Effect of Agricultural Land Reform on Household Wealth Accumulation and the Role of Urbanisation in Rwanda

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Foreword

This study investigates the effect of the land use consolidation (LUC) policy on household wealth accumulation in Rwanda and the role played by urbanisation. The key questions of the study are:

- Are households whose agricultural lands are in the land use consolidation program wealthier than those whose agricultural lands are not in the land use consolidation program?
- To what extent does the land use consolidation program influence household wealth accumulation in Rwanda?
- What is the role of urbanisation in agricultural land reform in stimulating household wealth accumulation?

To answer these questions, this study used data from Rwanda's 2015, 2018, and 2021 Comprehensive Food Security and Vulnerability Analysis (CFSVA) surveys. The results of the study confirm that the LUC program positively contributes to household wealth accumulation. Furthermore, this study demonstrates that implementing the land use consolidation policy accompanied by urbanisation, substantially shifts households from the poorest, poor, and medium wealth categories to the wealthy and wealthier categories. Notably, land consolidation stimulates the mass production of agricultural products, promotes rural revitalisation, and stimulates industrialisation, which leads to urbanisation on the one hand. On the other hand, urbanisation creates job opportunities which stimulate household income and the efficiency of agricultural markets. In this study, urbanisation is defined as a household's likelihood of being in an urban area.

From a policy perspective, this study suggests that implementing a land use consolidation policy supported by urbanisation would play a crucial role in significantly improving wealth accumulation in Rwanda more than implementing the LUC policy independently. This accompaniment of LUC and urbanisation would also play a key role in supporting the country to achieve inclusive growth and its ambition of becoming a Middle-Income Country by 2035 and a High-Income Country by 2050.

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List of Abbreviations

CFSVA	: Comprehensive Food Security and Vulnerability Analysis
CIP	: Crop Intensification Programme
HWA	: Household Wealth Accumulation
LUC	: Land Use Consolidation
LUCP	: Land Use Consolidation Policy
MINAGRI	: Ministry of Agriculture and Animal Resources
NISR	: National Institute for Statistics of Rwanda
UN-SDGs	: United Nations Sustainable Development Goals

Executive Summary

Globally, it has long been recognised that agriculture is a source of livelihood for poor rural households and the engine of economic growth, mainly in developing countries. However, the effect of land fragmentation, small-scale agricultural holdings, and farms divided into many small parcels have been a significant challenge to increasing agricultural productivity, improving food security, and achieving poverty alleviation in those countries. Like many other developing countries, Rwanda has implemented the Land Use Consolidation (LUC) Policy since 2008 to overcome the negative effects of land fragmentation and land parcellation on livelihoods. The literature has sufficiently discussed the effect of LUC on agricultural productivity, food security, adoption of agricultural technologies, use of improved agricultural inputs, and environmental degradation. However, little is known about the effect of LUC on household wealth accumulation. To contribute to knowledge and policy discussions, we investigate the effect of integrating agricultural land into the LUC program on household wealth accumulation and the role urbanisation could play. This study uses data from Rwanda's 2015, 2018, and 2021 Comprehensive Food Security and Vulnerability Analysis surveys. We hypothesise that households for which agricultural lands are integrated into the LUC program are more likely to have good livelihoods and wealth accumulation, assuming that LUC contributes to improving livelihood activities and household food security status through increasing agricultural productivity. Evidence from ordered probit regression models' estimations revealed that integrating agricultural land into the LUC program is associated with a significant improvement in wealth accumulation among households adopting the LUC program. The moderation and marginal effect estimates showed that urbanisation helps achieve a more significant effect of LUC in improving household wealth accumulation. From a policy perspective, these findings suggest that implementing a land use consolidation policy supported by urbanisation would be crucial in significantly improving wealth accumulation in Rwanda. This accompaniment of the LUC program and urbanisation would also play a key role in supporting the country to achieve inclusive growth and its ambition of becoming a Middle-Income Country by 2035 and a High-Income Country by 2050. Our results also show that variables such as being male head of the household, education level of the household head, access to credit, household size, and age of the household head have a positive and significant effect on the household's likelihood of shifting from a lower to higher wealth category.

Chapter One: Introduction

Although Rwanda aspires to become a Middle-Income Country by 2035 and a High-Income Country by 2050, around 80 percent of all households still depend on agriculture (National Institute for Statistics of Rwanda [NISR], 2022). Most of these households own small-scale farms, where about 85 percent of all agricultural households have land with less than 0.5 hectares and practice subsistence agriculture (NISR, 2023). Notably, the development of market-oriented agriculture still faces various challenges. These challenges include rapid population growth and land fragmentation associated with low production yields, the complexity of adopting new agricultural technologies, and barriers to implementing agricultural intensification programs (Ministry of Agriculture and Animal Resources [MINAGRI], 2024). The effect of land fragmentation and farm structures characterised by small agricultural holding sizes and farms divided into many small parcels have been a significant challenge for the country to increase agricultural productivity, improve food security, and achieve poverty alleviation in Rwanda (MINAGRI, 2024). The Land Use Consolidation (LUC) Policy was implemented in 2008 to overcome issues related to land fragmentation and parcellation on livelihoods. The LUC policy was implemented as part of the Crop Intensification Programme (CIP), aimed at increasing crop production through the distribution of improved seeds, chemical fertilisers and new agricultural technology, such as irrigation.

Studies on agricultural development and land use have proposed LUC as a key solution to increasing agricultural productivity and food security. Nevertheless, the effect of implementing the LUC policy on agricultural productivity, adoption of new agricultural technologies, use of improved agricultural inputs, and food security remains ambiguous (Zhou *et al.*, 2020; Nilsson, 2019). One stream of the literature documents that LUC harms agricultural productivity and does not facilitate the adoption of new agricultural technologies and the efficient use of improved agricultural inputs (Molnárová *et al.*, 2023; Ghatak & Roy, 2007; Crecente *et al.*, 2002). In contrast, another stream of the literature supports that land use consolidation positively affects agricultural productivity and improves household food security (Habyarimana & Nkunzimana, 2017). However, more generally, the literature documents that the LUC policy is a policy reform that leads to adjustments in rural livelihood activities and reduces poverty in the country.

In this study, we consider examining the role of policy reforms in the agricultural sector in stimulating livelihood and wealth accumulation in Rwanda. It has long been recognised that agriculture is a source of livelihood for poor rural households and the engine of economic growth (African Union *et al.*, 2010; Muchopa *et al.*, 2004; Nkamleu, 2004). However, as land and water are required to improve agricultural production, the central question is how to achieve reliable agricultural production for sustainable livelihood while people, agriculture, industry, and tourism, among others, compete for land and water. This competition among economic sectors has been the leading cause of different issues and challenges facing the agricultural sector. Among others, those issues and challenges mainly include land and water access, use and management; land grabbing; poor access to new agricultural technologies and improved inputs; poor infrastructure; and threats mainly related to global warming, political instability and health (African Union et al., 2010; Muchopa *et al.*, 2004).

The literature regarding whether LUC affects household wealth accumulation is scarce and lacking in Rwanda. Though the empirical findings of the effect of LUC on agricultural productivity and food security remain ambiguous, to the best of our knowledge, no study has investigated the effect of the LUC policy on wealth accumulation in Rwanda and the role played by urbanisation—in this study, urbanisation is defined as a household's likelihood of being in an urban area. Most existing policies focus on assessing the effect of the LUC on crop productivity and food security (Zhou *et al.*, 2019; Habyarimana & Nkunzimana, 2017), and comprehensive land consolidation helps to promote the overall revitalisation of rural industry, ecology, organisation, culture and talent (Zhou *et al.*, 2020). Thus, this study aims to investigate the effect of the LUC on household wealth accumulation in Rwanda. This study attempts to answer the following three questions: Do households in LUC have a good livelihood status compared with those not in the LUC? To what extent does the LUC influence household wealth accumulation in the country? What is the role of urbanisation in agricultural land reform in stimulating household wealth accumulation?

We use data from Rwanda's 2015, 2018, and 2021 Comprehensive Food Security and Vulnerability Analysis (CFSVA) surveys to investigate the proposed questions. We hypothesise that households for which agricultural lands are integrated into the LUC program are more likely to have good livelihoods and wealth accumulation under the assumption that LUC contributes to improving livelihood activities and household food security status through increasing agricultural productivity (Zhou *et al.*, 2020; Zhou *et al.*, 2019; Habyarimana &

Nkunzimana, 2017). The proxy used for LUC policy is the dummy variable for whether the agricultural land of a given household is included in the LUC program. In contrast, the proxy used for household wealth accumulation is the ordered variable on household wealth (where 1, 2, 3, 4, and 5 are for the poorest, poor, medium, wealth, and wealthiest categories, respectively).

The results of this study reveal that households participating in the LUC program are wealthier than those who do not participate in the LUC program. The results for the effect of LUC policy on household wealth accumulation are robust even after reducing the effects of omitted variable biases. This study empirically shows that LUC positively contributes to household wealth accumulation. This study suggests that a marginal change in the effects of factors determining households' adoption of the LUC program can cause significant changes in household wealth accumulation. Consequently, referring to the related literature the following chain can be defined: the adoption of the LUC program stimulates agricultural productivity (crop yield) (Zhou *et al.*, 2020; Zhou et al., 2019; Habyarimana & Nkunzimana, 2017), which in turn contributes to increasing household income (Zhou *et al.*, 2019; Habyarimana & Nkunzimana, 2017) and then stimulate household wealth accumulation. Finally, this study contributes to the literature by documenting the role of urbanisation in determining household wealth accumulation through LUC. In other words, implementing the LUC policy accompanied by urbanisation substantially shifts households from the poorest, poor, and medium wealth categories to the wealthy and wealthier categories.

The remainder of this study is organised as follows: Chapter 2 provides the literature review. Chapter 3 describes the data and econometric model specification. Chapter 4 presents empirical results and discusses them. Chapter 5 summarises our concluding remarks and provides policy implications.

Chapter Two: Literature Review

Land consolidation has been carried out mainly in the Middle East, Europe, Asia, and Africa, and different regions have achieved varied effects. European countries have a long tradition of land consolidation (Crecente *et al.*, 2002). With the development of urbanisation, the social and economic decline in rural areas of Central and Eastern European countries has intensified, leading to the fragmentation of land ownership and management. Most European countries have turned to land consolidation as an important way to solve land fragmentation and achieved the expected results, which promotes the sustainable development of rural areas (Van Dijk, 2007; Crecente *et al.*, 2002). The successful implementation of land consolidation depends greatly on the suitability of local conditions with respect to land tenure and land use (Abubakari *et al.*, 2016).

In South Asia, a steadily increasing population and scarce non-farming employment are the major forces behind land fragmentation in most of its countries, and they are committed to solving the problem of land fragmentation by land consolidation. Land consolidation is conducive to agricultural development in South Asia countries, but its actual effect is not apparent (Thapa & Niroula, 2008). Land consolidation has multiple goals but has remained oriented towards agriculture in many countries (Demetriou *et al.*, 2012). It has become an instrument for improving the quantity and quality of cultivated land, reducing land fragmentation, adjusting land ownership, optimising land-use structure, boosting modern agriculture development, beautifying the rural environment and supporting rural development and poverty alleviation (Zhou *et al.*, 2019; 2020; Jiang *et al.*, 2017; Luo & Timothy, 2017).

In Sub-Saharan Africa, land consolidation has not been successful due to the lack of consolidation of local conditions (Asiama *et al.*, 2017). Especially in Rwanda, land consolidation has been used as an important tool to supplement arable land, reduce land fragmentation and ensure national food security for more than 14 years. Rwanda is one of the few countries where the relationship between population and land is taut—the population density in Rwanda is 501 per Km^2— (NISR, 2023b). According to the work of Nimusima *et al.* (2018), it can be deduced that since 2000, with the implementation of different macroeconomic policies to boost economic growth in the country, the rapid population growth has been the major challenge hampering the efficiency of different developed agricultural policies to ensure food security and alleviate poverty. Increased land fragmentation and parcellation and lack of reserve arable land resources, coupled with adverse effects such as

climate change, natural disasters, land degradation and pollution, led the country to focus on LUC to increase cultivated land to ensure sustainable agricultural productivity and food security. So far, Rwanda's LUC has been carried out at the local administrative level and coordinated nationally by the MINAGRI. Extensive and in-depth research has been carried out to examine the effect of LUC on different dimensions of socioeconomic growth and development.

Bizimana (2009) examined the effect of population pressure and farm fragmentation and concluded that an LUC policy in Rwanda is justified. However, existing studies assessing the effectiveness and effects of LUC have generated mixed and opposing evidence. Huggins (2012) documents that despite initial technical problems in many areas, LUC has led to massive increases in crop yields, specifically among crops targeted by the Crop Intensification Program. Bizoza (2021) found no evidence of LUC's effects across economic, food and nutrition security, and environmental and climate change resilience outcomes. Nsabimana et al. (2023) document that implementing LUC leads to the uptake of agricultural inputs both in the short- and long run, but the effect is more in the long run. They also document that, in the short run, access to finance and asset ownership are the underlying conditioning factors for LUC to be effective. In the long run, the dominant complementary factor is access to credit. Nilsson (2019) documents a positive association between LUC and crop yields, but only among farm households with landholdings greater than one hectare, which is well above the average farm size in Rwanda. Del Prete *et al.* (2019) document that participation in LUC activities has ambiguous effects on household consumption habits. Habyarimana and Nkunzimana (2017) document that LUC has a positive and significant effect on crop yield and household food security; households for which lands are integrated in the LUC program rely more on the market for food acquisition. They also document that income from agricultural production is distributed less equitably among LUC households. Musahara *et al.* (2014) show that LUC has increased crop yield through the services accompanying the programme. Muhinda and Dusengemungu (2013) document that LUC stimulate crop specialisation, which in turn results in economies of scale.

The available literature argues that LUC has contributed to increased food crop production in Rwanda through agricultural land expansion and crop yield increase. Some studies claim that these developments have contributed to improved food security and poverty reduction in particular, and to agricultural development in general (Nilsson, 2019; Habyarimana &

Nkunzimana, 2017). Furthermore, the literature shows that land consolidation as a policy reform has increased the capacity of rural households to produce food crops, as well as providing increased opportunities for income generation, resulting in poverty reduction and the capacity to purchase food from the commercial market. Although few studies have investigated the effect of LUC on poverty reduction (Uwingabire, 2012), no study has probed the conditional role of urbanisation in agricultural land reform on household wealth accumulation by accounting for the moderating effect of urbanisation on the role of LUC in stimulating household wealth accumulation in Rwanda.

Chapter Three: Methodology

3.1 Data

We use the public data sets of Rwanda's 2015, 2018, and 2021 Comprehensive Food Security and Vulnerability Analysis (CFSVA) surveys, in which 7500, 9709, and 9000 households were interviewed, respectively. The CFSVA survey is a triennial survey conducted by the World Food Program in collaboration with the Ministry of Agriculture and Animal Resources and the National Institute of Statistics of Rwanda. Missing data are imputed in the available public datasets to manage missing information in the survey data set. Hence, after combining data for the three surveys, we used a sample of 26,209 observations in the public data set for 2016, 2019, and 2022 SCF. Moreover, to manage the effect of the CFSVA estimates' sampling error, we use the survey weights available in the public data set.

3.2 Model Specification

To investigate the effect of LUC policy on household wealth accumulation, we estimate the cross-sectional ordered probit model as in Equations 1 and 2. The estimated regression models are based on the combined data from Rwanda's 2015, 2018, and 2021 CFSVA.

$$HWA_i = \alpha + \beta^{LUCP \rightarrow HWA} LUCP_i + \gamma_j \sum X_{ij} + u_i, \quad (1)$$

$$HWA_i = \alpha + \theta^{LUCP \times UR \rightarrow HWA} LUCP_i \times UR_i + \varphi_j \sum X_{ij} + u_i, \quad (2)$$

where HWA_i denotes the outcome variable measuring household wealth accumulation (which is an ordered variable where 1, 2, 3, 4, and 5 refer to poorest, poor, medium, wealth, and wealthier categories, respectively) for household i in Equations 1 and 2. $LUCP_i$ in Equations 1 and 2 is the major regressor that measures the adoption of LUC programs for household i. $\beta^{LUCP \rightarrow HWA}$ in Equation 1 measures the effect of LUC policy on household wealth accumulation. $LUCP_i \times UR_i$ in Equation 2 is the interaction between LUC and Urbanisation. $\theta^{LUCP \times UR \rightarrow HWA}$ in equation 2 measures the effect of the interaction between LUC and Urbanisation on household wealth accumulation. X_{ij} in Equations 1 and 2 is a vector of j a set of control covariates included in the regression model to reduce the effect of omitted variable bias on the estimates. Employed control covariates include selected variables that could explain the household's wealth accumulation status (see Table 1). u_i is an $IIDN(0, \sigma^2)$ error term.

3.1. Definitions of Variables and Summary Statistics

Table 1 provides the definitions of the variables of major interest—household wealth accumulation and LUC policy—and a set of control covariates, X_j, included in the ordered probit models. The major outcome variable is the ordered variable for household wealth, where 1, 2, 3, 4, and 5 determine whether the household's wealth is under the poorest, poor, medium, wealthy, and wealthiest categories, respectively. The major regressor is a dummy variable where it takes one if the agricultural land of a specific household is included in the LUC program, while it takes zero otherwise. The vector of control covariates includes regressors related to a household's demographic and economic characteristics.

Table 2 presents descriptive statistics of variables used in this study and the correlation between the outcome variable and the set of explanatory variables. Table 2 shows the positive correlation between measures of the outcome variable (household wealth accumulation) and agricultural land reform (LUC policy) measures. Moreover, Figure 1 shows household wealth categories across the three combined datasets over 2015, 2019, and 2021. More specifically, households in wealthy and wealthier categories increased from 2015 to 2021. Figure 2 shows households whose lands are integrated into the LUC and those whose lands are not integrated into the LUC across the three combined datasets over 2015, 2019, and 2021. Since the three datasets combined together came from different cross-sectional surveys with different sample sizes, a lower percentage of households whose lands are integrated into LUC in the 2021 survey does not necessarily mean that the level of LUC adoption has decreased among the households. This would be assessed if the merged datasets were from a panel data survey.

Table 1. Description of variables

Variable name	Description
Wealth accumulation	Ordered variable where 1, 2, 3, 4, and 5 indicate poorest, poor, medium, wealthy, and wealthier, respectively
Land reform	A dummy variable takes one if the household's agricultural land in the LUC program and zero otherwise.
Urbanisation	A dummy variable takes one if the household is in urban area and zero otherwise.
Household head gender	A dummy variable takes one if the household head is a male and zero otherwise.
Access to credit	A dummy variable takes one if the household applied for a credit and zero otherwise.
Age of the household head	Age, in year, of the head of the household
Number of partners	Number of partners per household
Education level of the head of the household	Ordered variable where 0, 1, 2, 3, 4, and 5 indicate no education, primary, vocational, secondary, and university, respectively
Being in rural areas	A dummy variable takes one if the household is in a rural area and zero otherwise.
Household size	The number of persons in a household
Marital status (married)	A dummy variable takes one if the household head is married and zero otherwise.
Marital status (divorced)	A dummy variable takes one if the household head is divorced and zero otherwise.
Marital status (widow/widower)	A dummy variable takes one if the household head is a widow/widower and zero otherwise.
Marital status (single)	A dummy variable takes one if the household head is single and zero otherwise.
Firewood as the source of cooking energy	A dummy variable takes one if the household uses firewood as the major source of cooking and zero otherwise.

Table 2. Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Correlation with Wealth Accumulation
Wealth accumulation	2.927	1.368	1	5	1
Land reform	0.132	0.338	0	1	0.018
Urbanisation	0.153	0.360	0	1	0.371
Household head gender	0.732	0.443	0	1	0.135
Access to credit	0.217	0.412	0	1	0.150
Age of the household head	47.760	15.348	18	114	-0.048
Number of partners	1.028	0.164	1	2	-0.021
Education of head of household	0.960	0.936	0	4	0.398
Being in rural areas	0.847	0.360	0	1	-0.371
Household size	4.793	2.122	1	22	0.218
Marital status (married)	0.558	0.497	0	1	0.183
Marital status (divorced)	0.022	0.147	0	1	-0.037
Marital status (widow/widower)	0.197	0.398	0	1	-0.113
Marital status (single)	0.039	0.194	0	1	-0.007
Marital status (partner & separated)	0.183	0.386	0	1	-0.101
Firewood as cooking energy	0.860	0.347	0	1	-0.422
Observations	26,209				

Notes: The statistics are based on the combined datasets for Rwanda's 2015, 2018, and 2021 CFSVA surveys.

Figure 1. Household Wealth Categories by Year of the Survey

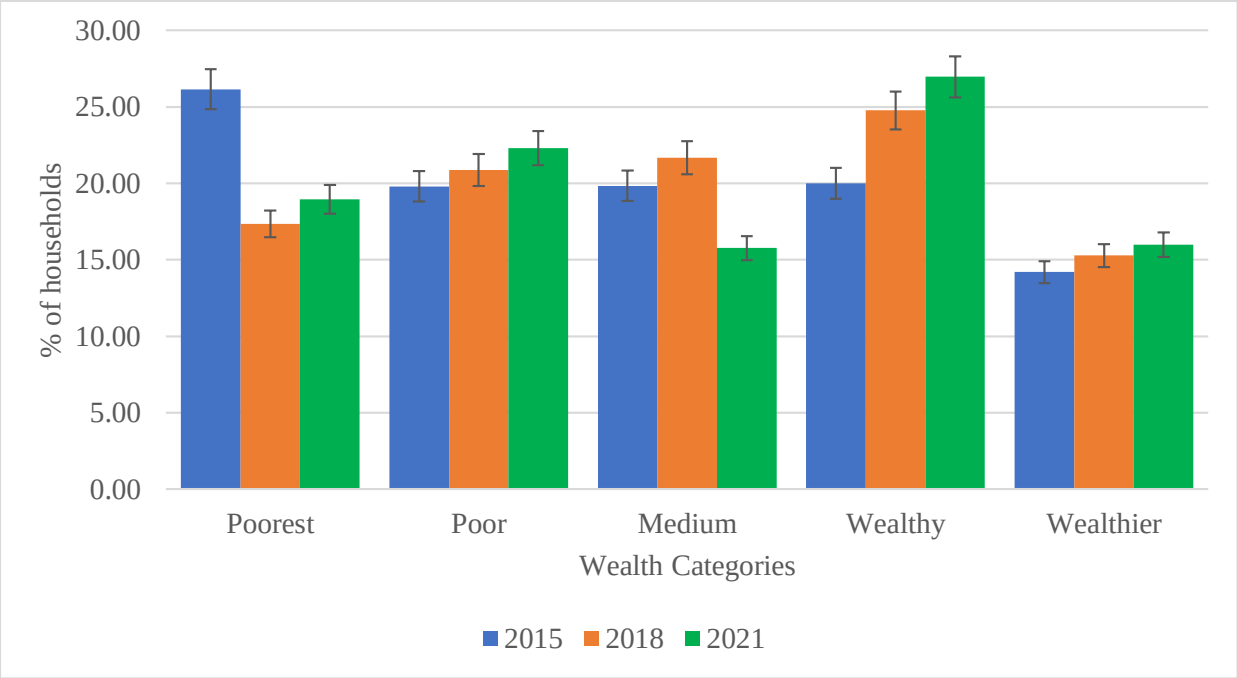
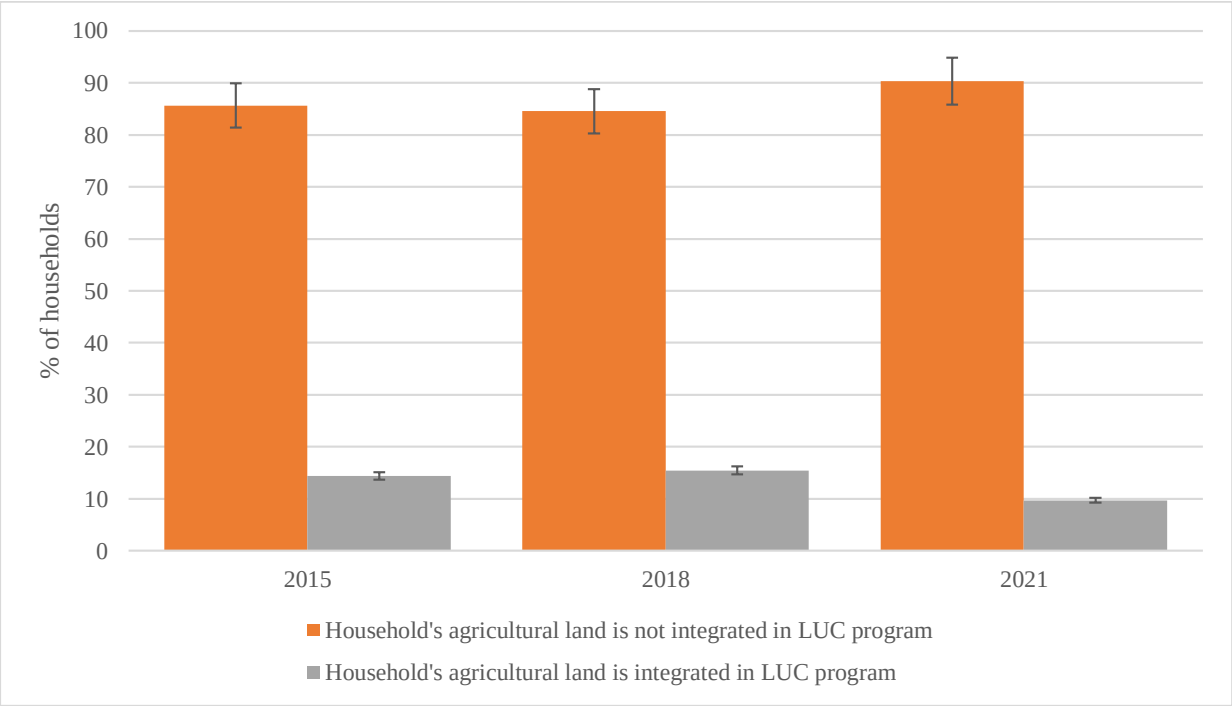


Figure 2. Household and LUC by Year of the Survey



Chapter Four: Empirical Results and Discussion

4.1 Preliminary Results

In Table 3, we present preliminary results of the direct effect of the LUC policy on household wealth accumulation based on the ordered probit model (OPROBIT). Results for marginal effects are reported in Table 4.

Overall, the preliminary results show that the LUC policy is positively and significantly associated with the household's wealth accumulation. Notably, preliminary results show that the effect of participating in the LUC program on household accumulation is consistently positive and statistically significant before (Column 1) and after (Column 2), reducing the issue of omitted variable bias. More specifically, Table 3 shows that adopting the LUC program shifts the household from lower to higher wealth accumulation. This effect is estimated at 0.25 percentage points by applying the OPROBIT model with control covariates.

Turning to the direct effect of control covariates in Table 3, Column 2.2, we observe that the effects of being male head of household, access to credit, age of the head of household, education level of the head of household, the number of persons in the household, and marital status of the household head are positive and statistically significant to explain the household accumulation. Noticeably, moving from a lower to a higher level in the education of the household heads—from no education to primary and high school to high school and some college and then to a university degree—increases the likelihood of shifting the household from a lower to a higher wealth accumulation status—from poorest to poor, poor to medium, and medium to wealthier—by 35.5 percentage point. Being the male head of the household increases the likelihood of shifting the household from a lower to a higher wealth accumulation status—from poorest to poor, poor to medium, and medium to wealthier—by 6.7 percentage points. Access to credit by the households increases the likelihood of shifting the household from a lower to a higher wealth accumulation status—from poorest to poor or poor to medium or medium to wealthier—by 27.1 percentage points. A 10-point increase in the age of the head of household is likely to increase the likelihood of shifting the household from a lower to a higher wealth accumulation status —from poorest to poor, poor to medium, and medium to wealthier—by 4.0 percentage points. A 10-point increase in the size of the household is likely to increase the likelihood of shifting the household from a lower to a higher wealth accumulation status —from poorest to poor, poor to medium, and medium to wealthier—by 0.77 percentage points.

However, we observe that the direct effects of being in rural areas and the dummy for using firewood as the major source of cooking energy are negative and statistically significant in predicting household wealth accumulation. Notably, using firewood as the major source of energy for cooking decreases the likelihood of shifting the household from a lower to a higher wealth accumulation status—from poorest to poor, poor to medium, and medium to wealthier—by 85.0 percentage points. Being in a rural area decreases the likelihood of shifting the household from a lower to a higher wealth accumulation status —from poorest to poor, poor to medium, and medium to wealthier—by 50.1 percentage points.

Table 3. The effect of LUC policy on household wealth accumulation

		OPROBIT – Model	
		Coefficient (1)	Coefficient (2)
Agricultural land reform		0.308***	0.247***
		(0.028)	(0.023)
Gender/household head (male=1)			0.067**
			(0.031)
Household access to credit			0.271***
			(0.020)
Age of the household head			0.004***
			(0.001)
Partners per household head			-0.056
			(0.045)
Education of the household head			0.355***
			(0.012)
Being in rural areas			-0.501***
			(0.050)
Household size			0.077***
			(0.005)
Married (marital status)			0.360***
			(0.024)
Divorced (marital status)			0.053
			(0.054)
Widow/er (marital status)			0.259***
			(0.033)
Single (marital status)			0.118***
			(0.044)
Firewood / cooking energy			-0.850***
			(0.039)
The year 2018		0.193***	0.176***
		(0.045)	(0.048)
The year 2021		1.049***	0.319***
		(0.027)	(0.036)
	cut1	-0.934***	-1.171***
		(0.028)	(0.083)
	cut2	-0.270***	-0.433***
		(0.028)	(0.079)
	cut3	0.272***	0.186**
		(0.033)	(0.076)
	cut4	1.140***	1.252***
		(0.032)	(0.079)
R-squared			
Observations		26,209	26,209

Notes. This table reports the effect of integrating agricultural land into LUC on household wealth accumulation based on OPROBIT based on the three recent rounds of Rwanda's CFSVA surveys (2015, 2018, and 2021). The dependent variable is the ordered variable, which takes 1, 2, 3, 4, and 5 if the household's wealth is poorest, poor, medium, wealthy, and wealthier. Estimates reported in Column 2 control for the effect of other selected control covariates, as presented in Table 1 and a factor variable for districts. Robust standard errors presented in parentheses are clustered into districts. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.2 Marginal Effect of Agricultural Land Reform on Household Wealth Accumulation

Table 4 reports the average marginal effect of adopting the LUC policy on household wealth accumulation, controlling for the effect of other selected control covariates that could influence it. Estimates presented in Table 4 are based on the ordered Probit model. More specifically, Table 4 shows that for households in the poor and poorest category, adopting the LUC program reduces the likelihood of staying in that category by 0.7 and 0.5 percentage points, respectively. For households in the wealthy and wealthier category, adoption of the LUC program increases the likelihood of staying in that category by 0.7 percentage points and 0.5 percentage points, respectively. These estimates are statistically significant at the 1% level.

Turning to the marginal effects of control covariates in Table 4, for households in the poor and poorest category, having a male head of the household reduces the likelihood of staying in that category by 1.1 percentage points and 0.8 percentage points, respectively. For households in the wealthy or wealthier category, having a male head of the household increases the likelihood of staying in that category by 1.1 percentage points and 0.8 percentage points, respectively. For households in the poor and poorest category, having access to credits reduces the likelihood of staying in that category by 1.3 and 1.0 percentage points, respectively. For households in the wealthy or wealthier category, having access to credits increases the likelihood of staying in that category by 1.3 percentage points and 1.0 percentage points, respectively. For households in the poor and poorest category, a 10 percent increase in the age of the household reduces the likelihood of staying in that category by 4.1 and 0.2 percentage points, respectively. For households in the wealthy or wealthier category, a 10 percent increase in the age of the household increases the likelihood of staying in that category by 4.1 percentage points and 0.2 percentage points, respectively.

For households in the poor and poorest category, an increase in the education level of the head of the household—from no education to primary and high school to high school and some college and then to a university degree—reduces the likelihood of staying in that category by 7.6 and 5.3 percentage points, respectively. For households in the wealthy and wealthier

category, an increase in the education level of the head of the household—from no education to primary and high school to high school and some college and then to a university degree—increases the likelihood of staying in that category by 7.6 and 5.3 percentage points, respectively. For households in the poor and poorest category, being in rural areas increases the likelihood of staying in that category by 9.4 and 6.5 percentage points, respectively. For households in the wealthy and wealthier category, being located in rural areas reduces the likelihood of staying in that category by 9.4 and 6.5 percentage points, respectively. For households in the poor and poorest category, using firewood as the major source of cooking energy increases the likelihood of staying in that category by 16.2 and 11.9 percentage points, respectively. For households in the wealthy and wealthier category, using firewood as the major source of cooking energy reduces the likelihood of staying in that category by 16.2 and 11.9 percentage points, respectively.

Table 4. The Marginal effect of LUC policy on household wealth accumulation

	Regressors				
	Agricultural land reform	Household head gender	Access to credit	Age of the household head	Number of partners
Panel A. Explained	(1)	(2)	(3)	(4)	(5)
Poorest	-0.007***	-0.011**	-0.013***	-0.041***	0.013
	(0.001)	(0.005)	(0.001)	(0.007)	(0.010)
Poor	-0.005***	-0.008**	-0.009***	-0.029***	0.009
	(0.000)	(0.003)	(0.001)	(0.005)	(0.007)
Medium	-0.000***	-0.000*	-0.001***	-0.002***	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Wealthy	0.007***	0.011**	0.013***	0.041***	-0.013
	(0.001)	(0.005)	(0.001)	(0.007)	(0.010)
Wealthier	0.005***	0.008**	0.010***	0.030***	-0.009
	(0.001)	(0.004)	(0.001)	(0.005)	(0.007)
	Education of the household head	Being in areas (7)	Household size	Married (Marital status)	
Panel B. Explained	(6)		(8)	(9)	
Poorest	-0.076***	0.094***	-0.081***	-0.044***	
	(0.003)	(0.009)	(0.005)	(0.003)	
Poor	-0.053***	0.065***	-0.057***	-0.031***	
	(0.002)	(0.007)	(0.004)	(0.002)	
Medium	-0.003***	0.004***	-0.003***	-0.002***	
	(0.001)	(0.001)	(0.001)	(0.000)	
Wealthy	0.076***	-0.094***	0.081***	0.044***	
	(0.003)	(0.009)	(0.006)	(0.003)	
Wealthier	0.056***	-0.069***	0.060***	0.033***	
	(0.003)	(0.007)	(0.004)	(0.003)	
	Divorced (Marital status)	Widow/er (Marital status)	Single (Marital status)	Firewood/cooking energy	
Panel C. Explained	(10)	(11)	(12)	(13)	
Poorest	-0.000	-0.011***	-0.001***	0.162***	
	(0.000)	(0.002)	(0.000)	(0.007)	
Poor	-0.000	-0.008***	-0.001***	0.113***	
	(0.000)	(0.001)	(0.000)	(0.007)	
Medium	-0.000	-0.000***	-0.000**	0.007***	
	(0.000)	(0.000)	(0.000)	(0.002)	

Wealthy	0.000	0.011***	0.001***	-0.162***	
	(0.000)	(0.002)	(0.000)	(0.009)	
Wealthier	0.000	0.008***	0.001***	-0.119***	
	(0.000)	(0.001)	(0.000)	(0.007)	
Observations	26,209	26,209	26,209	26,209	26,209

Notes. This table reports the marginal effects of integrating agricultural land into LUC on household wealth accumulation based on OPROBIT estimates presented in Table 3, Column 2. Explained variables are in rows, while regressors are presented in columns. Robust standard errors presented in parentheses are clustered into districts. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.2. Effect of the Interaction between Land Reform and Urbanisation on Household Wealth Accumulation

We now probe the conditional role of urbanisation in agricultural land reform on household wealth accumulation by accounting for the moderating effect of urbanisation on the role of agricultural land reform in stimulating household wealth accumulation in Rwanda. To do this, we interact the urbanisation indicators (which is a dummy variable that takes one if the household is located in rural areas; otherwise, it takes zero) with the measure of agricultural land reform, which is a dummy variable that takes the value of one if the household's land is integrated into the LUC program, otherwise it takes the value of zero. The effect of this interaction is obtained using the ordered Probit regression. Tables 5 to 6 report the regression results for the moderating (interactive) effects. Due to the consistency of the direct effects in these tables with our earlier findings in Tables 3 and 4, we focus mainly on the interaction. The direct effects and marginal effects presented in Tables 3 and 4 show how integrating agricultural land in the LUC program relates to household wealth accumulation in the absence of the role of urbanisation.

In Table 5, we find that the direct effect of integrating agricultural land in the LUC program on household wealth accumulation is significantly moderated by urbanisation. The coefficient of the interaction between the measure of agricultural land reform and urbanisation is positive and statistically significant at a 1% level, suggesting that increasing the number of households integrating their agricultural land into the LUC program significantly improves household wealth accumulation in the presence of urbanisation. As seen in Table 6, marginal effects estimated with the ordered probit regression are statistically significant at a 1% level. Overall, the results in Table 6 suggest that implementing the LUC policy accompanied by urbanisation substantially reduces the household's likelihood of staying in the wealth category of poorest, poor and medium. In contrast, it significantly increases the likelihood of staying in the wealth category of wealthy and wealthier. In other words, implementing the LUC policy accompanied by urbanisation substantially shifts households from the poorest, poor, and medium wealth

categories to the wealthy and wealthier categories.

Table 5. Interactive Effect of Agricultural Policy Reform and Urbanisation on Household Wealth Accumulation

	OPROBIT – Model	
	Coefficient (1)	Coefficient (2)
Land Reform * Urbanisation	0.168***	0.722***
	(0.025)	(0.066)
Land Reform	0.238***	
	(0.019)	
Urbanisation	0.488***	
	(0.036)	
cut1	-0.674***	-0.816***
	(0.077)	(0.078)
cut2	0.064	-0.083**
	(0.043)	(0.037)
cut3	0.684***	0.530***
	(0.075)	(0.085)
cut4	1.750***	1.583***
	(0.057)	(0.046)
R-squared		
Observations	26,209	26,209
Controls for LUC and urbanisation	Yes	No
Control covariates	Yes	Yes
Controls for survey year	Yes	Yes

Notes. This table reports the interactive effect of integrating agricultural land into LUC and urbanisation on household wealth accumulation based on OPROBIT regression models. Estimates are based on the three recent rounds of Rwanda's CFSVA surveys (2015, 2018, and 2021). The dependent variable is the ordered variable, which takes 1, 2, 3, 4, and 5 if the household's wealth is poorest, poor, medium, wealthy, and wealthier. Estimates reported in this table control for the effects of other selected control covariates, as presented in Table 1 and a factor variable for districts. Robust standard errors presented in parentheses are clustered into districts. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Interactive Marginal Effect of Agricultural Policy Reform and Urbanisation on Household Wealth Accumulation

	Regressors			
	Land Reform * Urbanisation	Land reform	Urbanisation	Land Reform * Urbanisation
Explained variable	(1)	(2)	(3)	(4)
Poorest	-0.000***	-0.007***	-0.017***	-0.001***
	(0.000)	(0.001)	(0.001)	(0.000)
Poor	-0.000***	-0.005***	-0.012***	-0.001***
	(0.000)	(0.001)	(0.001)	(0.000)
Medium	-0.000**	-0.000**	-0.001**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Wealthy	0.000***	0.007***	0.017***	0.001***
	(0.000)	(0.001)	(0.002)	(0.000)
Wealthier	0.000***	0.005***	0.012***	0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
Observations	26,209	26,209	26,209	26,209
Land reform included in the model	Yes	Yes	Yes	No
Urbanisation included in the model	Yes	Yes	Yes	No
Control covariates included in the model	Yes	Yes	Yes	Yes

Notes. This table reports the interactive marginal effect of integrating agricultural land into LUC and urbanisation on household wealth accumulation based on OPROBIT estimates in Table 5, Columns 2.1 and 2.2. Explained

variables are in rows, and regressors are in columns. Robust standard errors presented in parentheses are clustered into the year of the survey (2015, 2018, and 2021). ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.3 Discussion

We contribute to the literature on the effect of agricultural land reform on household wealth accumulation by examining the effect of LUC policy implementation in Rwanda on wealth categories—poorest, poor, medium, wealthy, and wealthier—among households in Rwanda. Our study extends existing literature with fresh evidence in two ways. First, it establishes the effect of the LUC policy on wealth accumulation. Second, it demonstrates how urbanisation moderates the effect of LUC policy on household wealth accumulation.

First, implementing an agricultural policy as measured by the indicator for integrating agricultural land into the LUC program is associated with improving household wealth accumulation. This suggests that LUC policy could be pivotal in achieving the country's target of reducing poverty and improving food security and its ambition of becoming a Middle-Income Country by 2035 and a High-Income Country by 2050. The literature demonstrates with evidence how implementing agricultural land reforms plays a key role in improving livelihoods (Zhou *et al.*, 2019; Habyarimana & Nkunzimana, 2017). Our results are also supported by the literature, which documents that land consolidation contributes to rural development and poverty alleviation whereby it offers mechanisms to stimulate employment opportunities, promote land resource capitalisation, increase farmers' income, and improve adoption of agricultural technologies (Zhou et al., 2019; Habyarimana & Nkunzimana, 2017).

Our findings suggest that increasing the number of households integrating their agricultural lands into the LUC program creates a more sustained household wealth accumulation in the country. Drawing from the theory of wealth distribution and wealth accumulation by Adam Smith, which suggests that individuals would invest a resource, such as land, labour, and capital, to earn the highest return on it, we contend that ensuring a sustainable integration of agricultural lands into LUC program among all bridges gaps in achieving higher wealth accumulation among households and this subsequently allows agricultural households to contribute favourably to the inclusive growth. Our argument is supported by the study of Zhou et al. (2019), which documents that land consolidation promotes rural revitalisation in rural areas. An interesting finding is that integrating agricultural lands into the LUC program is largely more influential in increasing household wealth accumulation in the country. This finding is not surprising. This is because LUC has long been cited as one of the important

factors with significant positive effects in determining crop yield, farmers' income, and access to agricultural technologies, among others (Zhou et al., 2020; Zhou et al., 2019; Habyarimana & Nkunzimana, 2017). Thus, we put forward that promoting household wealth accumulation to ensure food security and poverty alleviation to achieve inclusive growth would be more effective through implementing the LUC policy and incentivising more agricultural households to integrate their agricultural lands into the LUC program.

Moreover, our results also show that variables such as being male head of the household, education level of the household head, access to credit, household size, and age of the household head have a positive and significant effect on the household's likelihood of shifting from lower to higher wealth category. These results on control variables are supported by the literature whereby, for instance, Abdullah *et al.* (2025) document that education reduces income inequality. Denton and Boos (2007) demonstrate that women report lower levels of wealth because they receive differential returns to the material and social conditions of their lives. Bae *et al.* (2012) show that access to finance has positive effects in reducing income inequality and the poverty ratio.

Second, we find that urbanisation through implementing the LUC policy can significantly increase household wealth accumulation. Zhou et al. (2019) argue that land consolidation significantly promotes revitalisation in rural areas. Interestingly, we also find that urbanisation significantly increases household wealth accumulation. This finding is consistent with the argument that the increase in the urbanisation level significantly reduces income inequality (Ha et al., 2019) and the urban-rural income gap (Zhao & Liu, 2022). Thus, we argue that the capacity to achieve sustainable household income growth via LUC depends on how much the implementation of LUC stimulates sustainable urbanisation. Also, our findings highlight that the measure of household wealth accumulation is a factor to consider in understanding the role of LUC in stimulating urbanisation. We generally observe that urbanisation moderates the effect of integrating agricultural land into the LUC program to improve household wealth accumulation. This evidence indicates that integrating agricultural land into the LUC program promotes household wealth accumulation in the presence of urbanisation. While the literature has shown that land consolidation promotes rural revitalisation, creates job opportunities, and stimulates industrialisation (Zhou et al., 2019), our analysis shows that with improvement in urbanisation level, LUC could robustly contribute to sustainable household income growth. We argue that an ineffective urbanisation will likely make it challenging to achieve the LUC

policy's benefits in improving household wealth accumulation. Thus, promoting the role of LUC in improving household wealth may not thrive if there is no effective urbanisation linked with LUC policy. As far as our study reveals, it informs us that urbanisation plays a significant role in conditioning LUC to enhance household wealth accumulation.

Chapter Five: Concluding Remarks and Policy Implications

5.1 Concluding Remarks

In this study, we contribute to the literature by investigating the effect of integrating agricultural land into the LUC program on household wealth accumulation in Rwanda and urbanisation's role in such an effect. Notably, poverty and income inequality issues and consequential hunger and food insecurity problems are the global's current pressing issues, and global measures have been proposed to alleviate them to reduce global wealth inequalities and achieve global inclusive growth. The most recent proposed global measures are integrated into the United Nations Sustainable Development Goals (UN-SDGs). This study provides empirical evidence that can contribute to achieving Goals 1, 2, and 11, among others, which are no poverty, zero hunger, and sustainable cities and communities.

Despite the global push to alleviate poverty and hunger and promote rural revitalisation for sustainable cities and communities, wealth inequalities and the rural-urban wealth gap continue to expand. This study uses data from three surveys of Rwanda's 2015, 2018, and 2021 Comprehensive Food Security and Vulnerability Analysis (CFSVA) surveys to investigate the effect of agricultural land policy on household wealth accumulation. The results of this study show that Rwandan households that integrated their lands into the LUC program are more wealthy than their counterpart households that did not integrate their land into the LUC program. The study also demonstrated that integrating agricultural land in the LUC program significantly increases households' likelihood of shifting from lower wealth to higher wealth—from poorest to poor, poor to medium, medium to wealthy, and wealthy to wealthier. These results are robust when we control for covariates with the possibility of explaining the household's wealth accumulation status.

This study documents that wealth accumulation among households in Rwanda is not random but subject to the adoption of agricultural land policy reforms such as the analysed one, LUC policy, and other important factors we found to significantly stimulate household wealth (being male head of household, access to credit, age of the head of household, education level of the head of household, the number of persons in the household, and marital status of the household head). Thus, the study suggests that increasing the number of households integrating their agricultural lands in the LUC program is a valuable mechanism to improve wealth accumulation among households in Rwanda. Hence, for policymakers and development

practitioners to improve household wealth accumulation, a policy to promote land consolidation should be accompanied by urbanisation that considers the value of LUC.

5.2 Policy Implications

The study has enormous policy implications considering the Sustainable Development Goals and Rwanda's inclusive growth goals. Our study suggests that developing mechanisms, such as increased access to higher-value markets and subsidised agricultural credit, to incentivise households to integrate their agricultural land into the LUC should be integrated into formulating policies to improve household wealth accumulation. The evidence from this study shows that LUC is important in driving household wealth accumulation in Rwanda. We suggest that bridging the wealth gap among households requires policymakers and development practitioners to develop mechanisms to incentivise households to integrate their agricultural land into LUC. Our findings also show that improvement in household wealth accumulation can be achieved with urbanisation. In addition, urbanisation can support LUC in achieving further sustainable household wealth accumulation.

Although this study makes a substantial contribution to the literature, there is still an avenue for future research. First, while we considered the effect of LUC on household wealth accumulation at the micro level, future studies can focus on the macro level to examine how land consolidation can stimulate economic growth. Also, future studies can examine how a LUC policy that integrates an urbanisation mechanism affects household wealth accumulation and economic growth.

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