
(2) [house]Capability = 1

	Standardized	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
Measurement							
fam_size							
	Asset	.4890538	.0745423	6.56	0.000	.3429535	.635154
	_cons	1.206903	.0741901	16.27	0.000	1.061493	1.352313
age_1							
	Asset	.2287768	.080123	2.86	0.004	.0717386	.3858151
	_cons	3.223029	.1404492	22.95	0.000	2.947754	3.498304
educ							
	Asset	.167258	.0765834	2.18	0.029	.0171573	.3173586
	_cons	1.094629	.0713631	15.34	0.000	.95476	1.234498
land_1							
	Asset	.0235875	.0726473	0.32	0.745	-.1187986	.1659736
	_cons	4.315669	.1812246	23.81	0.000	3.960475	4.670863
land_size							
	Asset	-.031521	.0751685	-0.42	0.675	-.1788486	.1158066
	_cons	1.96202	.0965118	20.33	0.000	1.77286	2.15118
irriga							
	Asset	.4401978	.0684389	6.43	0.000	.30606	.5743357
	_cons	.8132501	.0650988	12.49	0.000	.6856587	.9408414
tlu							
	Asset	-.6375645	.0715467	-8.91	0.000	-.7777934	-.4973356
	_cons	3.536555	.151989	23.27	0.000	3.238662	3.834448
potablew							
	Asset	-.1759368	.0732259	-2.40	0.016	-.3194569	-.0324168
	_cons	.2744858	.0574864	4.77	0.000	.1618146	.3871571
coop							
	Asset	.1449275	.0781196	1.86	0.064	-.0081842	.2980392
	_cons	1.641377	.0864564	18.99	0.000	1.471925	1.810828
social							
	Asset	.2105768	.0744731	2.83	0.005	.0646121	.3565414
	_cons	8.95273	.3616826	24.75	0.000	8.243845	9.661615
train							
	Asset	.2708395	.0689948	3.93	0.000	.1356122	.4060669
	_cons	3.644379	.1559923	23.36	0.000	3.33864	3.950118
credit							
	Asset	.3560344	.0711455	5.00	0.000	.2165917	.495477
	_cons	2.170044	.1033599	21.00	0.000	1.967462	2.372626
house							
	Capability	.3722134	.0591418	6.29	0.000	.2562976	.4881292
	_cons	.419559	.0588643	7.13	0.000	.3041871	.5349309
energy							
	Capability	.2071087	.0655797	3.16	0.002	.0785748	.3356426
	_cons	.4142968	.058805	7.05	0.000	.2990411	.5295525
mobile							
	Capability	.2856911	.0646475	4.42	0.000	.1589844	.4123978
	_cons	1.352343	.0780824	17.32	0.000	1.199304	1.505381
lvgstrd							
	Capability	.7308778	.0474271	15.41	0.000	.6379223	.8238332
	_cons	.7401531	.0636949	11.62	0.000	.6153134	.8649928
productivity							

```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(188)	867.606	model vs. saturated
p > chi2	0.000	
chi2_bs(210)	1262.404	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.107	Root mean squared error of approximation
90% CI, lower bound	0.100	
upper bound	0.115	
pclose	0.000	Probability RMSEA <= 0.05
Information criteria		
AIC	9054.840	Akaike's information criterion
BIC	9294.801	Bayesian information criterion
Baseline comparison		
CFI	0.354	Comparative fit index
TLI	0.279	Tucker-Lewis index
Size of residuals		
SRMR	0.112	Standardized root mean squared residual
CD	0.896	Coefficient of determination

```
. estat eqgof, format(%9.0g)

Equation-level goodness of fit
```

depvars	fitted	Variance predicted	residual	R-squared	mc	mc2
observed						
fam_size	.4563268	.1091413	.3471855	.2391736	.4890538	.2391736
age_1	1.396608	.0730969	1.323512	.0523388	.2287768	.0523388
educ	1.090927	.0305189	1.060408	.0279752	.167258	.0279752
land_1	.048359	.0000269	.0483321	.0005564	.0235875	.0005564
land_size	5.92021	.0058822	5.914328	.0009936	.031521	.0009936
irriga	.2396142	.046431	.1931831	.1937741	.4401978	.1937741
tlu	.64957	.2640427	.3855272	.4064885	.6375645	.4064885
potablew	.0651548	.0020168	.063138	.0309538	.1759368	.0309538
coop	.1974218	.0041466	.1932752	.021004	.1449275	.021004
social	.1078036	.0047803	.1030233	.0443426	.2105768	.0443426
train	.0660067	.0048419	.0611649	.073354	.2708395	.073354
credit	.1444785	.0183142	.1261643	.1267605	.3560344	.1267605
house	.1272771	.0176333	.1096438	.1385428	.3722134	.1385428
energy	.1250354	.0053633	.1196722	.042894	.2071087	.042894
mobile	.2285385	.0186532	.2098853	.0816194	.2856911	.0816194
lvgstrd	.2448461	.1307925	.1140537	.5341823	.7308778	.5341823
productivity	.248285	.0755726	.1727125	.3043783	.5517049	.3043783
hdd_1	.1272763	.0553512	.0719252	.4348898	.6594618	.4348898
jobs_1	.2401415	.0041932	.2359484	.0174612	.132141	.0174612
savin	.2329504	.021974	.2109764	.0943291	.3071303	.0943291
incme_ad	.1589618	.0042853	.1546765	.0269578	.1641884	.0269578
overall				.8963098		

mc = correlation between depvar and its prediction
mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient

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. estat mindices

Modification indices
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		MI	df	P>MI	EPC	Standard EPC
Measurement						
educ	Capability	19.602	1	0.00	2.473831	.3145135
land_1	Capability	9.351	1	0.00	-.3612442	-.2181371
land_size	Capability	5.516	1	0.02	3.069729	.1675323
irriga	Capability	6.432	1	0.01	.6556631	.1778654
tlu	Capability	7.560	1	0.01	1.244098	.2049787
potablew	Capability	6.863	1	0.01	.3575818	.1860242
coop	Capability	11.156	1	0.00	.7947367	.237516
credit	Capability	12.426	1	0.00	-.7089149	-.2476622
house	Asset	4.351	1	0.04	-.1666041	-.1542784
energy	Asset	34.889	1	0.00	-.4816671	-.4500129
mobile	Asset	4.477	1	0.03	.2304857	.1592791
lvgstrd	Asset	18.291	1	0.00	-.4491346	-.2998641
productivity	Asset	8.946	1	0.00	-.3184166	-.211113
jobs_1	Asset	8.362	1	0.00	-.3293802	-.2220539
savin	Asset	22.341	1	0.00	.5177552	.3543949
incme_ad	Asset	10.212	1	0.00	.2952768	.2446682
cov(e.fam_size,e.age_1)		27.272	1	0.00	.2283816	.336912
cov(e.fam_size,e.land_size)		8.488	1	0.00	.2607496	.181966
cov(e.fam_size,e.coop)		5.509	1	0.02	.0384326	.1483648
cov(e.fam_size,e.social)		10.790	1	0.00	-.0398608	-.2107644
cov(e.fam_size,e.productivity)		19.292	1	0.00	-.0688121	-.2810102
cov(e.fam_size,e.incme_ad)		11.327	1	0.00	.0469899	.2027738
cov(e.age_1,e.educ)		14.254	1	0.00	-.2590286	-.218649
cov(e.age_1,e.irriga)		13.243	1	0.00	-.1151353	-.2276984
cov(e.age_1,e.coop)		18.144	1	0.00	.1244585	.246078
cov(e.age_1,e.house)		5.234	1	0.02	-.0507753	-.1332898
cov(e.age_1,e.mobile)		26.416	1	0.00	-.1562872	-.2965299
cov(e.age_1,e.productivity)		48.045	1	0.00	-.2008542	-.4201024
cov(e.age_1,e.hdd_1)		5.479	1	0.02	-.0461026	-.1494244
cov(e.age_1,e.savin)		7.125	1	0.01	-.0815438	-.1543158
cov(e.age_1,e.incme_ad)		29.283	1	0.00	.1401115	.3096689
cov(e.educ,e.tlu)		9.312	1	0.00	-.1459808	-.2283136
cov(e.educ,e.potablew)		13.130	1	0.00	.0538966	.2082955
cov(e.educ,e.social)		5.924	1	0.01	.0464568	.1405548
cov(e.educ,e.credit)		7.282	1	0.01	.0588933	.161013