

**Essays on Democratization, Development, and Well-being in Myanmar**

By

**Aung Nay Win**

**Dissertation**

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

**DOCTOR OF PHILOSOPHY**

**IN PUBLIC POLICY**

**2020**

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Approval as of November, 2020

## **ABSTRACT**

### **Essays on Democratization, Development, and Well-being in Myanmar**

BY

**AUNG NAY WIN**

This dissertation studies the effect of government policies on development and well-being. We examine the policies such as the agricultural loan policy, an education for all policy. In addition, this study discovers the impact of democratization on household welfare and access to public goods.

Chapter one studies on democratization, ethnic fractionalization, and household welfare in Myanmar. We use the difference-in-differences method to study the impact of the policy. Results indicates that democratization bring tangle benefits to households' welfare and access to public goods. However, the results discover the effect of democratization is constrained by ethnic fractionalization. We find the more ethnically heterogeneous society has less benefits of democratization. All results are robust and highly significant to using alternative measure of fractionalization indexes: religious fractionalization index and polarization index.

Chapter two examine the long-term impact of “education for all” policy on child mortality and labor outcomes by using the fuzzy regression discontinuity (RDD) method. The results show that mother education reduces the child mortality significantly. We also find that the more educated mother care more on early childhood learning. We find more educated females participate more in the current labor force and the more educated person work less in the elementary sectors. The study also explores the possible channel of causality through which the mother education may have an effect on child mortality.

Chapter three studies the impact of agricultural loan on farm production and household consumption. The paper use difference-in-differences method to examine the impact of policy. The finding indicates that the policy has a positive effect on chemical fertilizer use, pesticides use, and labor use in rice cultivating households. Moreover, the result shows a significant increase of per acre yield in rice plot. The results indicate that the policy has a positive and significant effect on total households' consumption calories.

The studies discover that the government agricultural loan policy has a significantly benefits for rice cultivating households comparing to other crop cultivating households.

**Keywords:** Democratization; Ethnic fractionalization; Household welfare and access to public goods; Education for all policy; Child mortality and labor outcomes; Agricultural loan policy; Agricultural inputs use and production; Household consumption

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## ACKNOWLEDGEMENTS

I would like to thank all the people who contributed in some way during my academic life. This work would not have been possible without the financial support of the KOICA-MDI scholarship. First and foremost, I thank my supervisor, Professor Shun Wang, for accepting me into his group. Every result described in this dissertation was accomplished with the help and support of my supervisor. Additionally, I would like to thank my Dissertation Committee members; Professor Chrysostomos Tabakis, Professor Dongseok Kim, Professor Jinsoo Lee, and Professor Taejong Kim for their constructive and valuable comments in my work. Each of the members of my Dissertation Committee has provided me extensive personal and professional guidance.

I would like to thank my parents; whose love and guidance are with me in whatever I pursue. They are the ultimate role models. Most importantly, I wish to thank my loving and supportive wife, Moe Kalyar, and my wonderful child, Phoo Phoo, who provide unending inspiration.

Finally, I would like to acknowledge friends who supported me during my time here. First and foremost, I would like to thank Lwin Khing Nyunt (Khayu) and Aung Wint Thu, May Lwin Oo, Aung Min Tun for their support, especially, for data collecting process. I am lucky to have met Tial Len Par, Mya Yae Mon, Salai Thar Kei Myo, and Mark Bigool and other friends here, and I thank them for their friendship, love, and unyielding support. I also owe a debt of gratitude to all the members of KDI staffs for their constant helps through my academic life.

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## CHAPTER ONE

### **Democratization, Ethnic Fractionalization, and Household Welfare in Myanmar**

#### **1.1 Introduction**

Since the 20th century, democratization process has been increasing in the developing world. What make some countries persist and some countries failed to shape the effective policies? Does democratic system to improve social welfare and public goods? Barro (1996) point out that the moderate democracy is necessarily needed to stimulate the economic growth, although further extension of democracy reduces growth. Acemoglu et al. (2008) also highlight that democracy and change in income are highly correlated since past 500 years ago. The existing literature discussed the potential answers on above questions that successful implantation of democratization process depends on historical preconditions (Lipset, 1959 and Acemoglu et al., 2008). The provision of public goods is dependent upon the religious fractionalization after village level election (Martinez-Bravo et al., 2014). They found that village government spending on public goods provision is high where the place with lower fragmentation.

Many literatures point out that ethnic diversity and social problems are highly associated. An ethnically diverse society has heterogenous of cultural, norm, behavior, and attitudes. A high level of Ethnic cleavages prone poor public policy and leads to more political and economic challenges (Alesina & Ferrara, 2005). They discuss the potential advantages and disadvantage of diversity. On one hand, diversity can bring new innovation, experience, and skills and then increase the productivity. On the other hand, since different groups have different preference, this creates less general consensus on public projects and lead to lowering utility from public good consumption. If a society is different from both ethnic identity and culture, it would reflect more social antagonisms and the worse political economic outcomes (Desmet & Wacziarg, 2017). Our result shows the strongly positive correlation of ethnic fractionalization and social conflicts which is consistent with Desmet & Wacziarg. According to 2014 census, Myanmar also have over 135 ethnicity and they also have their own language, and own culture, this probably a reason of creating social conflicts.

In Myanmar, the first election was introduced on 7 November, 2010 after almost 50 years of the military regime. Prior to democratization, the development planning

including expenditure was practiced top-down system, which rarely considered the needs of grassroots. After the political change, government has introduced the top-down system, which reflects the real needs of the grassroots. The needs of grassroots people are taken into consideration when formulating development plans through the community leaders and representatives. Fujiwara (2015) shows that increasing the political participation of the poor has more benefits for them. However, the effect of election would differ among regions base on voter heterogeneity (Martinez-Bravo et al., 2014). Many empirical literatures point out that ethnically diverse societies have more civil conflicts, less cooperation and contribution in public projects and redistribution (Alesina and La Ferrara, 2005; Miguel and Gugerty, 2005; Desmet et al, 2012). On the other hand, different abilities, experience, flexibility, which is important for innovation and productivity can be found in ethnically diverse societies (Alesina et al, 1999; Alesina and La Ferrara, 2005; Egel, 2013).

Although previous researches have demonstrated that the impact of democratization and ethnic fractionalization on redistribution and public good provision separately, no research has been done the interaction affects these together in a newly democratic country. This paper tends to fill this gap by examining how introduction of democratic system interacts with ethnicity fractionalization impact on households' welfare and access to public goods. The present findings demonstrate that the democratization has a positive effect on households' welfare, but its impact is constrained by ethnic diversity. We identify that the interaction effect of democratization and ethnic fractionalization has a negative effect on both households' welfare and access to public goods. Our results contribute to an understanding of the positive effect of democratization, but the negative effect of interaction between democratization and ethnic diversity on households' welfare and access to public goods. We highlight the important of ethnic fractionalization in successful democratization and effective policy implementation.

The difference-in-differences approach is applied to investigate the impact of democratization on household welfare. The difference-in-differences estimate the policy impact by comparing the change in outcomes over time between treatment and control groups. It is one of the most popular methods in quasi-experimental research design and applied economics (Meyer 1995; Angrist and Krueger 2005; Bertrand,

Duflo, and Mullainathan 2004; Athey and Imbens 2006). It can eliminate any differences between treatment and control group that are constant over time. Since this is a whole political system change from military government to democratic government, there is no such policy that can impact on the outcomes of our interest. To investigate the impact of political change on household's consumption on food and non-food expenditure, and access to public goods, we hypothesize the effect of democratization improves household welfare and access to public goods, but the effect differs based on ethnic fractionalization across districts. We looked at the two main outcomes. First, we studied the effect of policy on households' consumption calories, food and non-food expenditures. Second, we analyzed the impact of policy on access to public goods.

We explore the possible mechanism of this policy impact on household's welfare. First, we identify the correlation between ethnic fractionalization and political participation. Second, we check the link between fractionalization and social conflicts. Then, we check the correlation between political participation and government revenues. Finally, we show the interplay between government revenues and infrastructure development. We also check the robustness of baseline results by eliminating some townships from sample where ethnic armed conflicts occurred five times a year and by excluding the top and bottom 5 % and 10 % from the sample. We use alternative measure of ethnic diversity which is called ethnic polarization index to check the robustness of our results. Moreover, we check whether our results are sensitive to using different fractionalization index, religious fractionalization index. All robustness check results confirm that our baseline estimates are robust, consistence and statistically significant. Moreover, we performed falsification test to provide the validity of our baseline estimates. We also explored the heterogeneous effect of the policy. The interaction effect between democratization and EFI index gives the policy impact. If fractionalization restricts on the benefits of democratization, the sign of interaction would be negative and vice-visa.

In order to analysis the impact of democratic system change, the Integrated Household Living Conditions (IHLCA) and Myanmar Poverty and Living Conditions (MPLCS) surveys are used in this paper. Although ethnic, religious, and linguistic fragmentation are widely used to calculate Ethnic Fractionalization Index (ELF) in

most political literature, we use ethnic identity to calculate ELF. A major argument of using fractionalization index based on language is that different ethnicity may use the same language. Therefore, this paper uses ethnicity to calculate the fractionalization index. Whether the effect of a new political system on household welfare is positive or negative in ethnically diverse societies is an empirical question. This paper shows that the interaction effect is negative. We also found that the negative effect of democratization on access to public goods in ethnically diverse societies. The finding is consistent with the existing literature and contributes new information in the literature.

The structure of the paper proceeds as following. We provide an introduction, a brief overview of the political background in 1.2, and literature review in section 1.3. Section 1.4 presents the methodology and data we apply in this study. In section 1.5, we describe the impacts of the policy on food consumption and non-food consumption, and access to public goods. Moreover, we provide accessing the identification strategy in section 1.6. Section 1.7 turns to explore the possible channel. We discuss the conclusion in section 1.8.

## **1.2 Political background in Myanmar**

Myanmar had been under long suppression of the military government for almost five decades. The parliamentary democracy system lasted only for 14 years from 1948 to 1962 after independence (January 4, 1948). Through the parliamentary democracy system, the Anti-Fascist People's Freedom League (AFPFL) was dominant in the political power and was the strongest political party (Devi, 2014). On 2 March 1962, the military seized the political power for almost 50 years under the dissemination of saving the country from disintegration. The military governed the country under the different name of regimes. The first military regime was the Revolutionary Council (RC) which was formed in 1962. The RC lasted 12 years from 1962-1974. After the RC periods, the military dictatorship, General Ne Win introduced the 1974 constitution and formed one party system under the Burma Socialist Program Party (BSPP). It lasted for 14 years from 1974-1988.

Due to economic crisis and political disaffection in 1988, the general strike emerged across the country; as a consequent, the One-Party System led by General Ne Win was collapsed. People asked for democracy during the general strike. However,

the protesters were brutally suppressed and the state power was seized by military again in August 1988 with the new name of State Law and Order Restoration Council (SLORC). Then the military announced to public that they will held a general election in 1990 and they will return to barracks. Although the election was held in 1990, the winner political party was not recognized and the electro result was ignored by military. Therefore, the State power was not transferred to winner party which was National League for Democracy (NLD) led by Aung Sun Su Kyi. Then, the military took power under the name of State Peace and Development Council led by Senior General Than Shwe, which took for 25 years until 2010. In 2008, May 10, the military junta hold a referendum for “2008 Constitution” despite the fact that over hundred thousand of people were died due to Nargis Cyclone in May 2, 2008.

After long dominance of the military government in economic and politic for almost 50 years from 1962-2010, the election was held as the first time in Myanmar on 7 November, 2010. Myanmar is a unitary constitutional presidential republic with a union system (UEC, 2014). So, parliamentary democracy system is practiced and the president is the head of State. The life of president is 5 years terms and he or she could serve at most two terms continuously. Myanmar has 330 constituencies and uses the First-Past-the-Post electoral system which is also called “winner-takes-all”. Under the new political system, the national level legislature and state and regional level legislature are separated. The Union legislature is shared among two levels of legislatures. The national level legislature is also separated by Amyotha Hluttaw (House of Nationalities) and Pyithu Hluttaw (House of Representatives).

There are 224 seats in total in the House of Nationalities. 168 out of 224 seats are elected and the remaining 56 seats (25%) are appointed by Commander-in-Chief. In House of Representatives, there are total 440 seats and 330 seats out of that are elected and the remaining 110 (25%) are also appointed by a military leader. At the Region and State legislature, two representatives are elected from each township, so there are 644 seats in total. Among 664 sets 75% of constituencies are elected by public and 25% are army representatives appointed by the chief of the military. Moreover, if the ethnic population is more than 0.1 percentage of country’s population, they have the right to get elected to 29 seats.

Unlike the U.S system where the president is directly elected by the publi, in Myanmar, the president is elected through the Union Parliament. The process is that public votes for representatives of House of Nationalities and House of Representatives.



The combination of the two houses called Union Parliament has a power to elect the president and vice president. The president could be either from representatives or non-representatives. The president has a power to form the government with the agreement of the Union Parliament. However, the state and regional parliament has no right to elect chief minister of state or region. The president also has power to elect not only the union government, but also state and regional government with the agreement of state and regional parliaments.

The 2008 constitution gives the extraordinary power to military because the Commander-in-Chief has a right to appoint not only 25 % of representatives in every parliaments but also, he has a power to appoint a vice president and three major ministers from Ministry of Defense, Ministry of Home-Affairs and Ministry Border Affairs. The officers of the General Administration Department under Ministry of Home Affair are officially appointed as townships and district administers. However, it was reorganized under the Ministry of Office of the Union Government in December, 2018.

### **1.3 Literature review**

Democratization improves social welfare through redistribution especially for welfare of poor people and it has proved to be an instrument for strengthening the public policies. Moreover, it limits the power of the elite, increase the right to vote for adults, and increase grassroots participation in public projects and decision-making process. Acemoglu & Robinson (2001) state that there is no special power for the elite in voting in a democracy system. Barro (1996) states that the moderate democracy is required for economic growth. Acemoglu et al. (2008) also highlight that democracy and change in income are strongly correlated. Income Equality and the public goods provision can be achieved through elections (Martinez-Bravo et al., 2012). Carbone, 2012 states that democratization brings a tangible improvement in social welfare. Fujiwara (2015) investigated the impact of introduction to electronic voting system Brazil. He found that the increase in right to vote of less educated people get the attention of the politicians and then increase the government spending on health care services. He found the increase in political participation of poor person, lead to increase their welfare. Moreover, participation of ethnic minority in government bodies and the policy making process can improve infrastructure (Burgess et al., 2015). Therefore, democracy can be

viewed as an important channel to bring the improvement of public goods and social welfare.

Although the democratization has a positive impact on public good and social welfare, its effect potentially varies across countries and regions base on cultural, religious, and ethnic diversity. Since the first seminar on ethnicity diversity on economic performance in 1997 by Easterly and Levine, a lot of studies have been done in that area. Even though the relationship between ethnic diversity and access to public goods is still controversial, it has become an interesting topic among political economists (Yogo, 2015). Literatures highlight the negative impact of diversity on economic performance, provision of public goods, education, and quality of infrastructure (Easterly and Levine, 1997; Miguel and Gugerty 2005; Jackson 2010; Gören, 2014; Awaworyi Churchill 2015). Moreover, the more ethnically diverse society leads to lower public good provision (Alesina, Baqir, and Easterly, 1999, 2000).

Since individual ethnic group has a different culture, believe, language, and preference, these lead to a different choice. Consequently, the utility from consumption of public goods is low in a heterogeneous society. Moreover, people are self-interest and then they think their own ethnic group's interest rather than others. Alesina & Ferrara (2005) state that different ethnic group potentially attributes positive utility of their own group members of well-being and negative utility of other members of the group. When an individual has a different preference, they tend to less participation on a public project and less spending on public goods in ethnically diverse cities. Alesina et al. (1999) show that public spending and the provision of public goods are negatively impacted by ethnic diversification. Annett (2001) point out that the government consumption is positively associated with ethnic fragmentation because the government spends more budget to reduce ethnic conflict and appease the opposite parties rather than spending on the provision of public goods.

Social conflict and civil war are mostly engaged in ethnically diverse societies rather homogeneous societies. Ethnic fragmentation is highly associated with conflict and civil war that have a negative impact on economic and social capital (Collier, 1998; Montalvo and Reynal-Querol 2005; Laurence, 201; Wegenast and Basedau, 2014). Alesina and La Ferrara (2002) show that income redistribution is impacted by the ethnic due to the fact that one ethnic group feels that redistribution would favor to other ethnic groups. They point out the reason why ethnically heterogeneous societies are worse in public policies is due to lower social capital which participation in social activities and

trust. They found that the more ethnically diverse cities less participate in social activities, less trust, and low city growth. The common conclusion is that the ethnic fractionalization has a negative effect on economic growth and social capital (Van Staveren and Pervaiz, 2017). If societies have different ethnic identity and cultural social conflicts more are engaged (Desmet & Wacziarg, 2017). We also find that the ethnic fractionalization positively correlates with social conflict.

Even though a lot of studies have been done on the relationship between ethnic fractionalization and spending on public goods, to our knowledge, no research has been done by the joint effect of democratization and ethnic diversity on household welfare in newly democratic society. Most literature is only focus on democracy and public good provision and ethnic fractionalization and economic growth and conflict separately. Only Padro et al. (2013) studied the relationship between social fragmentation, public goods and elections in China. They found that the impact of the village election on the local economy depends on the religious fractionalization. They found that the heterogeneous society has less provision of public goods compare to a homogenous society. However, these studies have only dealt with the situation in the provision of public goods, whereas our study focus on not only access to public goods but also household's food and non-food consumption. Moreover, no studies have been done the interaction effect of new democratization and ethnic diversity on household's welfare. Besides, most literature has highlighted on across countries analysis and mature democratic countries, while this study focus on the newly democratic society by using the nationally representative sample. Moreover, this paper uses ethno-linguistic fractionalization index, which is based on ethnic identity while other based on language and religion to calculate the fractionalization index. This study also uses polarization index and religious fractionalization index for additional robustness check. The results find in this paper is consistent with previous literature on public good provision and bring new information on the joint determination of democratization and ethnic diversity on household welfare in a newly democratic society.

## **1.4 Data and methodology**

### **1.4.1 Data**

The multiple surveys are used to study the impact of democratization on household welfare. The integrated household living conditions assessment (IHLCA) survey was conducted by United Nation Development Program (UNDP) in December 2009 and May 2010. It was a nationwide survey and covered sample of 18,660 households. The survey used a stratified sample design with Probability Proportionate to Estimated size of Replacement (PPES). Selected townships across in 62 districts were used as the strata in the first stage. Then, as the second stage, ward and village were selected from urban and rural within the selected townships.

The Myanmar Poverty and Living Conditions Survey (MPLCS) survey were conducted by the World Bank with a closer cooperation of Ministry of Planning and Finance in 2015. It is also a nationally representative survey and developed based on sampling framework of 2014 census. The survey used a stratified multi-stage sample design and stratified by region, urban, and rural areas with probability proportional to size (PPS) within each stratum. Both surveys asked a question on food household consumption. Based on food items we calculate household consumption kilogram of individual food and then we calculate the household consumption calories. The MPLCS survey, the subsample of enumeration area (EA) was selected from the master sample with equal probability within each region, urban, and rural stratum.

Both surveys include basic household's social economic characteristics such as housing, education, health, consumption expenditures, assets, labor and employment, business, finance and savings. Since in most welfare analysis mainly focusses on household expenditure, education, health, and housing, both surveys are appropriate to use in this analysis. Although the sample size for MPLCS survey is smaller than IHLCA, it also included almost all questions covered in IHLCA surveys.

Data for ethnic fractionalization were collected from the General Administration Department. Myanmar is comprised by 14 states and regions and one Union Territory, 330 townships and 74 districts. All the ethnic groups live across states and regions. Although there has been over 135 ethnicities, eight major ethnic groups are well-known. However, the composition of ethnicity across townships for 135 is not officially revealed. Though population census was conducted in 2014, the exact number of ethnic populations across townships was not officially revealed by the government

due to political sensitivity. Therefore, data for ethnicity composition across districts was obtained from the General Administrative Department, which compiles the social economic indicators from township level occasionally. The current ethnicity data is based on the forty majority of the ethnic groups. We use 2016-2017 ethnicity data. We assume that the composition of ethnicity across district is not changed much during short periods. According to 2014 census, the domestic migration is 19.3 percent for lifetime of individual. Therefore, we assume the migration has not significant impact on ethnic composition or ethnic diversity during studying periods. To calculate the ethnic fractionalization across the districts, the ethno-linguistic fractionalization index (ELF) which is proposed by Taylor and Hudson in 1972 is used in this study. Based on the township level population of individual ethnicity groups, the ELF index is computed for each district.

To examine the effect of democratization on household welfare we use household's consumption calories, food expenditures, and non-foods expenditure as the main outcomes. Moreover, for public goods information, we used school location, access to electricity, access to mobile phone and internet, and time to collect to drinking water. We also use voter share as a proxy for political participation, social conflicts, government revenue, road miles to check the possible channel. The data for summary statistic is presented in Table 1.1.

#### **1.4.2 Methodology**

From 1962-2010, Myanmar had been under the military regime for almost fifty years. In 2010, surprisingly, it has changed from a military government to a civilian government. The first election was held during fifty years (excluding 1990 election) and the first elected government came into power in 2010. This paper examines how this drastic political change impact on household's welfare and access to public goods. Many literatures show that democracy improves the public goods provision through the redistribution. The literature also shows that a country with the higher diversity of ethnicities could have a diverse effect on economic growth and social welfare. To our knowledge, only one literature shows the interaction effect of election and fractionalization on public good provision. No literature has focused on the interaction effect of newly democratic system and ethnic fractionalization index on household's consumption and expenditures.

Whether democracy brings the improvement of social welfare and how the ethnic diversification affects the social welfare in the newly democratic country is the central questions of this research. Many literatures focused on cross countries analysis of ethnic fractionalization and its impact on economic and social conflicts. Moreover, most researches focused on mature democracy countries, not on the newly democratic country. To our best knowledge, only Padro et al. (2013) studied the relationship between social fragmentation, public goods and elections in China. We see most studies mainly focused on public goods provision and not focused on household's welfare (consumption calories and food and non-food expenditures). Moreover, they mostly use ethno-linguistic and religious index; the weak point of ethno-linguistic index is that people from different ethnic identity could use the same language. To measure diversity index; religious, ethno-linguistic, and ethnic fractionalization are widely used in most literature. This paper used the ethnic fractionalization index which is more realistic measurement for ethnic diversity. Alesina et al. (2003) indicate that ELF is slightly better than polarization index in determining of policies and economic outcomes.

To measure the ethnic fractionalization, the linguistic fractionalization index (ELF) proposed by Taylor and Hudson in 1972 is used in this paper.

$$ELF = 1 - \sum_{i=1}^k p_i^2$$

Where  $k$  is the number of groups  $i$  and  $p_i$  their relative group sizes of individual ethnicity within the district. The value ranges from zero and one. The index indicates that the probability of two randomly selected individuals from the population come from different ethnic groups. We calculate the districts level ethnic fractionalization index. The higher value of the index implies the more heterogeneous ethnicity. The value one indicates totally heterogeneous and zero indicates the society has only one ethnic group, totally homogenous society.

This paper rest on the assumption that the benefits of democratization on household welfare (household consumption and food and non-food expenditures) and access to public goods would differ across districts due to ethnic diversity. This means that the effect of democratization is constrained by ethnic diversity. The difference-in-differences approach is used to analyze the effect of democratization on household's welfare and access to public goods. The idea of the identification strategy for this paper is based on the before and after democratization and ethnic diversity across regions.

The difference-in-differences estimate the policy impact by comparing the change in outcomes over time between treatment and control groups. It is one of the most popular methods in quasi-experimental research design and applied economics (Meyer 1995; Angrist and Krueger 2005; Bertrand, Duflo, and Mullainathan 2004; Athey and Imbens 2006). It can eliminate any differences between treatment and control group that are constant over time.

The interaction term democratization ( $post=1$ ) and ethnic fractionalization index (ELF) gives the impact of the policy. Since the democratization has a long-term impact on the economy, it is impossible to see the sharp increase in general economic condition. Therefore, in order to see the impact of political change on household's welfare, we use consumption calories and expenditures on food and non-foods, which can be changed within a certain period. Moreover, we use the access to public goods to see the effect of democratization. To obtain the impact of policy, the following estimation equation is established

$$Y_{ijt} = \beta_0 + \beta_1 Post + \beta_2 ELF_j + \beta_3 Post * ELF_j + \beta_4 C_{ijt} + \mathcal{R}_{i,s} + \varepsilon_{ijt} \quad (1)$$

Where  $i$ ,  $j$ , and  $t$  indicates household, district, and time respectively.  $Y$  is the outcome variable (food and non-food consumption, expenditure, and access to public goods).  $Post$  is the dummy variable and it equals to 1 for the year 2015 and zero otherwise.  $ELF_j$  is the ethnic fractionalization index in each district  $j$ . Its value is range from 0 to 1.  $C_{ijt}$  is the vector of other household and housing characteristics including household size, number of children in the household (age between 0-6), number of elder person (age 60+), household head education, age, gender, marital status, religious, mother tongue, and type of dwelling.  $\mathcal{R}_{i,s}$  is the household fixed effect and regional fixed effect.  $\varepsilon_{ijt}$  is the error term (the standard errors are corrected for autocorrelation by clustering at the district level). The interaction between  $post$  and the ethnic fractionalization across district ( $Post * ELF_j$ ) gives the impact of democracy on household welfare.

The difference in differences (DID) needs the parallel trend assumption which is in the absence of the policy of the increase in household welfare and access to public goods would not have a substantial difference across districts. To test the credibility of baseline estimates, the falsification test is conducted by using pseudo policy. Moreover, we also check our results are not driven by outlier and robust by excluding bottom and top 5% and 10% of the sample. Moreover, we restricted the sample by

excluding townships where the ethnic armed conflicts were engaged. We also explore the heterogeneous effect of policy on household's welfare. To do this, we follow the Fujuwara's (2015) paper where he examined the effect of an increase in political participation of poorer (less educated people) on their welfare after introduction of an electronic voting system. We also use the level of household head's education to see the differential effect of the policy change. This is another way (the triple difference in differences-DDD) to test the credibility of the common trend assumption and to eliminate the bias from the cofounder (Wing et al.,2018).

## **1.5 Results and discussion**

### **1.5.1 Household's total consumption calories and expenditure**

This section discusses the effect of democratization on household's welfare is discussed. We find that the differential impact of democratization on household's across districts is due to ethnic fractionalization. Although democratization has improved household's welfare and access to public goods, its effect is constrained by ethnic diversity. The society where the high ethnically diverse has a negative effect both on household's food consumption calories, food and non-food expenditures, and access to public goods compare to that of low diversified society after democratization. According to dietary guideline (2015-2020), the average required calories is from 1600 to 2400 per day for women and 2000 to 3000 per day for men.

The estimation result for the impact of democratization on total household's food consumption calories, and food and non-food expenditures were presented in Table 1.2. All food consumption and expenditure are by weekly basis. Colum (1) shows that household's consumption calories increased significantly by 109 % (69330 calories) per week after changing military government to a democracy government. The coefficient of ELF index is negative and significant at 10% level meaning that the consumption calories decrease on average by 38% in an ethnically diverse society. We find one percent increase in fractionalization index lead to 38 percentage decrease in household consumption calories per week. Our main interest is the interaction effect of democratization and ethnic fractionalization index. It is also negative and significant at 1% level. We found that the benefits of democratization for household are constrained by ethnic fragmentation. Therefore, ethnic fractionalization is a major



obstacle to improving household welfare in newly democratic country. The interaction effect on household's consumption calories decreased by 143 % on average per week in a more diverse society.

The estimation result of total household expenditure on food and non-food were presented in columns (2) and (3). The interaction effects of democratization and ethnic fractionalization were negative and statically significant at 1% level. Therefore, household's food and non-food consumption were decreased by almost 4 US \$ per week and 7.1 US \$ per week in ethnically diverse districts after the democratization. The coefficient of democratization (post=1) is significantly positive at 1% level for both food and non-food expenditure. The results showed that after democratization households' food and non-food expenditures increase by 0.82 US \$ and 1.034 US \$ per week. The negative coefficient of ethnic fractionalization showed that 1 unit increase in ethnic fractionalization index lead to decreasing the household food expenditure by 0.664 US \$ on average per week. Interestingly, there is a positive of ethnic fractionalization on non-food expenditure, but statistically insignificant. The household non-food expenditure increased by 0.2 US \$ per week in the areas where there is high ethnic diversity. This effect could be mainly due to increase in social competition among youth in diverse societies. The non-food items such as apparel, cosmetics, mobile phone, home equipment, and vehicles are commonly used among youth.

We also found that other household characteristics are also determined the household consumption calories and expenditures. We found consumption calories and expenditure increase along with the size of household. The results are significant at 1% level. To adjust the household weight, we also control the number of children (age 0-6) and the number of elder person (age 60+). The coefficient of the number of children is negative and significant, but the coefficient of the number of older persons is statistically insignificant. We also found that consumption calories decreased by 3.7 % in female headed households compare to male headed households, but the result is not significant. Moreover, there is no significant difference of food and non-food expenditure among female and male headed household. Figure 1.1 and 1.2 show the distribution of total consumption calories and expenditure by comparing before and after democratization.

We also control the square of ethnic fractionalization index to capture the nonlinear effect on outcomes. Interestingly, we find the coefficient is positive, but only households' food expenditure statistically significant at 1 % level. We find although

the fractionalization has negative impact on consumption calories and food and non-food expenditure, the square term of fractionalization has positive effect on outcomes. The positive effect of square of fractionalization index means that when society get more heterogeneous, they have more consumption calories and expenditures. This is probably due to the fact that when the society get more and more heterogeneous, they have variety of capacity, ability, and ideas, which all lead to more economic performance. Our estimation results show that democratization bring an improvement of household welfare, but the interaction effect is negative. Therefore, we could say that the benefits of political change are constrained by ethnic fractionalization. We find that the more heterogeneous society is the less benefits of democratization in Myanmar.

### **1.5.2 Household's consumption calories**

Results for household consumption calories by type of food groups were presented in Table 1.3. We found rice consumption calories increase by 51 % after democratization and the result is statistically significant at 1% level. Since Myanmar is an agricultural country, the rice is a major food for all household in their daily life. This mean that the poor family could more afford rice consumption after political change. According to 2010 poverty profile, although Myanmar reduced the poverty form 29.6 % in 2005 to 22.7 in 2010, the poverty is still high especially in rural area. The small improvement due to political change bring a lot of family out of poverty. Therefore, we see the positive effect of democratization on rice consumption.

Other food group such as meat and fish, fruit and vegetable and oil and facts have positive and statistically significant at 1 % level respectively. The result show that household more consume healthy food meat and fish, fruit and vegetable, and root and bean and less consumes on normal good. The root and bean have a negative effect of democratization. We could see that when household increases income, they partly substitute root and bean with other foods. Therefore, we find root and bean consumption is decreased after democratization. On the other hand, people consume more on meat and fish, fruit and vegetable, and oil and facts after political change. In all food groups, the coefficients of ethnic fractionalization are negative meaning that the heterogeneous group has less consumption on food calories compare to homogeneous society. We also find that household size and household's head education is also important for food consumption calories.

The interaction effect (Post\*ELF) is negative in all groups of food. Therefore, we could conclude that the effect of political change is limited by ethnic heterogeneity. We found that the positive effect of political change from the military government to a democracy government on household food consumption. All effect is economically and statistically significant. The estimates of the interaction effect on household's consumption calories are negative in all groups of food. All estimation results are highly significant. Based on empirical evidence, we can conclude that the welfare effect of democratization differs based on ethnic diversity across the districts.

### **1.5.3 Household's non-food expenditure**

The effect of democratization on household non-food expenditures is presented in Table 1.4. We use household's energy, apparels, drinking water, clothing, travelling and other expenditures to measure the non-food expenditures. Household's energy, apparels, and drinking water expenditure are one-month expenditure. Clothing, travelling and other expenditures are six months expenditures. Other expenditures include the services for telephone line and mobile phone, cable TV, newspapers, journal, magazines, books, cinema, video house, video tape, internet Wi-Fi access, garbage disposal services.

The results show that the post estimation effects have a positive and highly significant at 1 % level in all non-food expenditure. The average expenditure on energy increase by 4.95 US dollars per month after democratization. Energy source includes firewood, charcoal, kerosene, diesel, gas, public private electricity, candles, battery, and other energy source. After democratization, the number of electrifying households increased significantly. The democratic government has strived to achieve the ambitious target that electricity covers all households in 2030. According to national electrification plan, 50 % of household will access electricity in 2020 and 100 % by 2030. After democratization, due to increasing the number of households that access electricity, the household's energy consumption also increases year by year. Therefore, we find the household's energy expenditure increased after democratization.

Household average expenditures on personal apparels, and drinking water also increase by 3.4 and 1.4 US dollars in a month respectively after democratization. Both results are highly significant at 1 % level. Democracy bring tangible and intangible benefits. Tangible benefit is that democratic government consider on all citizens

especially for poor person by setting up more effective policies for improvement of physical infrastructures. Intangibles benefit is that democracy bring openness which turn into increasing knowledge of citizens. Under the military regime, access to mobile phone and internet was just for elite and rich society and most people were unable to access it due to higher cost. The cost of mobile sim-card was about Kyats 3 million to 5 million (5000 US \$). Under the democratic regime, the price of sim-card was sharply decreased to 1500 Kyats (1.5 US \$ in 2015) along with decentralization of telecommunication. Therefore, most people access to internet and access information about education, health, economics, and politics. People also get understand the importance of quality of drinking water in their daily life. Therefore, we find the expenditure on personal apparels and drinking water increase after democratization. We see that the benefits of democratization are obvious for households in Myanmar.

The coefficients for ethnic fractionalization index are positive and significant at 1 % level for clothing and travelling expenditure (cost did not include for education and health). The result shows that 1 % increase in ethnic fractionalization index leads to increase the clothing and travelling expenditure by 155.5 and 23.4 US dollars on average six months. This would be due to the social competition among youth in different tribes within the village. We found that if different ethnic groups live in a same village, they generally cooperate within the same religious and ethnic group. Moreover, they know about the behavior of other ethnic groups. This leads social competition among the young group and leads the expenditure on non-food consumption especially on travelling, and clothes and apparel. However, the square term of ethnic fractionalization is negative for clothing and travelling expenditure. We do not find any significant effect of ethnic fractionalization on household's expenditure of energy apparels, drinking water, other expenditure.

The coefficient for interaction term (Post\*ELF) is negative for household expenditure of energy, personal apparel, and travelling, and other expenditure. The results are not only economically meaningful but also statistically significant at 1 % level respectively. The result shows that household average energy expenditure decreased by 40.8 US dollars per month. The average expenditure for travelling cost also declined by 118 US dollar, on average, in six months. Similarly, expenditure on drinking water decreased by 29.64 US dollars on average per month. We also find that the interaction effect is negative for other household expenditure which include the services for telephone line and mobile phone, cable TV, newspapers, journal,

magazines, books, cinema, video house, video tape, internet Wi-Fi access, garbage disposal services. Although we find the positive interaction effect on apparels and clothing, the results are not statistically significant. Therefore, we conclude that democratization has a positive effect on welfare, but the interaction effect has a negative effect on household's non-food expenditures. We point out that the benefits of democratization on household's welfare decrease for a society whether the ethnic fractionalization is high.

Interestingly, expenditure on home equipment increases in household that household head's education with primary and below compare to that of with secondary education and post-secondary education after democratization. This shows political participation of poor (less educated people), increase their welfare. However, expenditure on energy, clothes and apparel, and travelling increase in household head with secondary education and post-secondary education compare to household head with primary and below. We also found that expenditure on energy and home equipment decrease in female headed household, but clothes and apparel and travelling expenditure significantly increase compare to male headed household. We could see female headed household spend more on clothes and apparel and travelling than male headed household. Moreover, we find that the household's expenditure increases with the size of household.

#### **1.5.4 Access to public goods**

Under the military government, all revenue control by the union government. The regional government has their own revenue to implement infrastructure projects, but in case if they are unable to implement all necessary projects, they ask the union government to finance for the projects partially. Similarly, when the local government could not fully finance for a project, the local community have to contribute to the project partially. The regional government invests infrastructural project more and more especially school, health center, and roads after democratization. The regional government transfers the funds for budgets to related district administrators to manage the projects. In Myanmar, every district has district level development committees comprised of local community leaders, representatives, administrators, and other government agencies. They cooperate and formulate district level development plans

and implement the projects according to the plans. Under the military regime, Myanmar practiced the top-down system and then it has changed to bottom-up system under the democratic regime. Therefore, all development plans and projects were guided by union level and rarely to reflect to the need of grass-roots under the military government.

In Table 1.5 of column (1) through (4) to show the regression of the democratization on access to public goods. We use access to school, electricity, phone and internet, and drinking water to measure the access to public goods. All variables are economically and statistically significant at 1% level. Access to school is a dummy variable where it is equal to one if the school is located within the same village and zero otherwise. We found that the probability of access to school increases by 0.227 or 22.7 percentage point after democratization. Prior to the democratization, the government expenditure on education is very low and it was under 1 % of national GDP for long time. Under the democracy government, the government expenditure on education has increased yearly and it was 2.16 in 2017. Moreover, government has endeavored to implement the universal education system up to middle and high school. Therefore, we found that access to school increased after democratization.

Similarly, the probability of access to electricity also increased by 0.106. Since democratization, the government has set up ambitious target and formulated the energy master plan (2014-2035) to increase the number of electrified household and to improve renewable energy. According to 2014 census, Myanmar has 10.887 million households among them out of 2.1 million households have been excess electricity supply and it has reached 5.448 million (50.09%) in 2019. In December 2019, the government officially announced that more than 50 % of households have been access to electricity supply from government grid. Therefore, we found that the number of electrifying households significantly increased after democratization. We see that the democratic system has more benefits for household compare the military government system.

The access to phone and internet has a significant improvement after democratization. We found a positive and significant effect of political change on access to phone and internet. The probability of access to phone and internet increased by 0.785. The result is statistically significant at 1 % level. Prior to democratization, phone and internet are not a public goods. It was a luxury goods and only rich family could afford it. The cost of a mobile SIM card was considerably high and it was range from 5,000 to 2677 US\$ in until end of 2010. Therefore, poor and middle-income households were unable to access phone and internet. In 2012, the civilian government

liberalized the telecommunication sector, but the prices were 500 dollars and it was still high for poor families. Then, the price was gradually declined to affordable price for all family (price of a sim-card is 1500 Kyats equivalent to 1 US \$ in term of 2018 exchange rates). As a new market for mobile operators and the liberalization of the telecommunication sector, the mobile penetration rate was significant increased to 124 % with more than 67 million connections in Myanmar. Therefore, we find that access to phone and internet significant increase after democratization.

The negative coefficient of the post on access to drinking water show that household reduces the time to collect drinking water decreased after democratization. We found that household's time to get drinking water decrease by 1 hour and 38 minutes on average after the political change. Since 2012, regional government and union government have provided drinking water to townships where the drinking water is scarce especially in the summer season. Moreover, the regional government implement lake, well, and exploring underground water for areas where the drinking water is scare. In order to effectively implement for rural infrastructural projects, the Department of Rural Development was also established in July 2013. The department focusses mainly on development of rural electrification, drinking water and infrastructure by cooperating with local communities. Therefore, we found a significant effect of democratization on access to drinking water. The effect is large in magnitude and statistically significant at 1% level.

Our main interests of outcomes are the interaction effect of democratization and ethnic fractionalization. The regression results show that the all coefficient is negative except access to drinking water which is measured by time to collect drinking water. All outcomes are statistically significant and large in magnitude. The democratization effect of household's access to school decreased by 27.1 % on average in an ethnically diverse society. This is probably due to less cooperation of households in public project in a diverse society. In Myanmar, although the government has highlighted to improve education system and endeavored for all school age children to access to school, due to limited access to school teachers and schools in some regions, the villagers still have to contribute partly to build school and to hire teachers. In homogenous society, we found that this kind of public project could easily implement, while in the heterogeneous society it is hard to cooperate and negotiate to implement public projects. Therefore, after democratization, we found a negative effect of ethnic fractionalization on access to school in ethnically diverse society.

In column (2), the interaction effect is negative for access to electricity. Even though the effect of democratization on access to electricity is positive, we found the negative effect of the interaction term on access to electricity. We found access to electricity decreased by 3.384 %. Therefore, the result shows that society with high diversity has less access to electricity compare to society with low diversity. In order to get electricity supply from government grid, the villages have to apply to Ministry of Electricity and Energy. Most village has to establish the Village Electricity Committees (VEC) before applying to the ministry. Since the government is unable to support all cost for installation of the electricity grid and transformer, the villagers have to contribute most of the expenditure. In this regard, the VEC plays a vital role to negotiate the contribution rate for each household for village electrification project. We found that in an ethnically diverse society, to establish VEC and to implement the village electrification is not so much easy compare to less diverse society. Therefore, we found that the negative effect of the interaction term on access to electricity in fictionalized society.

In column 3 and 4, the sign of the interaction term for access to phone and internet is negative while the sign of the interaction is positive for access to drinking water. Both coefficients are significant at 1 % and 10 % level respectively. We found that household's access to phone and internet decreased by 4.554 %. Time to collect water increased by 0.799 %. This is also the same reason for village electrification project and school project. The government encourage every village to have their own well or lake for cooking and drinking. However, government could not fund fully, so the community have to contribute to complement well or lake for water. In more ethnically heterogeneous communities less contribute to common projects.

We conclude that democratization brings the tangible benefits for households welfare and access to public goods. However, the effect of democratization is constrained by ethnic fragmentation meaning that the benefit of democratization decrease in a society where the ethnic fractionalization is high. Our results are consistent with the finding of Alesina et al. (1999); Easterly and Levine, 1997; Miguel and Gugerty 2005; Jackson 2010; Gören; Padro et al. (2013); 2014; and Awaworyi Churchill, 2015. Ethnic diversity could potentially harm provision of public goods because its negative effect both on school funding and quality of school facilities (Edward Miguel and Mary Gugerty, 2004). The more ethnically diverse societies probably face more difficulties in setting common policy due to their diverse



preference. The increase in ethnic diversity lead to less contribute to local community (Cagla Okten and Una Okonkwo-Osili, 2004 and Adi Brender, 2005). Since Myanmar has different ethnicities and different culture and languages it leads more difficult to negotiate to set up common preference for community's projects. Alesina and La Ferrara (2002) show that the more ethnically diverse cities less participate in social activities, less trust, and low city growth. Therefore, our findings point out that fractionalization has negative impact on welfare and access to public goods regardless of political system.

## **1.6 Assessing the identification strategy**

### **1.6.1 Robustness check by restricting sample**

We ask the question whether our results are robust to restricting the sample? Whether the results are robust to the elimination of townships that are considered as the conflict areas? To answer these questions, we check our results are not driven by outliers and robust by excluding top and bottom (5 % and 10 %) from the sample. Table 1.6 of panel A shows the estimation results of household's food consumption calories, food and non-food expenditures by excluding the top and bottom 5 % of the sample to eliminate the outlier effect. Panel B shows the outcomes after removing top and bottom 10 % of the sample. In both cases, our results are robust, consistent, and statistically significant.

We also restricted the sample by excluding 5 districts from sample. In the districts, some townships in Shan, Kachin, and Kayar States were engaged in ethnic armed conflicts with government military. We drop the 5 districts from the sample where the armed conflicts were engaged three years continuously and at least five times a year. The data for armed conflict is obtained from Myanmar Information Management Unit (MIMU). We find a robust, consistence, and statistically significant results even after eliminating some districts from the sample. The estimation results are presented in Panel C of Table 1.6.

### **1.6.2 Robustness check using polarization index**

The previous section has provided the robustness check for that our results are not driven by outliers by excluding bottom and top 5 % and 10 % from the sample.

Moreover, we have shown that baseline estimates are robust to eliminating of conflict townships from the sample. This section we explore that our baseline estimates are robust to changing the measurement of the ethnic fractionalization index. One major concern is that ethnic conflict is less in either highly homogeneous and highly heterogeneous societies (Donald, 1985). He discussed in his seminal on the relationship between ethnic groups in conflict. If this is the case, the impact of democratization on household welfare would change when we use polarization index and the polarization should capture the likelihood of the welfare change among societies. Moreover, many scholars have pointed out the role of ethnic diversity in explanation of economic growth, government's efficiency, and investment (Montalvo and Reynal-Querol, 2005). The poor economic performance in Africa is partially due to very high level of ethnic societies Easterly and Levine (1997). Their hypothetical assumptions are based on ethnic polarization, not on the ethnic fractionalization. The index of fractionalization index (EFI) is at odds with the basic explanations and, therefore, cannot capture the relevant dimensions of ethnic divisions.

Therefore, the projective of this section to check the robustness of our baseline estimates by using different ethnic diversity index so called ethnic polarization index.

To check the robustness of baseline results, we use alternative measure of ethnic diversity index which is called ethnic polarization index. To calculate the ethnic polarization index, we follow Reynal- Querol's (2002):

$$RQ = 1 - \sum_{i=1}^N \left( \frac{1/2 - \pi_i}{1/2} \right)^2 \pi_i$$

The idea of this index is that how far the distribution of the ethnic groups is from the distribution of a bipolar  $(1/2, 0, 0, \dots, 0, 1/2)$ . An individual group belongs to the group if RQ index is zero or individual does not belong to the group if QR is zero. The interaction effect of democratization and ethnic polarization is very similar to our baseline estimates. All results are highly statistically significant, consistent and robust to our baseline results. The interaction effect is statistically significant and economically meaningful as well. We provide that even though we use the alternative measure of ethnic diversity index, polarization index, the results are very similar to our baseline estimates. The estimation results for total household consumption calories, expenditure, and access to public good are presented in Table 1.7 and Table 1.8 of panel

A. We find that all results are robust, consistent, and statistically significant after changing the different measurement of ethnic fractionalization index.

### **1.6.3 Robustness check using religious fractionalization index**

We check whether our baseline results are sensitive to changing the difference measurement of fractionalization index. We use the religious to measure the ethnic fractionalization index. We calculate the religious fractionalization index based on Taylor and Hudson in 1972. The religious data were collected from the book of regional indicators published by Ministry of President Office in Myanmar. Padró i Miquel et. al. (2013) study the impact of introduction to village level election on public good provision in China by using religious fractionalization index as a proxy for voter heterogeneity. They found the negative effect of interaction term on public good provision. We also use religious fractionalization index to check the robustness of our results. We found the interaction effect is negative. The results are robust, consistent and statistically significant. The interaction effect of using religious fractionalization index is slightly bigger than that of using ethnic fractionalization index. All estimation results are reported in Table 1.7 and Table 1.8 of Panel B.

### **1.6.4 Falsification test**

The difference in differences (DID) method is one of the most popular methods in quasi-experimental research design to analyze the impact of policy change on outcomes of interest by removing the effects of place and time. However, the difference in differences (DID) needs the parallel trend assumption which is in the absence of policy intervention the treatment and control groups would follow the same time trend. Therefore, in the absence of the policy for the improvement in household welfare would have not a significant difference across districts. Although this assumption is difficult to test, one way to check the validity of this assumption by using pseudo policy change. Since we have data for two pre-intervention years and one post year, we can check the validity of our baseline estimates.

We check the validity of our baseline estimates, by using pseudo policy change. We use the year 2010 as the pseudo policy change. The IHLCA was conducted two rounds in 2009 and 2010. The election was held on 7 November 2010. Our baseline

survey (IHLCA) was conducted in May 2010 before policy intervention. Therefore, we used the year 2009 as based year and the year 2010 as the post year. If the difference in trend between treatment and control groups is due to preexisting characteristic that change over time, the coefficient of interaction term from pseudo regression would be statistically significant. If this is the case, our baseline estimation results would be biased. We found that there is no evidence of preexisting difference in outcomes between the two groups. We have a confidence that the parallel trend assumption is hold and our baseline estimation results are consistent. The result for falsification test is presented in Table 1.9.

#### 1.6.4 Heterogeneous analysis

To examine the differential effects of democratization on household food consumption and food and non-food expenditure, we perform extra experiments. To do this, we follow the Fujuwara (2015) paper in which he examined the increase in the political participation of less educated people leads increase in welfare of the poor person after introduction of an electronic voting system. We also use the level of education as an extra variation. We check the heterogeneous effect of democratization on household's welfare based on different level of household head's education. The interaction effect of Democratization, ELF Index, and Education level is our main of interest. To perform this test, we use triple DID. It also ensures the validity of our baseline estimates. Berck and Villas-Boas (2016) suggest that when the outcome of the variable is determined by different groups of variables such as time, place, and other variables, the triple DID can be used. It can also reduce the bias and give more accurate estimation of policy impact on the outcome of interest.

To estimate the impact of democratization on household's welfare, the following equation is applied:

$$\begin{aligned}
Y_{ijt} = & \beta_0 + \beta_1 Post + \beta_2 ELF_j + \beta_3 Secondary Educ + \beta_4 postSecondary Educ + \\
& \beta_5 Post * ELF_j + \beta_6 Post * Secondary Educ_{ijt} + \beta_7 Post * \\
& postSecondary Educ_{ijt} + \beta_8 ELF_j * Secondary Educ_{ijt} + \beta_9 ELF_j * \\
& postSecondary Educ_{ijt} + \beta_{10} Post * ELF_j * Secondary Educ_{ijt} + \beta_{11} Post * \\
& ELF_j * postSecondary Educ + \beta_{12} C_{ijt} + \mathcal{R}_{i,r} + \mathcal{E}_{ijt} \quad (2)
\end{aligned}$$

Where  $i$ ,  $j$ , and  $t$  indicates household, district, and time respectively.  $Y$  is the outcome variable (consumption calories, food and non-food expenditures).  $Post$  is the dummy variable and equal to 1 for the year 2015 and otherwise zero.  $ELF_j$  is the ethnic fractionalization in each district  $j$  at time  $t$  and its value is range from 0 to 1. Education levels are primary and below, secondary and post-secondary.  $C_{ijt}$  is the vector of other household and housing characteristics including household size, number of children in the household (age between 0-6), number of elder person (age 60+), age, gender, marital status, religious, mother tongue, and type of dwelling.  $\mathcal{R}_{i,r}$  is the regional fixed effect.  $\varepsilon_{ijt}$  is the error term (the standard errors are corrected for autocorrelation by clustering at the district level).

Table 1.10 reports the estimation result of equation 2. The coefficient of the triple interaction term ( $Post * ELF_j * Secondary\ Education$ ) and ( $Post * ELF_j * Post\ secondary\ Education$ ) shows the impact of democratization on household's consumption calories, food expenditures and non-food expenditure per week. The interaction effect of  $Post * ELF_j$  is very similar with our baseline estimates in term of magnitude and significant. While not all results were same in magnitude with our baseline model (DID), the results are robust, consistent, and statistically significant. This confirms the validity of our baseline estimates. For the education level the based group is household head education with primary and below. The coefficient of triple interaction term ( $Post * ELF_j * Secondary\ Education$ ) shows a negative sign meaning that the democratization has more benefits for less educated people in ethnically diverse society compare to more educated person. The result showed that the democratization lead to an increase in welfare of families in less heterogeneous societies, but with a greater increase for the poor household (Household head with less education) compare rich family (household head with more education).

## 1.7 Channel

In this section we explore the specific channel why the benefits of democratization on household's welfare and access to public goods are constrained by ethnic fractionalization. Our assumption rests on three premises. First, ethnic fractionalization lead to less political participation and more social conflicts. Second, less political participation and social conflicts lead to less contribution to government revenue. Third,

consequently, it leads to less investment in infrastructure development. Finally, it impacts on household welfare. Infrastructure development play one of the important roles for development of economic and well-being. The increase in access to infrastructure significantly contribute to household welfare in developing countries (Mensah et. al., 2011 and 2014). In this section, we show the relationship between these variables.

### **1.7.1 Ethnic feralization, political participation and conflict**

We examine the relation between ethnic fractionalization and political participation. Since Myanmar is comprised by 330 administrative townships, the constituencies are based on 330 townships. Total seat is 224 in the House of Nationalities and 330 seats in House of Representatives. Election has a five years terms. President can serve at most twice continuously. In Myanmar, every citizen who age is 18 and above by the time of election commences has a right to vote. We use the voting share as a proxy for political participation. The data for political is obtained from Myanmar Union Election Commission. Moreover, we analyze whether the ethnic fractionalization is associated with social conflict (peaceful protest, armed conflict). The conflict data are collected from Myanmar Information Management Unit (MIMU).

Table 1.11 of columns 1 and 2 shows the relationship between ethnic fractionalization and political participation. We found a strong and negative relationship between ELF and voting share in both election terms (2010 and 2015 election). Results are statistically significant at 5 % level. One percentage increase in ethnic fractionalization is associated with 3.94 % and 4.09 % decrease in voting share in 2010 and 2015 elections respectively. This is probably due to less interest in politics due to long suppression of military government or due to less trust in political parties. Moreover, most people residing in the conflict area are poor and less educated and most of them have less knowledge the voting process (how to check voter list, how to claim if they are not in the voter list) which all also lead less political participation. Moreover, they may have the pressure from ethnic arm groups to disclose their preferences on politic and political parties. In some townships especially in the conflict areas, the political parties have a lot of limitation regarding with electioneering during campaign periods.

Other reason is that in 2010 election, there were 40 parties in total, but only 37 parties participated in the election. The major political party, National League for

Democracy (NLD) led by Aung Sun Su Kyi (she was under house arrest) did not participate in the election due to restriction by election law and boycott to 2008 constitution. Therefore, only Union Solidarity and Development Party (USDP) and other minority parties participated in the elections. Therefore, the voters did not have more choice to vote and this led to less political participation. Moreover, most citizens including ethnic minority are willing to amend the 2008 constitution, which give extraordinary power to the military. The election held under the 2008 constitution made people less willing to participate in the election. In July 2020, some people who dislike the 2008 constitution slammed “No Vote” campaign for the election, which will be held on November 8, 2020. Furthermore, since 2010 election is the first election during 50 years, the voter education was very low and the technology was also very limited for voter education to reach across country.

We also find that social conflict (including armed conflicts, peaceful protests, and violent protests) is positively and strongly associated with ethnic fractionalization. The result shows that the townships where there is ethnically diverse lead to more social conflicts. One percent increase in ethnic fractionalization is associated with 0.758 % increase in social conflicts. Our finding is consistent with the literature (Alesina et al., 1993; Miguel and Gugerty, 2005; Schneider and Wiesehomeier, 2008; Bleaney and Dimico, 2011; Taydas and Peksen, 2012). According to Desmet & Wacziarg (2017), the social conflicts and economic outcomes are worse if a society is different in both ethnic identity and culture. Since Myanmar has many different ethnic identities and cultural, we found the strong and positive association of ethnic fractionalization and social conflicts. The estimation results are presented in Table 1.11. Figure 1.1 shows the relationship between ethnic fractionalization and political participation. The figure show that the negative relationship of fractionalization and political participation meaning the more ethnic fractionalization is associated with less political participation.

### **1.7.2 Political participation and government revenue**

As an important point, we explore the link between political participation and government revenue. We find a positive correlation between political participation and government tax revenue. One percentage increase in voter share leads to 0.05 % (Kyat Million) increase in government revenue. To our best knowledge, social contribution including government tax has significantly increased under a democratic regime. This is probably due to increasing trust in government and political system. The transparency

in tax revenue and budget allocation has sharply increased under the democratic government. Before democratization, the public have no right to know government revenue and expenditure. Under democracy system, the government has to propose the estimated budget revenue and expenditure to parliament annually. Then, the union parliament discusses the government proposal related to budget allocation and then approve it. After this process, the president assigns signature and issues as a planning law. This budget process leads to increasing the transparency of government budgeting. Therefore, increasing political participation can be translated as trust in political and government. Therefore, we find the positive association of political participation and government revenue. The heterogeneous society less response to the 2000 census form which reflect to as a local public goods provision because the budget allocation of federal government depends on its response rate (Jacob Vigdor, 2004). Therefore, our finding reflects trust in government, representatives, and political system. Figure 1.2 shows government tax revenue before and after democratization. The estimation result is presented in Table 1.12.

### **1.7.3 Government revenue and infrastructural development**

We also examine the relationship between government revenue and infrastructure development. We found that total road mile highly associates with government revenue. The result shows that one percentage increase in government average revenue leads the increase in total road miles by 0.025 % miles. In Myanmar, infrastructure is a key constraint to economic development. Therefore, the government (Union, and state and regional government) sees the infrastructure development as a top priority. Therefore, we found the states and regions where the amount of government revenue is largely increasing the total road miles. The regression result is shown in Table 1.13.

## **1.8 Conclusion**

A lot of researches have been conducted to explore the impact of democratic on the provision of public good. Most literature examines the effect of democracy on redistribution and the effect of ethnic fractionalization on public good provision and economic performance separately, yet very little focus on these two effects together. This paper brings them altogether to see the interaction effect of democratization and ethnic fractionalization on household's welfare and access to public goods. To our



knowledge, no literature has discussed the effect of democratization on household welfare (household's food and non-food consumption) in newly democratic society. They mostly focused on government expenditure in mature democratic countries. This paper fills in this gap by examining how introduction of democratic system interacting with ethnic fractionalization impact on households' welfare and access to public goods.

To examine the impact of democratization on household's welfare, we use household food consumption calories, food expenditure, non-food expenditure, and access to public goods as the main outcomes. We hypothesize that the effect of democratization on household welfare and access to public goods is constrained by ethnic fractionalizations. We find that more ethnically diverse society has less benefits of democratization. Moreover, we find that democratization has a positive impact on both household's consumption and expenditures. Access to public goods is significantly improved after democratization, but ethnic diversity reduces the access to public goods.

We conduct various kind of robustness checks, including restricting top and bottom 5 % and 10 % of the sample, and eliminating some townships from the sample as these townships are supposed to highly armed conflictive area. All estimation results are robust to our baseline estimates. Moreover, we use the alternative measure of ethnic diversity index, polarization index. We also check whether our results are sensitive to an alternative fractionalization index, religious fractionalization index. All robustness checks give consistent results. We then perform falsification test to check the validity of our baseline estimates.

We also show a possible channel that ethnic fractionalization leads to less political participation. The result shows that there is a strong correlation between ethnic fractionalization and social conflicts. We also find positive association of political participation and government revenue. The regression result shows that the improvement of infrastructure (total road miles) is positively related with the revenue of state and regional governments.

This paper has five main important points. First, democratization improves households' welfare. Second, the benefits of democratization are constrained by ethnic fractionalization. Third, ethnic fractionalization has a strong negative correlation with political participation and a strong positive correlation with social conflicts. Fourth, we find a strong positive relationship between political participation and government revenue after controlling for regional characteristics. Finally, the result shows that the

increase in government revenue leads to an increase in the infrastructure development, and then an increase in household welfare. In summary, all the results confirm our hypothesis that democratization has a positive effect on household's welfare and access to public goods, but the interaction effect of democratization and ethnic fractionalization negatively affects household's welfare and access to public goods.

The findings reported here are important for policy making because we provide sound evidence that democratization improves both access to public goods and households' welfare. Increasing political participation of grassroots increase their welfare. It can also enhance public contribution to tax revenue.

Although Myanmar is viewed as a democratic country, it is still at the beginning of the democratization process. Moreover, the role of the military in both politics and economics is still extensive. Although the military involvement in political affairs has no significant impact on the decision for implementation of public projects by government, the military influence on economy and politics leads to a highly debate among political parties and ethnic minorities. Therefore, less political participation in heterogeneous society is probably a major reason of less trust in current democratic system. In order to improve the political participation, Myanmar should strive the further extension of democratic rights to every citizen, without discriminations. The increase in the ethnic rights and minority rights shall contribute to successful democratization process.

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## Appendix A

**Table 1.1 Descriptive statistics**

Variable	Obs	Mean	Std.Dev.	Min	Max
Post	40710	.087	.281	0	1
ELF	40710	.27	.251	0	.812
Religious ELF	40230	.17	.146	.002	.6
Polarization Index	40710	.393	.298	.001	.981
<b>Panel A: Household Head Characteristics</b>					
Primary and Below	34145	.559	.497	0	1
Secondary Education	34145	.374	.48	0	1
Post-Secondary Education	34145	.067	.25	0	1
Type of Residence	40710	.699	.46	0	1
gender	40709	.792	.406	0	1
Age	40709	53.21	13.72	16	100
Single	40709	.04	.203	0	1
Married	40709	.74	.44	0	1
Widowed	40709	.21	.40	0	1
Divorced	40709	.01	.08	0	1
Separated	40709	.01	.08	0	1
Household size	40709	5.05	2.23	1	24
# of Children (0-6)	40709	.49	.76	0	6
# of Elder Person (60+)	40709	.46	.69	0	6
Religious	40709	1.40	1.15	1	7
Mother Tongue	40709	6.71	3.41	1	13
<b>Panel B: Housing Characteristics</b>					
Condominium/Apartment/Flat	40702	.015	.12	0	1
Brick house	40702	.09	.29	0	1
Semi-pacca house	40702	.08	.27	0	1
Wooden house	40702	.53	.50	0	1
Hut with post life 2-3 year	40702	.18	.39	0	1
Hut with post life 1 year	40702	.02	.14	0	1
Other	40702	.08	.27	0	1
<b>Panel C: Access to Public Goods</b>					
School within village	22121	.33	.47	0	1
HH access electricity	22121	.47	.50	0	1
HH access phone and internet	40709	.11	.31	0	1
Time to collect drinking water (hours)	22121	.62	.75	0	16.65
<b>Panel D: Food and Non-Food Expenditure (1US\$=640.65 Kyats)</b>					
Food Expenditure (per month)	40710	26.83	21.98	0	1672.48
Non-Food Expenditure (per month)	40710	45.01	112.56	0	10996.6
Energy Expenditure (per month)	40710	11.48	47.98	0	8037.85
Apparel Expenditure (per month)	40710	8.50	8.25	0	406.306
Water Expenditure (per month)	40710	1.24	4.73	0	196.675
Clothing Expenditure (six months)	40710	78.45	452.86	0	53204.6
Home-equipment Expenditure (six	40710	8.52	52.06	0	4682.7

months)					
Other Non-Food Expenditure (six months)	40710	15.20	210.8626	0	39062.4
Travelling Expenditure (six months)	40710	10.80	144.355	0	17950.5
<b>Panel E: Log Food Consumption Calories Per Week</b>					
Total Consumption	40710	10.32	1.008	0	17.583
Rice	40710	9.727	3.225	0	17.583
Root and Bean	40710	9.415	1.293	0	14.2
Meat and Fish	40710	8.415	1.025	0	11.397
Fruit and Vegetable	40710	7.966	.919	0	11.312
Oil and Fats	40710	8.621	1.324	0	12.796

Note: The official exchange rate (LCU per US\$, period average) for 2012 was officially announced by Central Bank of Myanmar (floating exchange rate started on July 2012, 1US\$=878 Kyats in July). Average official exchange was 640.65 Kyats in 1US\$ in 2012.

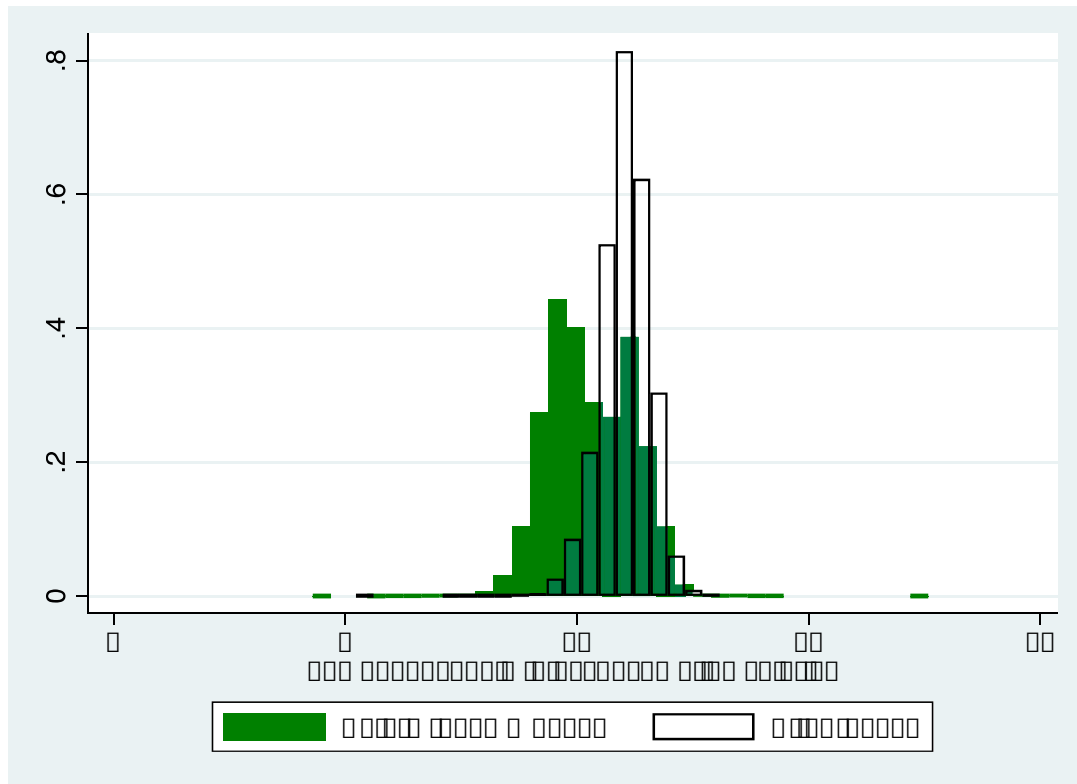


**Table 1.2 Household's total consumption calories and expenditure (per week)**

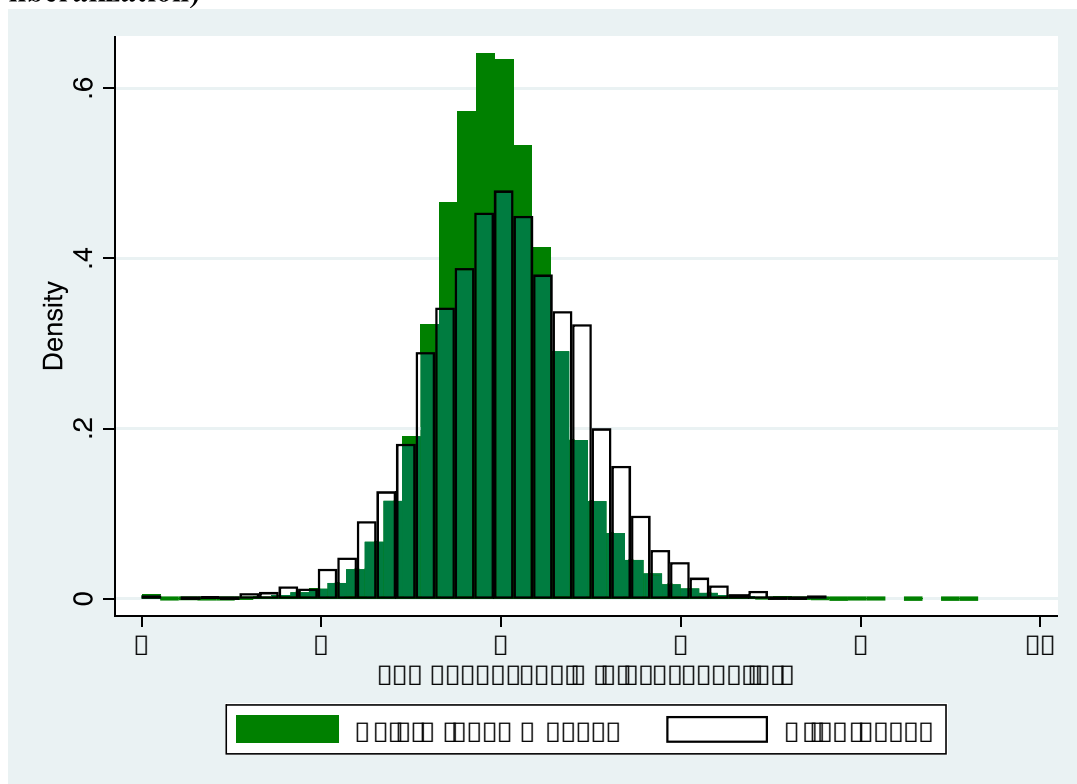
VARIABLES	(1)	(2)	(3)
	Log Calories	Expenditure (1US\$=640.65 Kyats)	
	Consumption	Food	Non-Food
Post (After Democratization)	1.098*** (0.0290)	0.820*** (0.0364)	1.034*** (0.0270)
ELF Index	-0.388 (0.247)	-0.664** (0.276)	0.200 (0.317)
Square ELF Index	0.235 (0.317)	0.943*** (0.288)	0.270 (0.386)
Post * ELF	-1.432*** (0.259)	-3.969*** (0.322)	-7.087*** (0.228)
Secondary Education	-0.00943 (0.0128)	0.0923*** (0.00870)	0.165*** (0.0104)
Post-Secondary Education	-0.0315 (0.0234)	0.183*** (0.0131)	0.336*** (0.0227)
Age	-0.0108* (0.00580)	0.0761** (0.0331)	-0.0179 (0.0651)
Household Size	0.139*** (0.00554)	0.109*** (0.00340)	0.112*** (0.00433)
No. of Children (0-6)	-0.0318*** (0.00501)	-0.0462*** (0.00504)	-0.0808*** (0.00984)
No. of Elder Person (60+)	-0.00692 (0.0102)	-0.0118 (0.00734)	-0.0146 (0.0102)
Female	-0.0372 (0.0258)	-0.0154 (0.0198)	0.0177 (0.0266)
Married	0.211*** (0.0282)	0.127*** (0.0233)	0.138*** (0.0233)
Widowed	0.0715** (0.0270)	0.0482** (0.0203)	0.0784*** (0.0226)
Divorced	-0.204 (0.128)	-0.0137 (0.0473)	0.0196 (0.0725)
Separated	-0.0247 (0.0711)	-0.0205 (0.0428)	-0.0486 (0.0596)
Constant	9.426*** (0.104)	2.877*** (0.0854)	3.564*** (0.0872)
Observations	34,138	33,992	34,099
Adjusted R-squared	0.191	0.316	0.333
Regional FE	YES	YES	YES
HH FE	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling, type of resident is excluded from the result table to save space. In education categories, the based group is below primary education. In the marriage variable, single household head is a based group. For both food and non-food expenditure we used 2012 real exchange rate (constant rate) which is 1US\$=640.65 Kyats. The periods are 2010 and 2015. "Post" is a dummy variable, which equals to one for the year 2015, zero for the year 2010. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Figure 1.1 Distribution of total consumption calories (before and after democratization)**



**Figure 1.2 Distribution of total expenditure (before and after export liberalization)**



**Table 1.3 Household's consumption (calories) per week**

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Log Consumption Calories: Per Week				
	Rice	Root and Bean	Meat and Fish	Fruit and Vegetable	Oil and Fats
Post (After Democratization)	0.516*** (0.108)	-0.927*** (0.0414)	0.0922*** (0.0331)	0.357*** (0.0349)	0.147*** (0.0332)
ELF Index	0.0533 (0.959)	-0.976** (0.373)	0.712** (0.273)	-1.269*** (0.411)	-1.988*** (0.290)
Square ELF Index	-0.0225 (1.870)	1.098*** (0.404)	-1.059*** (0.364)	1.064** (0.470)	2.185*** (0.357)
Post * ELF	-3.355*** (0.823)	-3.892*** (0.352)	-1.017*** (0.208)	-1.277*** (0.362)	0.749*** (0.271)
Secondary Education	0.0433 (0.0733)	0.0247 (0.0155)	0.0263* (0.0148)	0.00288 (0.0142)	0.0468** (0.0210)
Post-Secondary Education	-0.0800 (0.0570)	0.0895** (0.0422)	0.0626* (0.0346)	0.0456* (0.0258)	0.0959*** (0.0261)
Age	-0.00221 (0.00248)	0.0123 (0.00848)	-0.0279 (0.0539)	0.0935* (0.0550)	-0.0664 (0.0565)
Household Size	0.161*** (0.0190)	0.120*** (0.00555)	0.133*** (0.00464)	0.108*** (0.00468)	0.126*** (0.00507)
No. of Children (0-6)	-0.0587* (0.0301)	-0.025*** (0.0089)	-0.0424*** (0.0072)	-0.0362*** (0.0071)	-0.079*** (0.0114)
No. of Elder Person (60+)	0.0456 (0.0529)	-0.000634 (0.0105)	-0.00845 (0.0113)	-0.00636 (0.0110)	0.0169** (0.008)
Female	-0.104 (0.0895)	-0.0289 (0.0294)	0.0227 (0.0344)	-0.0653** (0.0270)	-0.126*** (0.0329)
Married	0.201*** (0.0576)	0.212*** (0.0381)	0.231*** (0.0338)	0.197*** (0.0256)	0.216*** (0.0425)
Widowed	0.0924 (0.0588)	0.103*** (0.0341)	0.113** (0.0430)	0.0712*** (0.0221)	0.0577 (0.0467)
Divorced	-0.177 (0.178)	-0.292** (0.120)	-0.306*** (0.101)	-0.187* (0.0974)	-0.293*** (0.0977)
Separated	-0.0892 (0.127)	0.00246 (0.0726)	-0.0401 (0.0959)	-0.171** (0.0676)	-0.0823 (0.0998)
Constant	8.342*** (0.877)	8.878*** (0.123)	7.314*** (0.125)	7.294*** (0.0786)	7.565*** (0.162)
Observations	34,138	34,138	34,138	34,138	34,138
Adjusted R-squared	0.138	0.479	0.159	0.160	0.130
Regional FE	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling, type of resident is excluded from the result table to save space. In education categories, the based group is below primary education. The periods are 2009, 2010 and 2015. "Post" is a dummy variable, which equals to one for the year 2015, zero for the year 2009 and 2010. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1.4 Household non-food expenditure (1US\$=640.65 Kyats)**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Expenditure (One Month)			Expenditure (Six Months)		
	Energy	Apparels	Drinking Water	Clothing	Travelling	Other
Post (After Democratization)	4.953*** (1.426)	3.373*** (0.323)	1.440*** (0.379)	61.84*** (11.94)	34.36*** (5.731)	173.5*** (3.977)
ELF Index	3.931 (9.441)	-1.768 (2.161)	0.251 (3.104)	155.5*** (45.82)	32.37*** (11.42)	13.28 (11.98)
Square ELF Index	0.668 (10.18)	5.795** (2.495)	-0.894 (3.782)	-187.8*** (61.18)	-40.91** (16.70)	-23.04 (19.26)
Post * ELF	-40.79*** (5.003)	2.125 (2.021)	-29.64*** (2.945)	45.97 (49.58)	-118.9*** (20.02)	-842.1*** (9.515)
Secondary Education	2.383*** (0.534)	0.890*** (0.0742)	0.189*** (0.053)	6.846 (6.638)	-0.618 (1.476)	1.942 (1.372)
Post-Secondary Education	4.487*** (1.216)	2.617*** (0.336)	0.258 (0.187)	39.32** (15.35)	7.675 (5.780)	24.03** (10.81)
Age	-0.0270 (0.0411)	- (0.00460)	-0.011** (0.005)	0.0215 (0.294)	-0.0683 (0.089)	-0.0319 (0.049)
Household Size	1.614*** (0.294)	1.176*** (0.0470)	0.131*** (0.022)	12.49*** (1.443)	1.468** (0.726)	1.784** (0.825)
No. of Children (0-6)	-0.936* (0.509)	- (0.0673)	-0.036 (0.027)	-4.022 (10.34)	-2.230* (1.213)	-2.112* (1.135)
No. of Elder Person (60+)	-0.253 (0.453)	-0.195 (0.134)	-0.022 (0.072)	-15.58*** (5.262)	1.149 (2.854)	3.951 (4.295)
Female	0.533 (1.361)	- (0.207)	-0.109 (0.095)	2.699 (3.441)	-1.579 (2.103)	3.430* (2.027)
Married	-0.116 (1.260)	0.685** (0.262)	0.416** (0.161)	18.23* (10.30)	3.725 (2.687)	-0.999 (3.859)
Widowed	1.869 (1.422)	0.321* (0.178)	0.351* (0.183)	7.932 (11.14)	1.709 (3.641)	-2.328 (2.731)
Divorced	0.335 (1.273)	1.667 (1.054)	0.326 (0.330)	13.30 (11.93)	-3.198 (2.475)	-5.196 (3.907)
Separated	-1.294 (1.149)	-0.551* (0.282)	0.076 (0.172)	-5.574 (10.94)	-2.163 (3.978)	-11.75*** (4.428)
Constant	10.89*** (2.505)	7.996*** (1.281)	4.049*** (1.224)	156.6*** (34.75)	40.11* (20.47)	0.464 (28.11)
Observations	34,138	34,138	34,138	34,138	34,138	34,138
Adjusted R-squared	0.024	0.186	0.116	0.024	0.011	0.022
Regional FE	YES	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling, type of resident is excluded from the result table to save space. In education categories, the based group is below primary education. In the marriage variable, single household head is the based group. The periods are 2010 and 2015. "Post" is a dummy variable, which equals to one for the year 2015, zero for the year 2010. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1.5 Access to public goods**

VARIABLES	(1)	(2)	(3)	(4)
	School	Electricity	Phone and Internet	Time to collect drinking-water
Post (After Democratization)	-0.227*** (0.005)	0.106*** (0.0213)	0.785*** (0.0136)	-1.381*** (0.017)
ELF Index	0.105** (0.0459)	-0.367 (0.312)	0.0226 (0.0661)	-0.582*** (0.164)
Square ELF Index	-0.0283 (0.049)	0.778* (0.418)	0.0184 (0.125)	0.752*** (0.208)
Post * ELF	-0.271*** (0.0561)	-2.974*** (0.245)	-4.224*** (0.0614)	0.881*** (0.118)
Secondary Education	-0.026** (0.0127)	0.183*** (0.00973)	0.0614*** (0.00625)	0.172*** (0.0185)
Post-Secondary Education	-0.027* (0.016)	0.253*** (0.0371)	0.194*** (0.0175)	0.260*** (0.045)
Age	-0.070*** (0.009)	0.0231*** (0.004)	0.00297 (0.002)	0.031*** (0.007)
Household Size	0.061*** (0.005)	0.012*** (0.002)	0.007*** (0.001)	0.001 (0.005)
No. of Children (0-6)	0.054*** (0.006)	-0.0331*** (0.0052)	-0.009*** (0.003)	-0.024*** (0.006)
No. of Elder Person (60+)	-0.0146* (0.008)	0.010 (0.007)	0.00700*** (0.00220)	-0.005 (0.010)
Female	0.009 (0.013)	-0.068*** (0.0120)	-0.012** (0.005)	-0.018 (0.013)
Married	0.101*** (0.011)	-0.0173 (0.0132)	0.0130* (0.007)	-0.048*** (0.012)
Widowed	0.127*** (0.012)	-0.0324* (0.0163)	-0.001 (0.010)	-0.049*** (0.019)
Divorced	0.100*** (0.033)	0.0535 (0.039)	0.0284 (0.0280)	-0.079 (0.067)
Separated	0.051 (0.046)	-0.0443 (0.030)	-0.029** (0.0135)	-0.099*** (0.027)
Constant	0.238*** (0.0542)	0.620*** (0.059)	0.352*** (0.0634)	1.364*** (0.098)
Observations	18,380	18,380	34,138	18,380
Adjusted R-squared	0.277	0.309	0.387	0.248
Regional FE	YES	YES	YES	YES
HH FE	YES	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling are excluded from the result table. Access to school is dummy variable where a school is located (within village or ward=1) and outside=0). Similarly, Access to electricity and phone and internet are also dummies if household access electricity =1 and access to phone or internet =1. However, access to drinking water is a continuous variable whereas it is time to collect the water in minutes. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1.6 Robustness check**

VARIABLES	(1)	(2)	(3)
	Consumption Calories	Food Expenditure	Non-Food Expenditure
<b>Panel A: Bottom and Top (5 %)</b>			
Post (After Democratization)	1.066*** (0.0185)	18.70*** (0.600)	12.03*** (0.871)
ELF	-0.296 (0.178)	-12.78* (7.397)	6.660 (11.97)
Square ELF Index	0.241 (0.227)	19.72** (7.718)	13.50 (13.58)
Post*ELF	-1.758*** (0.168)	-138.5*** (6.539)	-116.9*** (9.740)
Constant	9.659*** (0.0582)	11.09*** (0.976)	23.96*** (3.100)
Observations			
Adjusted R-squared	32,085	30,767	30,836
Regional FE	0.135	0.179	0.191
Household FE	YES	YES	YES
<b>Panel B: Bottom and Top (10 %)</b>			
Post (After Democratization)	0.884*** (0.00970)	8.094*** (0.490)	3.389*** (0.606)
ELF	0.0619 (0.0769)	-11.04* (5.703)	3.184 (7.715)
Square ELF Index	-0.0844 (0.135)	16.43*** (5.960)	12.01 (8.984)
Post*ELF	-2.450*** (0.0833)	-70.51*** (5.440)	-52.54*** (6.949)
Constant	10.04*** (0.0456)	15.61*** (0.879)	23.90*** (2.073)
Observations			
Adjusted R-squared	27,532	27,416	27,374
Regional FE	0.086	0.131	0.153
Household FE	YES	YES	YES
<b>Panel C: Restricted Sample</b>			
Post (After Democratization)	1.236*** (0.0386)	17.78*** (0.323)	75.39*** (2.122)
ELF	-0.699* (0.413)	-34.92*** (4.296)	-104.4*** (36.11)
Square ELF Index	1.082* (0.612)	42.58*** (9.947)	186.9*** (61.44)
Post*ELF	-1.655*** (0.358)	-66.10*** (3.888)	-740.4*** (24.75)
Constant	9.583*** (0.138)	7.193 (4.425)	18.55 (21.42)
Observations			
Adjusted R-squared	18,242	18,242	18,242
Regional FE	0.180	0.217	0.047
Household FE	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling are excluded from the result table to save space. In education categories, the based group is below primary education. In the marriage variable, single household head is the based group. The periods are 2010 and 2015. “Post” is a dummy variable, which equals to one for the year 2015, zero for the year 2010. We dropped some township from sample where the civil armed conflicts were engaged. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 1.7 Robustness check**

VARIABLES	(1)	(2)	(1)
	Calories	Expenditure	
	Consumption	Food	Non-Food
<b>Panel A: Polarization Index</b>			
Post (After Democratization)	1.121*** (0.0189)	26.49*** (0.674)	113.8*** (4.425)
Polarization Index	-0.135** (0.0532)	-2.200 (1.933)	5.891 (4.473)
Post* Polarization Index	-0.851*** (0.0722)	-57.05*** (2.724)	-478.5*** (6.258)
Constant	9.375*** (0.107)	22.52*** (2.447)	85.87*** (11.38)
Observations	34,138	34,138	34,138
Adjusted R-squared	0.190	0.246	0.064
Regional FE	YES	YES	YES
Year FE	YES	YES	YES
Household FE	YES	YES	YES
<b>Panel B: Religious ELF</b>			
Post (After Democratization)	1.035*** (0.0404)	23.53*** (1.551)	123.5*** (4.215)
ELF Index	-1.103*** (0.253)	-38.37*** (12.91)	23.09 (19.92)
Square ELF Index	2.200*** (0.607)	73.30*** (21.03)	-32.18 (29.55)
Post * ELF Index	-1.630*** (0.291)	-121.5*** (12.05)	-1,23*** (19.66)
Constant	9.394*** (0.107)	25.08*** (2.539)	85.22*** (12.61)
Observations	33,748	33,748	33,748
Adjusted R-squared	0.191	0.249	0.064
Regional FE	YES	YES	YES
Year FE	YES	YES	YES
Household FE	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling are excluded from the result table to save space. In education categories, the based group is below primary education. In the marriage variable, single household head is a based group. For both food and non-food expenditure we used 2012 real exchange rate (constant rate) which is 1US\$=640.65 Kyats. The periods are 2010 and 2015. "Post" is a dummy variable, which equals to one for the year 2015, zero for the year 2010. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Table 1.8 Access to public goods (robustness check)**

VARIABLES	(1)	(2)	(3)	(4)
	School	Electricity	Phone and Internet	Time to collect drinking-water
<b>Panel A: Polarization Index</b>				
Post (After Democratization)	-0.224*** (0.00528)	0.169*** (0.0190)	0.825*** (0.0125)	-1.357*** (0.0154)
ELF Index	0.0580*** (0.0216)	0.0327 (0.0574)	0.0281** (0.0139)	-0.111*** (0.0288)
Post * ELF	-0.151*** (0.0285)	-1.824*** (0.0561)	-2.345*** (0.0222)	0.325*** (0.0458)
Constant	0.251*** (0.0524)	0.669*** (0.0658)	0.356*** (0.0613)	1.371*** (0.111)
Observations	18,380	18,380	34,138	18,380
Adjusted R-squared	0.277	0.303	0.387	0.248
Regional FE	YES	YES	YES	YES
HH FE	YES	YES	YES	YES
<b>Panel B: Religious ELF</b>				
Post (After Democratization)	-0.192*** (0.00796)	0.160*** (0.0357)	0.865*** (0.0190)	-1.243*** (0.0808)
ELF Index	0.329*** (0.0902)	-0.319 (0.302)	0.0372 (0.115)	0.906 (0.713)
Square ELF Index	-0.507*** (0.161)	0.712 (0.655)	-0.0163 (0.190)	-1.639 (1.278)
Post * ELF	-0.514*** (0.0946)	-4.343*** (0.200)	-5.984*** (0.0996)	-0.134 (0.605)
Constant	0.227*** (0.0543)	0.705*** (0.0680)	0.362*** (0.0614)	1.235*** (0.161)
Observations	18,188	18,188	33,748	18,188
Adjusted R-squared	0.279	0.306	0.390	0.248
Regional FE	YES	YES	YES	YES
HH FE	YES	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling are excluded from the result table. Access to school is dummy variable where a school is located (within village or ward=1) and outside=0). Similarly, Access to electricity and phone and internet are also dummies if household access electricity =1 and access to phone or internet =1. However, access to drinking water is a continuous variable whereas it is time to collect the water in minutes. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1.9 Falsification test**

VARIABLES	(1)	(2)	(3)
	Log Calories	Log Expenditure	
	Consumption	Food	Non-Food
Pseudo Post	-0.326*** (0.0509)	0.101*** (0.0197)	-0.0215 (0.0328)
ELF Index	-0.0195 (0.117)	-0.657*** (0.196)	0.0207 (0.0719)
Pseudo Post * ELF	-0.261 (0.148)	0.0700 (0.0569)	0.0342 (0.0647)
Secondary Education	0.0198** (0.00718)	0.127*** (0.0206)	0.183*** (0.00758)
Post-Secondary Education	0.0684*** (0.0133)	0.273*** (0.0364)	0.473*** (0.0239)
Age	-0.00102*** (0.000295)	0.000300 (0.000340)	0.000479 (0.000367)
Household Size	0.119*** (0.00341)	0.130*** (0.00543)	0.0815*** (0.00225)
No. of Children (0-6)	-0.0412*** (0.00753)	-0.0492*** (0.0110)	-0.0646*** (0.00626)
No. of Elder Person (60+)	0.0179** (0.00555)	-0.00689 (0.0114)	0.0352*** (0.00676)
Female	-0.0756*** (0.0117)	0.0249 (0.0157)	-0.00875 (0.0150)
Married	0.0344** (0.0144)	0.00601 (0.0103)	0.00753 (0.00792)
Widowed	-0.0141 (0.0166)	-0.0698*** (0.0171)	-0.0542** (0.0222)
Divorced	-0.0788 (0.0664)	-0.0254 (0.0581)	-0.00321 (0.0357)
Separated	-0.151*** (0.0241)	-0.103*** (0.0288)	-0.0490 (0.0486)
Constant	9.070*** (0.0889)	2.481*** (0.325)	3.549*** (0.0794)
Observations	26,967	26,860	27,069
Adjusted R-squared	0.348	0.187	0.193
Regional FE	YES	YES	YES
Household FE	YES	YES	YES
Year FE	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling are excluded from the result table to save space. In education categories, the based group is below primary education. In the marriage variable, single household head is a based group. For both food and non-food expenditure we used 2012 real exchange rate (constant rate) which is 1US\$=640.65 Kyats. Post is a dummy variable, which equals to one for the year 2010, zero for the year 2009. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1.10 Heterogeneous analysis**

VARIABLES	(1)	(2)	(3)
	Log Calories Consumption	log Expenditure (1US\$=640.65 Kyats) Food	Non-Food
Post (After Democratization)	2.156*** (0.0359)	0.0404 (0.0492)	0.416*** (0.0408)
EFL Index	-0.250* (0.149)	-0.466** (0.197)	0.301*** (0.0610)
Secondary Education	0.00208 (0.0190)	0.0307 (0.0259)	0.154*** (0.0129)
Post-Secondary Education	0.0809** (0.0347)	0.171*** (0.0350)	0.416*** (0.0377)
Post * ELF	-2.290*** (0.150)	-3.958*** (0.232)	-6.584*** (0.123)
Post* Secondary Education	0.00896 (0.0414)	0.163*** (0.0555)	0.0333 (0.0594)
Post*Post-Secondary Education	-0.0465 (0.0561)	0.154 (0.0937)	-0.0280 (0.0908)
ELF* Secondary Education	0.0661 (0.0437)	0.325*** (0.0728)	0.0599 (0.0362)
ELF* Post-Secondary Education	-0.0304 (0.115)	0.428*** (0.103)	0.102 (0.194)
Post*ELF* Secondary Education	-0.230** (0.0947)	-0.307** (0.150)	0.00209 (0.157)
Post*ELF* Post-Secondary Education	-0.167 (0.159)	-0.547** (0.250)	-0.326 (0.276)
Age	-0.000812** (0.000311)	9.82e-06 (0.000403)	0.000252 (0.000308)
Household Size	0.121*** (0.00427)	0.124*** (0.00665)	0.0877*** (0.00321)
No. of Children (0-6)	-0.0445*** (0.00677)	-0.0535*** (0.0144)	-0.0710*** (0.00833)
No. of Elder Person (60+)	0.0164*** (0.00594)	-0.0123 (0.0114)	0.0291*** (0.00801)
Female	-0.0761*** (0.00717)	0.0140 (0.0137)	-0.0143 (0.0159)
Constant	8.822*** (0.0589)	2.765*** (0.124)	3.648*** (0.0892)
Observations	29,645	29,532	29,786
Adjusted R-squared	0.494	0.171	0.214
Regional FE	YES	YES	YES
Household FE	YES	YES	YES

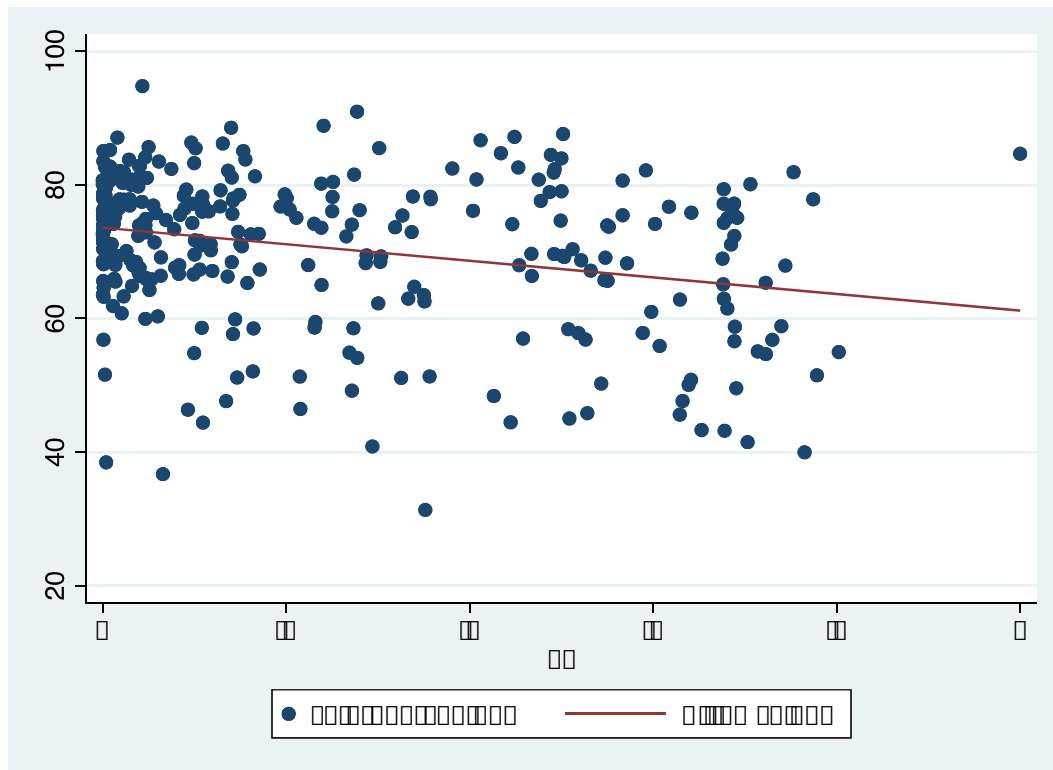
Note: Coefficients with standard errors are reported in parentheses clustered at district level. Other variables such as religious, mother-tongue, and type of dwelling are excluded from the result table. In education categories, the based group is primary and below. In the marriage variable, single household head is the based group. The periods are 2009, 2010 and 2015. "Post" is a dummy variable, which equals to one for the year 2015, zero for the years 2009 and 2010. \*\*\* p<0.01, \*\* p<0.05, \* p<0.

**Table 1.11 Ethnic feralization, political participation and conflict**

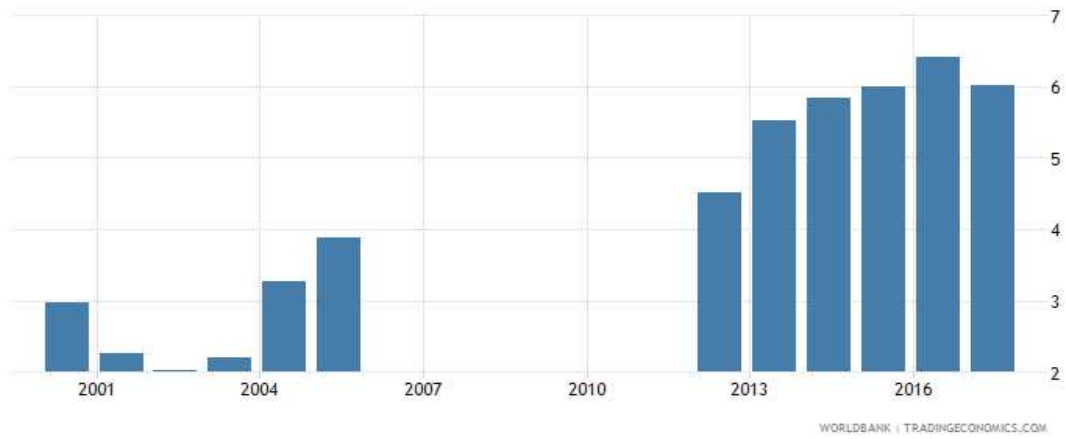
VARIABLES	(1)	(2)	(3)
	Voting Share		Log Total Conflicts
	First Election (2010)	Second Election (2015)	2010 to 2017
ELF	-3.935** (1.602)	-4.080** (1.601)	0.758* (0.444)
Log of Total Population	-1.919 (1.645)	-3.067*** (0.925)	1.660*** (0.298)
Unemployment Rate (Age 10+)	-0.358** (0.164)	-0.354** (0.164)	0.0557 (0.0702)
Log # Rural Literate Person	0.110** (0.0544)	0.102** (0.0503)	-0.0193 (0.0127)
Household with Electricity (Share)	2.039 (4.053)	0.0547 (3.008)	1.989** (0.911)
Household with Apartment (Share)	-2.267 (18.47)	-1.900 (18.79)	9.538** (4.085)
Log # Household Access Internet	-0.0793 (0.483)	-0.0977 (0.488)	0.0626 (0.169)
No toilet (percentage)	-0.00791* (0.00468)	-0.00776 (0.00470)	-0.000270 (0.00148)
Constant	90.81*** (13.87)	104.2*** (10.25)	-11.01*** (3.354)
Observations	275	275	249
Adjusted R-squared	0.477	0.477	0.482
Regional FE	YES	YES	YES

Note: Coefficients with standard errors are reported in parentheses clustered at district level. Conflict is a total conflict in each township through the year 2010 to 2018. All data are township level data. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Figure 1.3 Relationship between ELF and political participation**



**Figure 1.4 Government tax revenue (2001-2016)**



Source: World Bank Development Indicators

**Table 1.12 Voter share and average revenue (state and regional level)**

VARIABLES	(1) log Average Revenue (Million Kyats)
Voter Share	0.0511** (0.0189)
Log Total Population	-1.139*** (0.369)
Log # Unemployed Person	-0.00518 (0.115)
Log Per Capita GDP	-0.0276 (0.0249)
Urban Population Ratio	4.108*** (1.144)
Log illiterate (15+)	1.329*** (0.397)
Log Household with Electric	-0.678** (0.301)
Log Household with Mobile Phone	1.706*** (0.415)
Log # of Bamboo House	-0.00882 (0.0129)
Constant	-12.85*** (3.431)
Observations	279
Adjusted R-squared	0.791
Regional FE	YES

Note: Coefficients with standard errors are reported in parentheses clustered at State and Regional level. We use average tax revenue of each State and Region through the year 2011 to 2017. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 1.13 Government venue and infrastructural development (state level)**

VARIABLES	(1)
	Log Total Road Miles
Log Average Revenue	0.0249** (0.00900)
Log Total Population	1.319*** (0.00757)
Unemployment Percent	-1.219*** (0.0165)
Log Per Capita GDP	-0.0832*** (0.0001)
Log # of Illiterate (15+)	-3.172*** (0.00301)
Rural Illiterate Rate	0.0142*** (0.000460)
Log Household with Electric	1.133*** (0.00233)
Log Household with no Toilet	0.0988*** (0.000986)
Log Household with Mobile Phone	-1.484*** (0.00383)
Log Household with Television	1.013*** (0.000865)
Log # of Bamboo House	-0.0111*** (0.000610)
Constant	28.57*** (0.145)
Observations	78
Adjusted R-squared	0.991
Regional FE	YES

Note: Coefficients with standard errors are reported in parentheses clustered at state and regional level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## CHAPTER TWO

### **The Long-term Impact of “Education for All” Policy on Child Mortality and Labor Outcome**

#### **2.1 Introduction**

According to 2015 world economic forums, 13 million children died in 1990 and it reduced to 6 million in 2013. Although tremendous progress has been made in reduction child mortality, at least 17,000 of children still died each day in 2013. Therefore, world leaders have set an ambitious target to reduce child mortality in Million Development Goal. However, developing countries are still facing high mortality rate. About 6.2 million children under age 15 were died due to preventable causes in 2018 (UNICEF, 2019). Out of 6.2 million, the newborns accounted 2.5 million, under one-year age for 1.1 million, age between 1 and 4 for 1.3 million, and age between 5 and 14 for 1 million respectively.

What could be a major tool for reducing child mortality? Regarding this question, many scholars point out education as a major tool in reducing child mortality. Moreover, education boost the capacity of the labor productivity. Although a lot of research has been conducted on the connection between education and child mortality, most are not causal relationship. Duflo and Breierova (2004) analyzed the causal effect of education on child mortality by using time and regional variation in school construction program as an instrument to address the endogeneity of education. They found that both mother and father education is important in reducing child mortality. Duflo (2001) showed that school construction program in Indonesia generate more years of schooling and then it increase the labor wages. Castello and Domenech (2002) also pointed out that the inequality of education is more important than that of income equality for economic growth. Therefore, we could see education as a major tool not only to reduce child mortality but also to increase wages. We also find the education increases female labor force participation meanwhile it reduces working in the elementary sectors.

Most empirical results showed that the important of mother education in reducing child mortality. The increase in access to primary education for female potentially contribute to reducing under five mortality rates (Makate and Makate, 2016). Therefore, maternal education can be seen as an instrument for reducing child



mortality in developing (Andriano and Monden, 2017). They use Universal Primary Education reform as an instrument for mother education. They found mother education reduces child mortality in both Malawi and Uganda. They also pointed out that a lot of studies used single and multi-level regression model and it probably could omit the factors that effect on both education and child mortality. Omitting unobserved confounding factors may produce the attenuation bias.

Despite a lot of research has been done, more studies have to be conducted to ascertain the causal effects of education on child mortality. Andriano and Monden (2017) use regression discontinuity design (RDD) to study the causal effect of maternal education on child mortality. However, they found insignificant effect of mother education on child mortality. We use the fuzzy regression design (RDD) in this paper to analyze the impact of education on child mortality and labor outcomes. We find mother education significantly reduces child mortality. This paper uses the exposure to the policy (which is a dummy variable, 1 if age $\leq$ 11 in 1990 and 0 otherwise) as an instrument for years of schooling.

In Myanmar, compulsory primary education policy was intensively initiated across the country by fully collaboration with USAID, and UNIFIC in 1990 under the military government. The policy had a significant effect on all school age children. The way of addressing the endogenous problem of education is that using the forces of nature or government policy as an exogenous source of variation can produce an akin to a randomize experiment (Angrist & Krueger, 2001). Therefore, the methodology based on education policy is appropriate to analyze the impact of education on child mortality and labor outcomes. The purpose of this study is to determine the effect of compulsory education policy (Education for All Policy 1990-2000) on child mortality and labor outcomes.

For the robustness check we use different age windows and a different data set. Moreover, we use difference-in-difference method to check robustness of our baseline estimates. We use the age cohorts (young cohort if age $\leq$ 11 in 1990 as treatment and old cohort if age $>$ 11 in 1990 as control group) as the first variation and the treatment townships where the the townships are geographically difficult to commute as the second variation. These townships were high in the school drop-out rate and the government more focused on these townships. Therefore, the more socially unable to commute townships received more benefits of the policy. The two variations, age cohorts and remote townships are jointly determined the effect of the policy.

Although the effect of mother education on child mortality and labor outcomes has been often mentioned in health research, little studies has been done the causal relationship between them. To analysis the impact of maternal education on child mortality, previous researches use an instrumental variable (IV) approach while the current research use the fuzzy regression discontinuity (RDD) approach. The education expansion policy or school construction project used in the previous papers were implemented under the democratic government system, while the education policy used in this research was implemented under military regime. We examine the long-term impact of education policy on current households. Moreover, little studies provide the possible channel through which the mother education reduces child mortality. This paper also provides a possible channel of causality through which mother education reduces child mortality. We find that the mother education reduces the child mortality through the channel of increasing pre-post antenatal care and delivery care.

Although the education policy used in this paper was implemented under military dictatorship, the data used in this paper were collected under democratic regime. We identify that mother education reduce neonatal mortality, infant mortality, under 5 mortality, mortality (age 5-15), and mortality (ever born in a family). Moreover, we show maternal education has a significant effect on early childhood development, and fertility preference. We also find that education is the determinate of female labor force participation and transformation of labor structure. The more educated females participate more in current labor force and less work in the elementary sectors. This is the first paper utilizes the education for all (EFA) policy in Myanmar to analysis the causal impact mother education on child mortality and labor outcomes. Our results also contribute to an understanding of the long-term impact of education policy and it has a lot of benefits for households even though it was implemented under military regime.

The structure of the paper is as follows. Section 2.1 is an introduction. In section 2.2, we discuss the background of the Education for All (EFA) Policy. In section 2.3 we discuss the literature on education and child mortality. We provide the data and methodology used in this paper in section 2.4. We provide results and discussion in section 2.5. We discuss accessing the identification strategy in section 2.6. In section 2.7, we examine the potential channel of causality of relationship between mother education child mortality. Finally, we discuss the conclusion of the paper in section 2.8.

## **2.2 Background of “Education for All” policy in Myanmar**

Myanmar gained independence on January 4 1948. Since then, parliamentary democratic system was practiced till 1962. However, the military seized political power, in the meantime, general Ne Win form a first military regime so called the Revolutionary Council (RC) in March of 1962. After the RC periods (1962-1947), the military dictatorship introduced the 1974 constitution and formed one party system, which is the Burma Socialist Program Party (BSPP). The Burma Way to Socialism (1947-1988) in Myanmar was ended with a sparked mass protests in 1988 due to chronic inflation and long-term economic stagnation. Therefore, in the early 1990s the military government formed a new political regime and launched the market economy as the economic reform. Meanwhile, the government also endeavored for all school age children access primary education. In 1990, the government set an ambitious target to reach primary completion rate 100% by the end of 2000 through the Education for All policy. The policy targeted to reach the primary completion rate from 62% in 1990 to 100% in 2000. In order to successfully implement the EFA, the Implementation Committees were formed at States and Regional level, District level, and Township Level respectively. According to EFA 2000 assignment reports, the national EFA central coordination committee was formed on December 27, 1996, under government notification No. (45/96). Under the policy all school age children in classroom program were initiated, which mainly focused on the primary education level.

Although the policy was initiated across country, it mainly focused on townships where the school drop-out rates were high. Generally, these townships were remote and geographically difficult to communicate. Therefore, the impact of the policy would be different among townships. In 1992 the government started the education sector study (ESS) by cooperation with UNDP and UNESCO. The study is aimed at to provide the better strategies and implementation of the education sector development. Moreover, the study found out that Myanmar had a significant regional disparity in term of qualified and trained teachers, schools, class size, and student teacher ratio and other school facilities. The survey also found out that the school drop-out were high twice in the remote areas. Although primary education was universally accessible in most part of the country, the policy unable to reach fully in remote places (The Union Myanmar, 1996).

Follow up the national project, the Department of Basic Education and UNICEF conducted a survey, Primary School Age Non-Enrolment Gap Survey, which found that almost 39 percent of primary school children in surveyed area never enrolled in school. Surprisingly, the survey discovered that 34 percent out of 61 enrolled students in primary level dropped out the school. This was due to poverty, inadequate government support and declining belief on the value of education. Especially never enroll and dropped out rate was high in remote areas and poor family because families were unable to meet the basic cost of education. Therefore, the EFA policy induced the more year of schooling in remote townships.

Prior to the policy, there was no such a significant education reform at primary level. Both parents and children were never motivated to go to school. Under the program, committee and sub-committee were formed up to village level, which involved various bodies such as government, local community, and INGOs (such as UNICEF, UNESCO, and UNDP). Mass dissemination of these committees had a significant effect on the program. Under the program framework, the share of budget used for primary education increased and it accounted 75.1 percent of total education expenditure. About 1.6 million children in 9,000 disadvantaged schools were covered by the primary education projects. The number of primary students increased from 5,975,558 in 1990 to 6,874,826 in 1999 respectively during policy periods (Union of Myanmar, 1999). The program was accompanied by a sequent of transformation such as changing the curriculum, pedagogy, and upgrading teaching training all these encouraged all parents and children to go and continuous to school. The policy intensively motivated parents and communities' leaders, teachers, and children to participate in the program and it generated significant educational improvement. Hence, the number of students enrolled in primary school increased approximately 1.0 million during the project cycle (Union of Myanmar, 1999). The program caused a sharp increase in primary school enrollment rate in Myanmar.

### **2.3 Literature review**

Child mortality is still a central problem for policy makers in the developing world. Regarding this issue, education can be seen as a tool for reduction of the child and maternal mortality. Investing in education has the substantial benefits not only for economic but also for social capital such as knowledge and health capital. Education polishes human skills and then induces the productivity, earning, and standard living.

The more educated person reads more health magazine, journals and newspapers. Therefore, they are more knowledgeable for family health. Hobcraft (1993) stated that the child health and mortality could be influenced by mother education.

Many researches have been conducted on the relationship between child mortality and parent's educational attainment, especially in primary and secondary education levels. Although the channel of education to child health is unclear, it is found that maternal education is highly related to child health and better nutrition for children (Cochrane et al., 1980). Child survival improved in more educated mother comparing with less educated mother. The reason is that more educated mothers care more about their children's hygiene and nutrition, which are important for child health. Cleland and Van (1988) stressed that infant mortality and child mortality are highly associated with the length of formal schooling of the mother. Generally, more educated mothers know more about health slogan and the way to nurture their children, which have a strong impact on child survival. Some researchers found that secondary schooling achievement reduces child mortality (Grepin & Bharadwaj, 2015; Makate & Makate, 2016).

Parent education potentially contributes to child health through direct and indirect ways. The direct channel is that the educated parents have much more acquisition and use of the health knowledge for family. As an indirect effect, educated parents have higher potential to get a good paid job that increases family income and creates a good family environment. The medical service can be readily accessed for higher income family. Grossman, 1972 pointed out that the demand for health service and health expenditure increases together with family income. He also stated that the investment in stock of health is higher in more educated people. Duflo (2001) found that education has a positive effect on labor wage. She found that the increase in average year of education from 0.12 to 0.19 lead the increase in wages from 1.5 to 2.7 US dollars. Making investment in formal schooling or in on-the-job training has potential gains productivity (Grossman,1972, 2006). He also pointed out that education is an ideal investment for health and economic growth because it brings knowledge capital and health capital.

Duflo and Breierova (2002) examined the causal effect of education on fertility and child mortality. They used the school construction program as an instrumental variable (IV) to address endogenous problem. They found that both mother and father education is equally important in reducing child mortality. Although a lot of studies

show that education and child mortality have a negative relationship, the impact differs across countries based on the cultural variations (Ware, 1984). Therefore, the mortality rate in across countries varies based on the other unobserved characteristics such as culture and other individual characteristics. However, Frenzen and Hogan (1982) argued that after controlling the demographics and environmental characteristics, the mother education and contraceptive use remain significant positive effect on infant survival and infant care.

Although a lot of research has been conducted the impact of maternal education on child mortality, most are not the causal studies and some used the instrumental approach. Duflo and Breierova (2002) and Andriano and Monden (2017) study the causal impact of education on child mortality using the instrumental variable approach. Andriano and Monden (2017) used the regression discontinuity design to examine the causal impact of maternal education on child mortality, but they found no significant effect of mother education on child mortality. Therefore, the purpose of this study is to ascertain the effect of compulsory education policy (Education for All Policy 1990-2000) on child mortality and labor outcomes. We use fuzzy RDD to examine the impact of education on outcomes.

## **2.4 Data and methodology**

### **2.4.1 Data**

The data used in this paper come from the 2015-16 Myanmar Demographic and Health Survey (MDHS). The survey is a national sample survey and conducted as the first time in Myanmar to provide information on demographic and households' health conditions. Survey areas were stratified by type of residence, rural and urban across the country. Both women and men age 15 to 49 from households were randomly selected across the country.

The DHS survey provides the highest education level, highest years of education and education in a single year. The sample is chosen based on the running variable, age of respondent in this paper. The optimal bandwidth is  $\pm 11$ . Therefore, only the observations are taken into account for people whose age was between 1 and 22 in 1990 which is equivalent to between 26 and 47 at the time of survey, 2015. In this paper the education in a single year is used rather than the highest level of education to capture the whole duration of the studying. The average years of schooling are 5.8 and 4.3 in

in the treatment control groups showing that the EFA program implemented in 1990 caused more year of schooling for young cohort group who receive the policy treatment. The primary completion and year of schooling in the treatment group are higher than the control group which means that program has a significant impact on years of schooling. The mean of the infant mortality in treatment is much lower than the mortality in the control group. Other characteristics are very similarly between the two groups. Summary statistics for DHS survey data are presented in Table 2.1.

We also use the 2014 census data to check robustness of our baseline estimates. Since the census data covered education, occupation, age, birth place, and number of child dead, total number of children, and other individual and housing characteristics we could utilize to find the long-term impact of education for all policy (EFA) on today households. The 2014 census covered 10,889,348 households. To analyze the policy effect, we use 1,063,169 households which are 10% of the census data. The descriptive statistics for census data are shown in table 2.11. For robustness check, we also apply difference-in-differences method by using different data. We hypothesize that even though the policy was implemented across the country, the government mainly focused on remote area where the school drop-out rates were high, so the policy impact would be different across regions. The data for the number of school age children, schools, students, teacher, drop out-rate in 1990 are from the Ministry of Education. The lists of remote areas are collected from General Administrative Department (GAD) and Myanmar Information Management Unit (MIMU).

#### 4.2.2 Methodology

To estimate the impact of mother schooling years on child mortality and labor outcomes, the following regressing equation is established.

$$Y_i = \beta_0 + \beta_1 S_i + \beta_2 V_i + \beta_3 age_i + \beta_4 age\_square_i + \mathcal{R}_j + \varepsilon_i \quad (1)$$

Where  $Y_i$  indicates outcomes (child mortality, pre-post antenatal care and delivery care, early childhood learning, fertility preference, and labor outcomes) of interest for individual  $i$ ;  $S_i$  is schooling years of the individual  $i$ ;  $V_i$  is a vector of characteristics of the respondent;  $age_i$  and quadratic function of age;  $\mathcal{R}_j$  is regional and household fixed effect, and  $\varepsilon_i$  is an error term.

The simplest way to estimate the equation (1) is using the ordinary least square (OLS) method. Since year of schooling is endogenous, it may be captured the effect of

some omitted characteristics that affect both education and our outcomes variables. Therefore, the OLS regression result is invalid and unable to establish a causal effect. We need to establish the exogenous source of variation in years of schooling in order to cope with the endogenous issue.

Although the policy applied to all school age children, some may not fully comply the policy. In sharp regression discontinuity design (RDD), all person whose age is below cut-off are assigned to treatment group (young age cohort) and actually received treatment and all person whose age is above cut-off are assigned to control group and do not receive the treatment. Therefore, at the cutoff the change in probability of receiving treatment goes from zero to one in a sharp RDD. By contrast, in a fuzzy RDD some person who are assigned to treatment failed to take treatment, but some person who are assigned to control group receive the treatment. Thus, in a fuzzy RDD, although the probability of treatment change at the cut-off, it is not completely deterministic and the change in the probability is always less than one. Therefore, we apply Fuzzy RDD to estimate the program effect. In this case age is a forcing variable. Since no such education policy was implemented prior to EFA policy we do not worry the impact of other policies on outcomes. Moreover, unlike the cash transfer program, there was no incentive for parents to change the age of their children to send to school. Therefore, the likelihood of manipulation on age is very low.

RDD method is used in many studies to analyze the policy impact (Imbens and Lemieux 2008; Card et al. 2008 and 2009; Lee and Lemieux 2010; Anderson et al. 2012 and 2014). It is appropriate for this study because it provides the discontinuous change in years of schooling. Therefore, using the education for all (EFA) Policy as an exogenous shock of variation in mother education, we can establish the causal impact of education on labor outcomes and child mortality. This study applies the two-stage least square (2SLS) and intention to treat (ITT) to estimate the causal impact of years of schooling on outcomes of interest.

In RDD, choosing the appropriate models which are parametric (global) and non-parametric (local), has the trade-off between bias and precision (Cattaneo et al., 2017). Since parametric approach use all data in analysis, the precision of estimate is greater than nonparametric approach. However, the major concern of parametric approach is that it is difficult to find a correct functional form because of a large range of data, so it can potentially increase bias. On the other hand, nonparametric approach only uses sub-set of data around cut-off, so it can reduce the bias. However, since the



method only use observations below and above cut-off, it will reduce sample size and the statistical power. This paper uses the local polynomial methods to estimate the policy impact. To estimate the impact of mother education on outcomes, we use the exposure to education policy (which is dummy 1 if age  $\leq 11$  in 1990 and 0 otherwise) as an instrument variable for mother year of schooling. The estimate of the first stage regression as following:

$$S_i = \beta_0 + \beta_1 Exposure\_Policy_i + \beta_2 v_i + \mathcal{R}_i + \varepsilon_i \quad (2)$$

Where  $S_i$  is years of schooling.  $Exposure\_Policy_i$  is the age dummy (1 if age of respondent less than and equal 11 in 1990 and 0 otherwise).  $v_i$  is a vector of other characteristics such as individual and housing characteristics.  $\mathcal{R}_i$  is the regional and household fixed effect.  $\varepsilon_i$  is the error term. We use the fitted value of  $S_i$  in the second stage regression. For the second stage, we perform the following regression:

$$Y_i = \beta_0 + \beta_1 \widehat{S}_i + \beta_2 v_i + \beta_3 age_i + \beta_3 age\_square_i + \mathcal{R}_i + \varepsilon_i \quad (3)$$

Where  $Y_i$  is our interest of outcomes (child mortality, early childhood learning, pregnancy and delivery Care, fertility preference, and labor outcomes). The coefficient of  $\beta_1$  gives the impact of mother education on our interest of outcomes.

We also examine the direct effect of policy on child mortality and early childhood learning, and labor outcomes by using the reduced form regression. We estimate the intention to treat (ITT). It gives the impact of policy regardless of whether or not those in the treatment group actually enroll in the program. We use the following equation to estimate ITT:

$$Y_i = \beta_0 + \beta_1 Exposure\_Policy_i + \beta_2 v_i + \beta_3 age_i + \beta_3 age\_square_i + \mathcal{R}_i + \varepsilon_i \quad (4)$$

The  $\beta_1$  from equation (5) gives the direct effect of the policy.

We also check robustness of our result by changing different age windows. We also perform the robustness check by using different survey data. Moreover, we also use difference-in-differences (DID) method to check consistence of our baseline estimates. Identification of DID estimation rests on regional variation and age variation. Although the program was introduced nationwide, the policy mainly focused on remotes areas where the school drop-out rates were high. Government also mainly targeted the remote and rural areas where the school drop-out rates were high twice compare to other urban areas. We hypotheses that the education policy has significant impact on the remotes townships. In 1992 the government started the education sector

study (ESS) by cooperation with UNDP and UNESCO. According to the education sector study (ESS), dropout rate of the remote area and rural areas were high more than twice compared to urban areas. Therefore, the regional birth creates the first variation. The townships are separated as treatment and control groups based on remote townships. The list of remote townships are officially reported by government General Administrative Department under Ministry of President Office (It used to be under Ministry of Home Affair before 2017).

Basic education system in Myanmar is comprised by 5-4-2 (primary school, middle school, and high school). Children whose age above 11 have generally completed the primary school. Since the entrance age is five (5+) years at the time of school commencement date, parents have to send their children to school. Prior to the reform, there was no such education reform and both parent and children were never motivated to go to school. Therefore, the respondents whose age  $\leq 11$  in 1990 were affected by the policy. This age cohort groups create the second variation of the program.

The interaction between age cohort groups and treatment township jointly determines the impact of education policy. Under the parallel trend assumption, the standard Difference-in-Differences (DID) is used to estimate the long-term effect of education policy on child mortality and labor outcomes. To estimate the policy impact, the following regression model is used:

$$M_{ijk} = \beta_0 + \beta_1 Age\ Cohort_i + \beta_2 Treatment\ township_i + \beta_3 Age\ Cohort_i * Treatment\ township_i + \beta_4 v_i + \mathcal{R}_i + \varepsilon_i \quad (5)$$

Where  $M_{ijk}$  indicates child mortality for an individual  $i$ , in township  $j$  and cohort  $k$ . *Age Cohort* is a dummy variable (1 if age  $\leq 11$  in 1990 and 0 otherwise).  $v_i$  is the vector of individual characteristics.  $\mathcal{R}$  represents household fixed effect and regional fixed effect.  $\varepsilon_i$  is an error term. The two dimensions of variation based on age cohort groups and treatment township jointly determine the long-term impact of education policy on child mortality and labor outcomes. The coefficient of the difference in differences of the two dimensions of variation ( $\beta_3$ ) can be interpreted as the causal effect of the policy.

Investing in educational infrastructures can cause an increase in the year of schooling and then increase in earnings is the basic concept of development economists (Duflo, 2001). Therefore, The EFA policy increases the educational attainment and then

it impacts on the occupations. However, the DHS and 2014 census surveys did not cover the wage question. Therefore, we only use the occupations question to analyze the labor outcomes, which are labor force participation and working in elementary sectors. According to the International Standard Classification of Occupations (ISCO), the occupations are classified into 10 major groups namely: “Managers, Professional, Technicians and associate professionals, Clerical support workers, Service and sales workers, Skilled agricultural, forestry and fishery workers, Craft and related trades workers, Plant and machine operators, and assemblers, Elementary occupations, Armed forces occupations”. Conceptually more educated persons participate more in the current labor force and work less in elementary sectors. In order to test this assumption, the following regression model is applied:

$$\varphi_{ijk} = \beta_0 + \beta_1 \text{Age Cohort}_i + \beta_2 \text{Treatment township}_i + \beta_3 \text{Age Cohort}_i * \text{Treatment township}_i + \beta_4 v_i + \mathcal{R}_i + \varepsilon_i \quad (6)$$

Where  $\varphi_{ijk}$  represents labor force participation and working in elementary sector of the individual  $i$  in 2015 in township  $j$  and in cohort  $k$ .  $v_i$  is a vector of other control variables.  $\mathcal{R}_i$  is regional and household fixed effect.  $\varepsilon_i$  is the error term.

## 2.5 Result and discussion

### 2.5.1 First stage regression and graphical presentation

For binary dependent variables, the IV-Probit model is used and report as the marginal coefficient (the predicted probability) the casual effect of year of schooling on the outcomes. To capture the variation in child mortality among the respondent, non-linear regression forms is more plausible. Table 2.2 of panel B shows the first stage regression results. The instrument in this study is valid because the F-statistic of the first stage regression is significantly greater than 10. Moreover, we also provide the manipulation test. The test shows that there is no statistical evidence of systematic manipulation on the running variable (age).

Figure 2.1 show the graphical presentation of policy impact on year of schooling, infant mortality, neonatal mortality, and child alive. We see the year of education increased significantly in young age group which was impacted by the compulsory primary education policy. The figure also shows neonatal mortality, infant mortality, and child mortality under age 5 significantly decreased in young age group.

### **2.5.2 The causal impact of mother education on child mortality**

Panel A of Table 2.2 shows the main estimation results of mother education on child mortality (neonatal mortality, infant mortality, mortality under age five, mortality age 5-14, and mortality every born). The coefficients of years of schooling is significantly negative at 1% level. Therefore, education significantly reduces neonatal mortality, infant mortality, mortality under age five, mortality age 5-14, and mortality of every born children. The result shows that increasing additional year of education reduces the probability of neonatal mortality by 28.0 percentage point on average. By the same token, education has a similar effect on infant mortality, under five mortality, age 5-14 mortality, and every born mortality. Additional year of education reduce the probability of infant mortality, under five mortality, age 5-14 mortality, and every born mortality by 31.5, 30.5, 27.0, and 26.5 percentage point respectively. This is probably due to the fact that the more educated mothers have more awareness of family health, pre- and post-pregnant care and delivery care.

Interestingly, the household that made a joint decision in family matters has a positive effect on child mortality. The results are statistically at 1% and 5 % respectively. Moreover, all results show that child mortality decrease in rural families compare to urban families. This indicates that the education policy has more benefits for rural families compare to urban families. Although the breastfeeding reduces the child mortality the result is not statistically significant. The coefficients of household that has electricity and telephone are significant and positive, but the magnitude is smaller than that of education impact. Therefore, housing characteristics is not as important as education in reducing child mortality. The estimation result for the number of children age under five and children ever born in the family has a negative, so it is logically consistence. If a mother born more children, the likelihood of child mortality is higher.

Table 2.2 of Panel B shows the first stage of the regression result. We found that the year of schooling significantly increase in young age cohorts impacted by policy compares to old age cohorts who were not impacted by the policy. The year of schooling increases by 0.287 years on average in young cohort group compares to old cohort group. We also find a number of children and mother education conversely relates. The F statistic is also larger than 10, so we can safely use the exposure to policy (1 if age $\leq$ 11 in 1990 and 0 otherwise) as an instrument for years of schooling. The

results are significant of controlling for housing characteristics, the regional fixed effect, and household fixed effect.

### **2.5.3 The effect of education policy on early childhood learning**

We also examine the differential effect of mother education on early childhood learning. Early childhood is considered as the most important for child development and their adult development. Early childhood learning can be generally specified two ways: learning from books and learning from others. It can contribute physically, emotionally, and socially and intellectually development of the child for their adulthood. Early childhood learning is important for child development in their early and adult age. Investment in early childhood development gives a high return for their future life (Rolnick & Grunewald, 2003; Grunewald & Rolnick, 2006). We measure both formal and informal teaching to analysis the impact of education on early childhood development. We use the number of children book parent bought, parent reading book to children, parent telling story to children, parent singing songs to children, parent bring children outside home (such as garden and playground), parent playing with children, and child playing with toys as the proxy for early childhood learning.

Panel A of Table 2.3 shows the impact of education on the number of purchase books, parent read and tell the story to the child, parent sings songs to the child. We find that the more educated parents buy more books for children than less educated parents. Column 1 shows that increasing additional year of education leads to increase the number of child-books by 0.34 on average. Reading, telling story, and signing songs for kids are also found similar effect of the mother year of schooling. The result shows that increasing one more year of schooling leads to average increase in mother reading book, telling story, and singing songs to children by 23.9, 30.0, 31.0 percentage point respectively. We find a large impact of education on early childhood learning. All results are statistically significant at 1% level. The results indicate that more educated mother more care more on early childhood development.

Panel B of Table 2.3 reports the estimation results of the parent bringing the child outside home (such as garden and playground), parent playing with child, and child playing with toys (homemade toys, manufacturing toys, and household items). We find the positive effect of education on all outcomes. The estimation results show that the increase in the additional year of schooling lead to an average increase in the

probability of parents brings children outside home and playing with children by 25.2 percentage point and 21.6 percentage point. The results are significant at 5% level except the parent the playing with children. It indicates that more educated parents care more on their children and give more time for their children. Panel B of column 3, 4 and 5 shows that positive effect of education on children playing with different type of toys. The results indicate that the increase in year of schooling by one lead to increase the probability of children playing with homemade toys, manufacture toys, and household items, on average, by 29.6, 26.0, and 29.6 percentage point respectively. All results are statistically significant at 1% level. Therefore, we could conclude that mother education is very important not only to reduce child mortality but also to improve early childhood development. All results show that the more educated mother more interacts with their children and give more time for parenting.

#### **2.5.4 Education and fertility preference**

In this subsection we analyze the impact of mother education on fertility preference. Table 2.4 presents the impact of education on age at 1st birth, fertility preference, marriage to 1st birth, and contraceptive use. We find that the positive effect of education on women's age at first birth. The result shows that increasing additional year of education tends to increase the age at first birth by 1.147 year on average. We could translate that the more educated women are less likely to get marriage at their early age. Marrying early potentially has social conflict, poor mental health, malnutrition and then its impact on their children. The result shows the educated person could avoid the early marriage.

In column 2, we analyze the impact of education on fertility preference which is a dummy (1 if female want another child and zero otherwise). We find the positive effect of education on fertility preference. The result indicates that the additional year of education lead to increasing in the probability of willing to have child by 0.279 or 27.9 percentage point. It indicates that the preference on children is higher in more educated mother compare to less educated mother. Moreover, we find the more educated mothers want the ideal number of children 3 children while less educated mothers want more than 3 children. The result is statistically significant at 1% level.

In column 3 we also find the negative effect of education on duration of marriage to first birth. That is consistence with our assumption that the more educated women get late marriage and willing to have baby when they get marriage. It indicates

that the more educated women prepare more time to get marriage and then they try to get baby after marrying. Therefore, we find the negative effect of education on time from marriage to first birth. The result shows that additional year of schooling decrease on average the duration of marriage to first birth by 0.30 year.

Column 4 and 5 present the effect of education on “know ovulatory cycle” and “Contraceptive Use” which all are dummy variables. The coefficient of education is positive on both variables. The results show that increasing the additional year of education tends to increase the probability of knowing the ovulatory cycle and contraceptive use by 32.8 and 33.7 percentage point respectively. Therefore, we find the more educated female has more knowledge about the ovulatory cycle. Moreover, education has a positive causal impact on contraceptive use. Our finding is consistent with existing literature (Shapiro & Tambashe, 1994; Ainsworth et al., 1996; Tawiah, 1997; and Larsson & Stanfors, 2014).

### **2.5.5 Education and labor outcomes**

In this section we explore the effect of policy on labor outcomes. Table 2.5 shows the long-term effect of policy on labor outcomes. Since the data only cover occupation groups and current working condition, we are unable to study the policy impact on income directly. Instead of income, we study the effect of education on occupation and working condition. We categorize the occupation by two groups which are elementary sectors and other sectors. According to international labor organization (ILO), elementary sector means workers have to use of hand-held tools and physical efforts. It generally involves the labors such as cleaners, helpers, agricultural labors, forestry, fishery, mining, construction, manufacturing, transport, food preparation assistants, street sales, and refuse workers.

Column 1 shows the impact of education on working condition which is a dummy variable (1 if currently working and 0 otherwise). We find that increasing additional year of education leads to the increase in the probability of participating in labor force by 0.32 or 32.0 percentage point. The result is highly significant at 1% level. In Myanmar, the labors force participation was 12.4 million for male and 9.5 million for female in 2015. According to 2015 labor force survey, the employment rate was 99.2 percent and labor force participation rate were 64.7 percent. The female labor force participation is increasing in Myanmar. Column 2 shows that the coefficient of education on female working in the elementary sector. We find that the more educated

female less likely to work in the elementary sector. This can be seen as the labor transformation from basic sector (unskilled and physical workers) to services and manufacturing sectors (skilled and intellectual workers). The result indicates increasing additional year of education tends to decrease the probability of working in the elementary sector by 33.0 percentage point on average. The result is consistent with existing literature (Akresh et.al., 2018). We also control for housing characteristics, regional fixed effect, and household fixed effect. Results are highly significant at 1% level. Therefore, we could conclude that the more educated females participate more in current labor force and work less in elementary sector.

### **2.5.6 Direct impact of policy on outcomes (or) Intent-to-Treat Effect (ITT)**

We also examine the direct effect of policy on child mortality, early childhood learning, and labor outcomes by using the reduced form regression. It gives the impact of policy regardless of whether or not those in the treatment group actually enroll in the program. In the absence of full compliance in the treatment group, ITT estimates gives a comparison of average outcomes between treatment (all people who were assigned to treatment group: participant and non-participant) group and control group. We find that the reduced form regression for child mortality is consistent with RDD estimates and statistically significant at 5% level although the magnitude of the policy impact is changed slightly. Moreover, the reduced form regression from early childhood learning gives consistent results with our baseline estimates. For the labor outcome, ITT gives similar and consistent results with our baseline estimates. The results of the reduced form regression or ITT are presented in Table 2.6, Table 2.7, and Table 2.8 respectively.

## **2.6 Assessing the identification strategy**

### **2.6.1 Robustness check (using various age windows)**

As a robustness check for baseline estimates, we use various sub-sample by using different bandwidths of age. We employ five different bandwidths of the age in 1991 ranging from: Age (3 -22), Age (4-21), Age (5-15), Age (6-14), and Age (8-12). The robustness check for neonatal mortality, infant mortality, child mortality, adult mortality age (5-14), and mortality of children ever born are presented in Table 2.9. Column 1 show the probability of neonatal mortality of different age windows. We find



the negative of coefficient of education for neonatal mortality in all age windows. Moreover, the magnitudes are very similar for all age windows and all results are statistically significant at 1%. Therefore, we find the estimation results for neonatal mortality are very robust to changing different age windows.

Column 2 shows the impact of years of schooling on infant mortality with different bandwidth of the age. We find coefficient of education is negative and significant for infant mortality in all age specification. The results of robustness check are very similar with our baseline estimates. In column 3, we present the result of under five-year mortality. In all differences of bandwidths of age, the results are very robust and consistence. The coefficient on years of schooling is significantly negative at 1 level.

Column 4 and 5 show the outcomes for adult mortality (age 5 to 14) and overall mortality (children ever born in the family). The results show that additional year of education of the mother reduce the probability of adult mortality by 0.316 or 31.6 percentage point. Similarly, mortality of children ever born in the family reduce by 31.4 percentage point. All results are similar and statistically significant at 1% level. The results indicate that mother year of schooling has a causal impact on child mortality. All result are statistically significant, robust and consistent.

### **2.6.2 Robustness check (using different survey data)**

We also check the robustness of our baseline estimates by using the census data. However, we could only check child mortality and labor outcomes because the 2014 census data provides limited information on children compares to DHS data. Table 2.10 presents the summary statistics of the census survey data.

Table 2.10 presents the RDD estimation results using census data. Columns 1 and 2 show the impact of mother year of schooling on working status and working sector. The result indicates that the more educated mother participates more in the current labor force. It shows that increasing the additional year of education tends to increase the probability of currently working by 0.311 or 31.1 percentage point, which is very similar with our baseline estimate. The result is statistically significant at 1% level. Moreover, the coefficient of years of schooling on working in elementary sector is negative and significant at 1% level. The result indicates that female with more year of schooling are less likely to work in the elementary sectors. The result is robust, consistent and statistically significant. The result shows that the additional year of

female education lead to decrease the probability of working in the elementary sector by 0.172 or 17.2 percentage point, which is slightly smaller than our baseline estimate. The impact of education on child mortality is not statistically significant. We are unable to analyze specific mortality like our baseline estimates because census survey data only provide very limited information.

### **2.6.3 Robustness check (using different survey data with DID method)**

We also check the robustness of our baseline estimates and the long-term impact of policy on child mortality and labor outcomes by using the census data and difference-in-differences (DID) method. Although the program was introduced nationwide, the policy mainly focused on remotes areas where the school drop-out rates were high. Government also mainly targeted the remote area and a rural area where the school drop-out rates were high twice compare to other urban areas. Therefore, we hypothesize that the education policy has more benefit for the remote townships. The youngest cohort and treatment township jointly determine the policy effect. Table 2.12 shows the DID estimation results of labor outcomes and child mortality.

Table 2.12 of column 1 shows the effect of EFA policy on child mortality. The interaction effect of age cohort and treatment township shows the policy impact on child mortality. The result shows that child mortality decrease by 1.62% (0.0162). The result shows that child mortality significantly decreases in young cohort groups who were impacted by the policy compares to old cohort group who were not impacted by the policy. In column 2 and 3 shows the effect of policy on current working status and working in the elementary sector. The interaction effect on currently working is not significant. However, we find a negative coefficient of the interaction term on working in elementary sectors. The result shows that the interaction effect reduces the probability of working in the elementary sector by (0.035) or 3.5 percentage point. We also find a significant effect of policy on labor outcomes of young cohort group. The young age group is more likely to participate in the current labor force compares to the old age group. Moreover, the young group is less likely to work in the elementary sectors. Although not all coefficients are significant, we find the DID estimation results are consistence with RDD estimation results.

## 2.7 Potential channel of causality

In this section, we provide the potential channel through which mother education may have affected child mortality. The important channels of mother education are that the more educated mother more care on pre-post antenatal care and delivery care which significantly contribute in reducing child mortality. We show the impact of maternal education on mother behavior such as pre-antennal care, delivery care, and post-antennal care. The regression results for potential channels of causality are presented in Table 2.13.

Panel A shows the impact of mother education on pre-antennal care. The coefficient of mother year of schooling is positive. The result shows that the increase in an additional year of education tend to increase the number of parental visits during pregnancy by 0.241 on average, but the result is not statistically significant. The coefficient on years of schooling is positive and statistically significant at 1% level for antennal care with the health professionals. The additional year of schooling tends to increase the probability of antennal care with health professionals increase on average by 28.3 percentage points (0.283). Moreover, we find the more educated mother uses more iron pill during pregnancy. Iron pill is one of the best ways for pregnancy supplements. When a woman has a pregnant, she needs twice amount of iron than normal time. According to the world health organization (WHO) guideline, a pregnant woman needs the iron supplementation from 30mg to 60mg per day to prevent low birth weight, preterm birth, maternal anaemia, and puerperal sepsis. The result shows that the additional year of mother education leads to increase the probability of using iron pills during pregnancy period by 27.6 percentage points or (0.276). The result is highly significant at 1% level.

Panel B shows the impact of mother education on delivery care. Colum 1 shows the effect of mother education on tetanus injection before delivery. The tetanus injection is very important for pregnant women to prevent neonatal mortality. The WHO also recommends that all pregnant women need to receive the tetanus toxoid vaccination to prevent neonatal mortality. We find the more educated mother receives more the tetanus injection before delivery. The result shows that increasing additional year of mother education leads to increasing the probability of receiving tetanus toxoid vaccination by 0.245 or 24.5 percentage point. The result is statistically significant at the 5 % level. The coefficient of mother education is positive for place of delivery care.

We find an increase in additional year of mother education tend to increase the probability of mother who delivers at the hospital by 0.014 or 1.40 percentage point, but the result is not significant. Hospital includes public, private and medical centers. We also find positive and statistically significant effect of education on pregnant women who deliver with a midwife and health professional. The result show that the increase in one year of education increase, on average, the probability of women delivers with midwife and health professionals by 25.1 percentage points. Therefore, we point out that the more educated mother more cares on child delivery.

Panel C shows the impact of mother education on post-antennal care. Column 1 shows the impact of mother education on newborn baby's physical examination with health professional which is relatively important for child survival. The result is positive and statistically significant at 1%. It indicates that more educated mothers more check the health of the newborn baby with health professionals. We find that increasing additional year of mother education tend to increase the probability of using health professional to check the newborn baby physical examination by 33.5 percentage points. Moreover, we find the positive effect of mother education on using antibiotic pills, giving antimotility, and giving an antibiotic injection. Antibiotic pills, antimotility drug, and antibiotic injection are necessarily important to prevent bacteria infection. The results show that the increase in the additional year of mother education leads to increasing the probability of using antibiotic pills, antimotility drug, and antibiotic injection by 16.8, 30.6, and 9.3 percentage point respectively. Over all, we find that the more educated mother more care on pregnancy period, delivery period, and post delivery period. According to WHO, mothers are less likely to lose their baby by 16 % if they receive midwife-led continuity of care (MLCC) provided by health professional. The results indicate that mother with more year of schooling care more one pre-post antennal and delivery. Therefore, we find the mother education significantly reduces the child mortality through the channel of pre-post antenatal care and deliver care.

## **2.8 Conclusion**

This is the first paper that examines the causal effect of maternal education on child mortality, early childhood learning, fertility preference, and labor outcomes in Myanmar by using EFA policy. The uniqueness of this paper is that the policy used in this paper was implemented under the military regime in 1990, and the survey was

conducted in 2014 and 2015 which is under the democratic regime. We study the long-term impact of the policy on current mortality, pre-post antenatal care and delivery care, early childhood learning, and labor outcomes.

We use fuzzy regression discontinuity design (RDD) as a main model and difference in differences (DID) estimates for robustness check. The policy encouraged every school age child to go to school and every parent sent their children to school. Therefore, it generated a discontinuous increase in the year of schooling of young age cohort. To estimate the causal impact of mother education on outcomes of interest we use fuzzy regression discontinuity (RDD) design. We apply the exposure to policy which is a dummy variable (1 if age $\leq$ 11 in 1990 and 0 otherwise) as an instrument for a year of schooling. We find mother education significantly reduces neonatal mortality, infant mortality, mortality under age five, mortality age 5-14, and mortality every born. We find the positive effect of mother education on outcomes of interest. Both models show a consistent and a similar result of the education on outcome variables. We find that compulsory primary education policy implemented under the military government has the significant benefits on current households. We point out that compulsory education policy implemented under any kind of political system has a positive long-term impact on current households.

The results also indicate that the more educated parents are more likely to care about early childhood learning compares to less educated mother. We find more educated mother more interact with children and give more time for early childhood learning such as buying children's books, reading book to children, telling stories to children, singing the songs to children, playing with children, bring the children outside home, buying toys for children, and creating homemade toys for children. All these outcomes are highly significant.

Moreover, we find that the more educated women prepare more time to get marriage. The result shows that mother education has a positive and significant impact on age at first birth. It indicates that more educated female are less likely to get marriage in their early life. We find that the negative effect of mother education on duration of marriage to first birth. This is probably due to the fact that educated female gets marry late and then when they got marriage, they are willing to have a baby. We also find positive and significant effect of mother education on contraceptive use which is consistent with existing literatures. Moreover, we find that the more educated mother

is more likely to participate in the current labor force. The results also point out that the mother who effected by policy is less likely to work in the elementary sector.

We provide the robustness checks by using different age windows. We also test the robustness of our baseline estimation by using different survey data and a different method. We use census data to check the robustness of our baseline estimates. We apply both RDD and DID method by using census data. We find that both estimation results are robust and consistence with our baseline estimates. We then examine the potential channel of causality of mother education and child mortality. We find that mother year of schooling has significantly increase the probability of pre-antennal care with a health professional, and using iron pill during pregnant. We also find a significant positive effect of mother education on delivery care such as tetanus injection before delivery, mother who delivers at the hospital, and deliver with a health professional. We show the positive effect of mother education on post-antenatal care such as checking the baby with a health professional after delivery, taking antibiotic pills for baby, giving antimotility to baby, and giving antibiotic injection to baby. Therefore, we explore that the mother education has significant impact on child mortality through the channel of increasing pre-post antenatal care and delivery care.

The findings in this paper point out the importance of compulsory education policy (Education For All) which has a significant long-term effect on households. Although the return of education on wage are unable to provide due to data limitation, we find that the policy increased the year of schooling and then decrease the likelihood of working in elementary sectors, and increase the female labor force participation. We also find the positive effect of mother education on child mortality, and early childhood learning. The empirical results show the importance of mother education. More importantly the compulsory education policy works regardless of the political system. Although the EFA policy was implemented under the military regime it has a significant impact on current households. Education is very important for human capital, so the government should implement not only compulsory primary education policy but also compulsory secondary education policy. The government should guarantee that every school age children must have a right to access formal education. Since the secondary school drop-out rate is still high in Myanmar, the government should set up an effective policy for all school age children to complete at least secondary education. Moreover, the government should use the education policy to reduce child mortality and to improve labor market.

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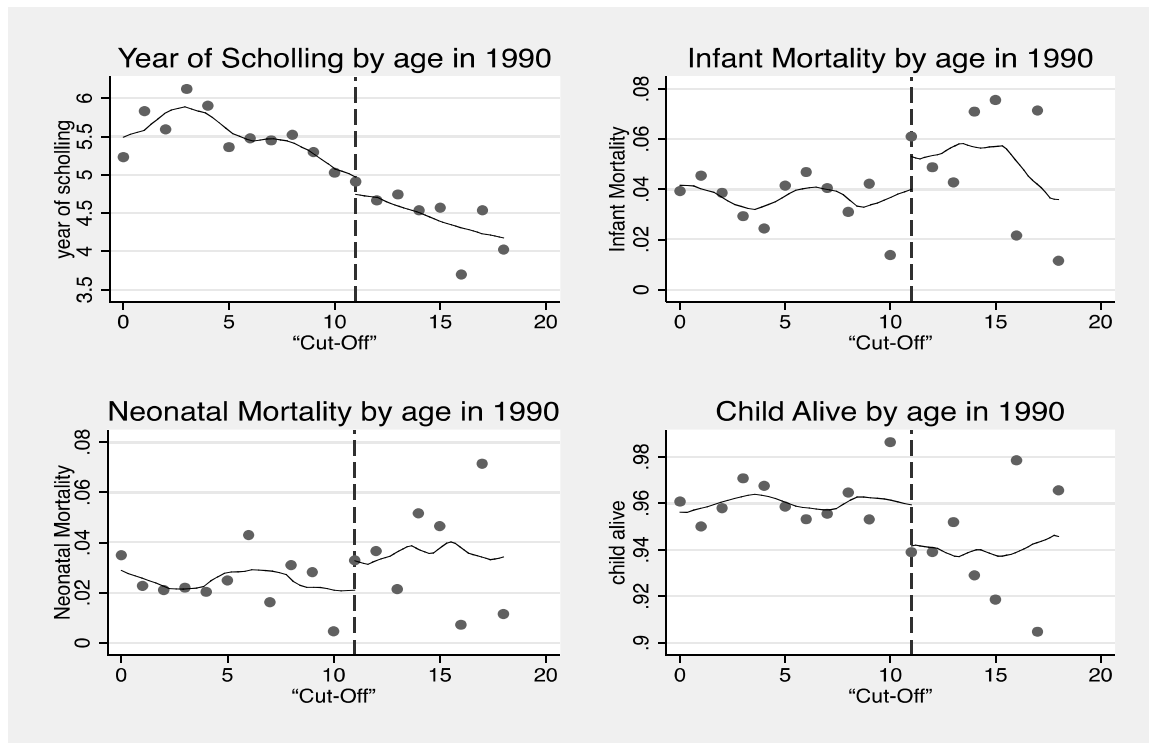
## Appendix B

**Table 2.1 Descriptive statistics**

Variable	Obs	Mean	Std.Dev.	Min	Max
<b>Panel A: Child Mortality</b>					
Neonatal Mortality (age <1 month)	22989	.039	.194	0	1
Infant Mortality (age <1 year)	22989	.075	.263	0	1
Infant Mortality (age <5 years)	22989	.096	.295	0	1
Mortality (age ≥5 & age <15)	22989	.104	.305	0	1
Mortality (Children Ever Born)	22989	.107	.309	0	1
<b>Panel B: Early Childhood Learning</b>					
# of Purchased Books	10547	.258	1.073	0	10
Parent Reading Book to Children	10550	.338	.473	0	1
Parent Telling Story to Children	10550	.043	.202	0	1
Parent Singing Song to Children	10550	.043	.202	0	1
Parent Took Children Outside	10550	.142	.349	0	1
Parent Playing with Children	10550	.103	.303	0	1
Children Playing with Manufactured Toy	10531	.671	.47	0	1
Children Playing with Homemade Toy	10522	.544	.498	0	1
Children Playing with Household Items	10528	.771	.42	0	1
<b>Panel C: Pregnancy Care and Deliver Care</b>					
# of Parental Visit during Pregnancy	3865	5.472	9.195	0	20
Parental Visit to doctor (Yes=1)	3867	.269	.443	0	1
Prenatal (Midwife/Community Health Center)	3867	.01	.097	0	1
Use Iron Pill (Yes=1)	4575	.063	.243	0	1
Tetanus injections Before Giving Birth	1118	.096	.294	0	1
Gives Birth with doctor	4815	.291	.454	0	1
Give Birth Midwife	4815	.077	.267	0	1
Age 1 <sup>st</sup> Birth	22989	21.325	4.163	12	43
<b>Panel D: Fertility Preference</b>					
Fertility Preference (Want more Children=1)	22059	.216	.411	0	1
Marriage 1 <sup>st</sup> birth (Month)	22988	81.595	230.177	0	275
Use Contraceptive	22989	.42	.494	0	1
<b>Panel E: Labor Outcomes</b>					
Currently Working (Yes=1)	22979	.621	.485	0	1
Working in Elementary Sector (Yes=1)	22942	.788	.409	0	1
<b>Panel F: House and Mother Characteristics</b>					
Mother Year of Schooling	22985	5.063	3.855	0	16
Exposure to Policy (Young Cohort=1)	22989	.311	.463	0	1
Age in 1990	22989	14.041	7.377	-10	25

Age Square/100	22989	15.149	5.397	2.25	24.01
# of Children (Under 5)	22989	.838	.876	0	5
# of Children (Ever Born)	22989	4.228	2.328	1	12
HH Has Electricity	22621	.545	.498	0	1
HH Has Telephone	22621	.056	.23	0	1
Rural Residence	22989	.786	.41	0	1
Child (Twin)	22989	.019	.138	0	1
Breastfeeding (Yes=1)	4815	.973	.163	0	1
Joint Family Decision for HH Affair (Yes=1)	22989	.219	.414	0	1

**Figure 2.1 Graphical Analysis**



Note: Treatment age group is (Age $\leq$ 11 in 1990) impacted by the policy.

**Table 2.2 The effect of mother education on child mortality**

Variable	(1)	(2)	(3)	(4)	(5)
	Child Mortality				
	Neonatal (Under 1 month)	Infant (Under one year)	(Under 5 years)	(Age 5-14)	(Ever Born)
<b>Panel A: Main Results</b>					
Mother Year of Schooling	-0.280*** (0.0374)	-0.315*** (0.018)	-0.305*** (0.019)	-0.270*** (0.019)	-0.265*** (0.019)
Mother Age	0.079*** (0.022)	0.065*** (0.018)	0.058*** (0.016)	0.058*** (0.016)	0.058*** (0.016)
Mother Age Square	-0.144*** (0.052)	-0.115** (0.045)	-0.103*** (0.038)	-0.103*** (0.038)	-0.103*** (0.038)
# of Children (under 5)	-0.332* (0.198)	-0.248 (0.171)	-0.276 (0.220)	-0.276 (0.220)	-0.276 (0.220)
# Children (ever born)	-0.0727 (0.074)	-0.103 (0.072)	-0.103 (0.076)	-0.103 (0.076)	-0.103 (0.076)
Has Electricity	0.273*** (0.081)	0.313*** (0.069)	0.306*** (0.066)	0.306*** (0.066)	0.306*** (0.066)
Has Telephone	0.365** (0.158)	0.473*** (0.172)	0.483*** (0.187)	0.483*** (0.187)	0.483*** (0.187)
Rural Residence	-0.606*** (0.091)	-0.634*** (0.059)	-0.626*** (0.068)	-0.626*** (0.068)	-0.626*** (0.068)
Child (Twin)	0.686* (0.372)	0.510** (0.263)	0.559* (0.326)	0.559* (0.326)	0.559* (0.326)
Breastfeeding	-0.760 (0.475)	-0.504 (0.375)	-0.512 (0.416)	-0.512 (0.416)	-0.512 (0.416)
Joint Family Decision	0.108*** (0.036)	0.0738** (0.031)	0.0865*** (0.033)	0.0865*** (0.033)	0.0865*** (0.033)
Cons	3.186*** (0.219)	3.170*** (0.251)	3.100*** (0.230)	3.100*** (0.230)	3.100*** (0.230)
<b>Panel B: Year of Schooling – First Stage</b>					
Young Cohort	0.287** (0.143)	0.287** (0.143)	0.287** (0.143)	0.287** (0.143)	0.287** (0.143)
Mother Age	0.187*** (0.044)	0.187*** (0.044)	0.187*** (0.044)	0.187*** (0.044)	0.187*** (0.044)
Mother Age Square	-0.224*** (0.062)	-0.224*** (0.062)	-0.224*** (0.062)	-0.224*** (0.062)	-0.224*** (0.062)
# of Children (under 5)	-0.002 (0.100)	-0.002 (0.100)	-0.002 (0.100)	-0.002 (0.100)	-0.002 (0.100)
# Children (ever born)	-0.577*** (0.059)	-0.577*** (0.059)	-0.577*** (0.059)	-0.577*** (0.059)	-0.577*** (0.059)
HH Has Electricity	1.019*** (0.203)	1.019*** (0.203)	1.019*** (0.203)	1.019*** (0.203)	1.019*** (0.203)
HH Has Telephone	1.797*** (0.269)	1.797*** (0.269)	1.797*** (0.269)	1.797*** (0.269)	1.797*** (0.269)
Rural Residence	-2.156*** (0.098)	-2.156*** (0.098)	-2.156*** (0.098)	-2.156*** (0.098)	-2.156*** (0.098)

Child (Twin)	0.425 (0.434)	0.425 (0.434)	0.425 (0.434)	0.425 (0.434)	0.425 (0.434)
Breastfeeding	0.0459 (0.187)	0.0459 (0.187)	0.0459 (0.187)	0.0459 (0.187)	0.0459 (0.187)
Joint Family Decision	0.237* (0.129)	0.237* (0.129)	0.237* (0.129)	0.237* (0.129)	0.237* (0.129)
Cons	8.760*** (0.557)	8.760*** (0.557)	8.760*** (0.557)	8.760*** (0.557)	8.760*** (0.557)
Observation	4641	4641	4641	4641	4641
Regional FE	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES
adj. R2	0.291	0.291	0.291	0.291	0.291
F	249.1	249.1	249.1	249.1	249.1
athrho2_1	1.637** (0.645)	1.964** (0.778)	1.909** (0.858)	1.909** (0.858)	1.909** (0.858)
lnsigma2	1.141*** (0.0167)	1.141*** (0.0167)	1.141*** (0.0167)	1.141*** (0.0167)	1.141*** (0.0167)

Note: Table 4 Panel A reports 2nd Stage and Panel B reports 1st Stage. We instrument years of schooling by using young cohorts (1 if age $\leq$ 11 in 1990 and 0 otherwise). Infant mortality is the death of children under the age of one. Neo-natal mortality is the death of children during the first 28 days. HH has electricity, telephone, breastfeeding, and joint family decision are dummies (1 if “yes” and 0 if “no”). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.3 The effect of mother education on early childhood learning**

Variable	Panel A: Purchase; Read; Told Story; Sang Song				Panel B: Playing with Parent and Toy				
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(5)
Mother Year of Schooling	0.335*** (0.007)	0.239*** (0.06)	0.300*** (0.025)	0.310*** (0.025)	0.252** (0.114)	0.216 (0.149)	0.296*** (0.031)	0.260*** (0.096)	0.296*** (0.043)
Mother Age	-0.014 (0.027)	-0.033 (0.024)	-0.032 (0.029)	-0.032 (0.029)	-0.053** (0.021)	0.010 (0.079)	-0.016 (0.022)	-0.014 (0.042)	-0.052*** (0.016)
Mother Age Square	0.025 (0.037)	0.049 (0.033)	0.045 (0.042)	0.045 (0.042)	0.074*** (0.024)	-0.0003 (0.109)	0.040 (0.028)	0.027 (0.055)	0.078*** (0.022)
# Children (under 5)	0.059** (0.029)	0.254** (0.120)	0.043 (0.037)	0.043 (0.037)	0.172 (0.108)	0.122* (0.064)	0.024 (0.039)	0.045** (0.022)	0.113 (0.072)
# Children (ever born)	0.163*** (0.024)	0.176*** (0.031)	0.170*** (0.032)	0.170*** (0.032)	0.152*** (0.074)	0.0701 (0.108)	0.106* (0.056)	0.118 (0.076)	0.186*** (0.020)
HH Has Electricity	-0.300*** (0.066)	-0.369*** (0.062)	-0.350*** (0.066)	-0.350*** (0.066)	-0.246** (0.123)	-0.288** (0.148)	-0.223** (0.089)	-0.313*** (0.050)	-0.342*** (0.052)
HH Has Telephone	-0.456*** (0.102)	-0.537*** (0.131)	-0.508*** (0.162)	-0.508*** (0.162)	-0.405 (0.285)	-0.357 (0.318)	-0.399*** (0.144)	-0.348 (0.317)	-0.553*** (0.158)
Rural Residence	0.552*** (0.067)	0.632*** (0.090)	0.566*** (0.087)	0.566*** (0.087)	0.496 (0.313)	0.139 (0.464)	0.459*** (0.137)	0.521* (0.285)	0.671*** (0.068)
Child (Twin)	-0.217 (0.163)	-0.374 (0.291)	-0.076 (0.199)	-0.076 (0.199)	-0.227 (0.212)	0.037 (0.200)	0.127 (0.266)	-0.237 (0.185)	-0.182 (0.197)
Breastfeeding	0.050 (0.039)	0.032 (0.060)	-0.037 (0.064)	-0.037 (0.064)	-0.096* (0.055)	-0.048 (0.136)	0.037 (0.043)	0.087 (0.122)	0.068 (0.135)

Joint Family Decision	-0.063 (0.039)	-0.063* (0.035)	0.010 (0.092)	0.010 (0.092)	0.071 (0.143)	-0.027 (0.027)	0.040 (0.086)	0.076 (0.170)	-0.017 (0.064)
Cons	-3.156*** (0.230)	-3.015*** (0.298)	-3.243*** (0.354)	-3.243*** (0.354)	-3.259*** (0.333)	-2.442* (1.383)	-2.211*** (0.496)	-2.301** (0.995)	-2.888*** (0.281)
N	4499	4570	4489	4489	4539	4513	4551	4549	4561
adj. R <sup>2</sup>	0.290	0.315	0.291	0.251	0.271	0.210	0.211	0.270	0.265
Regional FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: I instrument years of schooling using young cohorts (1 if age<11 in 1990 and 0 otherwise). HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Joint Family Decision is a dummy variable (1 if Joint Family Decision and 0 otherwise). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.



**Table 2.4 The impact of mother education on fertility preference**

Variable	(1)	(2)	(3)	(4)	(5)
	Age of 1 <sup>st</sup> Birth	Fertility Preference	Marriage 1 <sup>st</sup> Birth	Know ovulatory cycle	Contraceptive Use
Mother Year of Schooling	1.147** (0.472)	0.279*** (0.024)	-0.300*** (0.038)	0.328*** (0.017)	0.337*** (0.007)
Mother Age	0.571*** (0.099)	-0.084*** (0.020)	0.038 (0.039)	-0.036 (0.025)	0.085 (0.075)
Mother Age Square	0.098 (0.151)	0.071** (0.029)	-0.030 (0.075)	0.045 (0.039)	-0.117 (0.110)
# Children (under 5)	1.446*** (0.143)	-0.032 (0.052)	0.001 (0.051)	0.015 (0.026)	-0.082** (0.041)
# Children (Ever born)	-1.408*** (0.276)	0.073** (0.037)	-0.188*** (0.019)	0.199*** (0.023)	0.185*** (0.014)
HH Has Electricity	-0.952 (0.605)	-0.232*** (0.068)	0.283*** (0.082)	-0.300*** (0.058)	-0.345*** (0.0933)
HH Has Telephone	-1.782* (1.025)	-0.383*** (0.109)	0.00 (.001)	-0.419** (0.163)	-0.518*** (0.128)
Rural Residence	2.512** (1.019)	0.808*** (0.042)	-0.778*** (0.121)	0.590*** (0.094)	0.821*** (0.098)
Child (Twin)	1.772*** (0.636)	-0.295 (0.262)	0.000 (.001)	-0.166 (0.115)	-0.090 (0.252)
Duration of Breastfeeding	-1.375*** (0.392)	0.010 (0.052)	0.092 (0.082)	0.0267 (0.143)	0.008 (0.195)
Joint Family Decision	-0.246 (0.188)	-0.025 (0.045)	0.064 (0.182)	-0.0768*** (0.027)	-0.0384 (0.109)
Cons	13.61*** (4.234)	-2.424*** (0.348)	2.979*** (0.353)	3.319*** (0.229)	-2.450*** (0.693)
Observation	4684	4656	3747	4684	2301
adj. R <sup>2</sup>	0.170	0.172	0.180	0.160	0.360
Regional FE	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES

Note: I instrument years of schooling using young cohorts (1 if age<11 and 0 otherwise). HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Joint Family Decision is a dummy variable (1 if Joint Family Decision and 0 otherwise). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.5 The impact of female education on labor outcomes**

Variable	(1)	(2)
	Currently Working	Elementary Sector
Year of Schooling	0.318*** (0.013)	-0.330*** (0.007)
Mother Age	0.039 (0.029)	-0.033* (0.019)
Mother Age Square	-0.058 (0.042)	0.0453 (0.031)
# of Children (under 5)	-0.123 (0.078)	0.136 (0.111)
# of Children (Ever born)	0.186*** (0.021)	-0.169*** (0.063)
HH Has Electricity	-0.328*** (0.046)	0.215 (0.288)
HH Has Telephone	-0.564*** (0.102)	0.499 (0.312)
Rural Residence	0.710*** (0.046)	-0.581 (0.384)
Child (Twin)	-0.282 (0.298)	0.432 (0.556)
Breastfeeding	-0.075 (0.0870)	0.138 (0.143)
Joint Family Decision	0.087 (0.342)	-0.095 (0.450)
Cons	-2.069*** (0.398) (0.023)	2.352*** (0.422) (0.023)
N	2956	2945
adj. R <sup>2</sup>	0.210	0.171
Regional FE	YES	YES
HH FE	YES	YES

Note: We instrument years of schooling by using young cohorts (1 if age<11 in 1990 and 0 otherwise). HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Currently working is dummy variable (1 if currently working and 0 otherwise). Elementary sector is that workers have to use hand-held tools and physical effort. Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.6 Intent-to-Treat: The impact of mother education on child mortality**

Variable	(1)	(2)	(3)	(4)	(5)
	Child Mortality				
	Neonatal (Under 1 month)	Infant (Under one year)	(Under 5 years)	(Age 5-14)	(Ever Born)
Exposure to Policy	-0.010** (0.004)	-0.023** (0.008)	-0.025** (0.010)	-0.020** (0.010)	-0.024** (0.010)
Mother Age	0.003*** (0.001)	0.004 (0.003)	0.006 (0.003)	0.004 (0.003)	0.007 (0.003)
Mother Age Square/100	-0.009*** (0.001)	-0.014*** (0.005)	-0.012** (0.005)	-0.012** (0.005)	-0.012** (0.005)
# of Children (under 5)	-0.039*** (0.004)	-0.061*** (0.005)	-0.073*** (0.008)	-0.053*** (0.008)	-0.042*** (0.008)
# Children (ever born)	0.013*** (0.001)	0.022*** (0.002)	0.027*** (0.002)	0.023*** (0.002)	0.021*** (0.002)
Has Electricity	0.002 (0.003)	0.005** (0.002)	0.003** (0.001)	0.002** (0.001)	0.002** (0.001)
Has Telephone	-0.005 (0.006)	-0.010 (0.006)	-0.008 (0.007)	-0.008 (0.007)	-0.008 (0.007)
Rural Residence	0.006*** (0.001)	0.009*** (0.002)	0.014*** (0.003)	0.011*** (0.003)	0.011*** (0.003)
Child (Twin)	0.174** (0.043)	0.196** (0.045)	0.219** (0.031)	0.219** (0.031)	0.219** (0.031)
Breastfeeding	-0.400*** (0.033)	-0.416*** (0.023)	-0.421*** (0.022)	-0.401*** (0.022)	-0.408*** (0.022)
Joint Family Decision	0.004 (0.005)	-0.001 (0.005)	0.003 (0.006)	0.003 (0.006)	0.003 (0.006)
Cons	0.509*** (0.034)	0.594*** (0.041)	0.571*** (0.043)	0.579*** (0.043)	0.579*** (0.043)
Observation	4684	4684	4684	4684	4684
adj. R <sup>2</sup>	0.239	0.207	0.21	0.202	0.202
Regional FE	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES

Note: Exposure to Policy is dummy variable whereas (1 if age<11 and 0 otherwise). Infant mortality is the death of children under the age of one. Neo-natal mortality is the death of children during the first 28 days. HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.7 Intent-to-Treat Effect: The impact of mother education on early childhood learning**

Variable	Panel A: Purchase; Read; Told Story; Sang Song				Panel B: Child Playing with Parent and Toy				
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(5)
	# of Book	Read Book	Told Story	Sang Song	Outside Home	Play With Child	Manufacture	Homemade	HH-Items
Exposure to Policy	0.216*** (0.029)	0.034* (0.018)	0.021* (0.010)	0.021* (0.010)	0.024 (0.022)	0.010 (0.014)	0.053*** (0.007)	0.045 (0.042)	0.056 (0.034)
Mother Age	0.082*** (0.020)	0.007 (0.006)	0.005 (0.004)	0.005 (0.004)	-0.002 (0.007)	0.011* (0.005)	0.029*** (0.008)	0.024*** (0.007)	0.009* (0.005)
Mother Age Square	-0.079** (0.028)	-0.003 (0.011)	-0.004 (0.008)	-0.004 (0.008)	0.006 (0.011)	-0.012 (0.010)	-0.021 (0.012)	-0.022 (0.015)	-0.0001 (0.007)
# of Children (under 5)	0.114*** (0.037)	0.152*** (0.009)	0.008** (0.004)	0.008** (0.004)	0.063*** (0.007)	0.027*** (0.007)	0.007 (0.015)	0.022** (0.009)	0.074*** (0.013)
# Children (ever born)	-0.059*** (0.011)	0.025*** (0.005)	-0.001 (0.001)	-0.001 (0.001)	0.004 (0.007)	-0.013*** (0.002)	-0.042*** (0.005)	-0.021** (0.009)	0.011** (0.004)
Has Electricity	0.077** (0.032)	-0.075*** (0.014)	-0.011 (0.008)	-0.011 (0.008)	0.0063 (0.012)	-0.015 (0.011)	0.051*** (0.016)	-0.032 (0.026)	-0.031* (0.018)
Has Telephone	0.667** (0.249)	-0.054** (0.023)	0.011 (0.020)	0.011 (0.020)	0.018 (0.012)	0.013 (0.027)	0.073** (0.028)	0.082*** (0.019)	-0.012 (0.045)
Rural Residence	-0.547*** (0.124)	0.062*** (0.0153)	-0.021** (0.00763)	-0.021** (0.00763)	-0.0150 (0.0236)	-0.089*** (0.00641)	-0.101*** (0.0232)	-0.026 (0.0501)	0.030** (0.00988)
Child (Twin)	-0.256** (0.096)	-0.183** (0.065)	0.008 (0.030)	0.009 (0.030)	-0.057 (0.071)	0.034 (0.042)	0.134* (0.070)	-0.100 (0.072)	-0.068 (0.075)
Breastfeeding	0.098 (0.082)	0.036 (0.025)	0.002 (0.017)	0.002 (0.017)	-0.024 (0.035)	-0.004 (0.037)	0.055* (0.028)	0.083*** (0.023)	0.086 (0.053)
Joint Family Decision	-0.007 (0.042)	-0.006 (0.017)	0.019* (0.010)	0.019* (0.010)	0.048*** (0.013)	0.005 (0.007)	0.070** (0.026)	0.087*** (0.024)	0.038*** (0.012)

Cons	0.728*	-0.061	0.028	0.028	-0.0002	0.236***	0.763***	0.491***	0.361***
	(0.346)	(0.076)	(0.074)	(0.074)	(0.061)	(0.070)	(0.040)	(0.117)	(0.065)
N	4570	4570	4570	4570	4570	4570	4563	4558	4561
adj. R <sup>2</sup>	0.089	0.115	0.006	0.006	0.022	0.019	0.085	0.031	0.043
Regional FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: Exposure to Policy is dummy variable whereas (1 if age<11 and 0 otherwise). Infant mortality is the death of children under the age of one. Neo-natal mortality is the death of children during the first 28 days. HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\*, \* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.8 Intent-to-Treat: The impact of mother education on labor outcomes**

Variable	(1)	(2)
	Currently Working	Elementary Sector
Exposure to Policy	0.065 (0.0473)	-0.042* (0.020)
Mother Age	0.039* (0.019)	-0.020** (0.009)
Mother Age Square	-0.046* (0.025)	0.017 (0.015)
# of Children (under 5)	-0.080*** (0.020)	0.026** (0.009)
# Children (ever born)	0.006 (0.010)	0.019*** (0.005)
Has Electricity	-0.035 (0.028)	-0.086*** (0.019)
Has Telephone	0.041 (0.033)	-0.129*** (0.031)
Rural Residence	-0.006 (0.028)	0.168*** (0.036)
Child (Twin)	-0.157** (0.059)	0.0459 (0.047)
Breastfeeding	0.015 (0.035)	0.027 (0.028)
Joint Family Decision	0.366*** (0.016)	-0.185*** (0.019)
Cons	0.691*** (0.136)	0.646*** (0.067)
N	2962	4674
adj. R <sup>2</sup>	0.125	0.157
Regional FE	YES	YES
HH FE	YES	YES

Note: Exposure to Policy is dummy variable whereas (1 if age<11 and 0 otherwise). Infant mortality is the death of children under the age of one. Neo-natal mortality is the death of children during the first 28 days. HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.9 Robustness check (using various age windows)**

Variable	(1) Neonatal Mortality (Under 1 month)	(2) Infant Mortality (Under one year)	(3) Child Mortality (Under 5 years)	(4) Mortality (Age 5-14)	(5) Mortality (Ever Born)
<b>Women's Age in 1990</b>					
Age (3 -22)	-0.316** (0.016) 2920	-0.319*** (0.009) 2920	-0.318*** (0.009) 2920	-0.316*** (0.009) 2920	-0.314*** (0.009) 2920
Observation Age (4-21)	-0.320*** (0.018) 2607	-0.321*** (0.007) 2607	-0.301*** (0.008) 2607	-0.311*** (0.008) 2607	-0.321*** (0.008) 2607
Observation Age (5-15)	-0.308*** (0.054) 2207	-0.319*** (0.016) 2207	-0.310*** (0.019) 2207	-0.305*** (0.019) 2207	-0.302*** (0.019) 2207
Observation Age (6-14)	-0.323*** (0.023) 1806	-0.323*** (0.008) 1806	-0.323*** (0.006) 1806	-0.320*** (0.006) 1806	-0.321*** (0.006) 1806
Observation Age (8-12)	-0.314*** (0.042) 895	-0.316*** (0.075) 912	-0.325*** (0.008) 986	-0.322*** (0.008) 986	-0.302*** (0.008) 986
Observation Other Control	YES	YES	YES	YES	YES
Regional FE	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES
Quadratic age function	YES	YES	YES	YES	YES

Note: 1 instrument years of schooling using young cohorts (1 if age<11 and 0 otherwise). Infant mortality is the death of children under the age of one. Neo-natal mortality is the death of children during the first 28 days. HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if "yes" and 0 if "no"). Other controls are the control variables used in baseline estimates. Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\*, \* and \* represent significant at 1, 5 and 10 percent respectively.

**Table 2.10 Descriptive statistics**

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std.Dev.</b>	<b>Min</b>	<b>Max</b>
Child Mortality (Ever Born)	133000	.717	.45	0	1
Age Cohorts(treatment=1)	793000	.248	.432	0	1
Log Driving Distance (Km)	904000	4.366	1.171	.588	7.692
Year of Schooling	998000	5.291	3.932	0	18
# of Children	133000	3.577	2.383	0	18
Age	998000	48.186	14.806	13	93
Male	998127	.7597	.4273	0	1
HH Has Television	998000	.504	.5	0	1
HH Has Mobile Phone	998000	.341	.474	0	1
Internet at Home	998000	.066	.247	0	1
Housing Ownership	998000	.848	.359	0	1
HH Has Electricity	998000	.341	.474	0	1
Type of Roof	998000	.659	.474	0	1
Type of Residence	133000	1.743	.437	0	1
<b>Type of Dwelling</b>					
Condominium/Flat	998000	.049	.215	0	1
Brick	998000	.071	.258	0	1
Semi-Pacca	998000	.069	.253	0	1
Wooden	998000	.412	.492	0	1
Bamboo	998000	.367	.482	0	1
Hut (2-3 years)	998000	.017	.129	0	1
Hut (1 year)	998000	.007	.084	0	1
Other	998000	.008	.089	0	1



**Table 2.11 The impact of mother education on mortality and labor outcomes**

Variable	(1)	(2)	(3)
	Currently Working	Working in Elementary Sector	Child Mortality (Ever Born)
<b>Panel A: Main Results</b>			
Mother Year of Schooling	0.311*** (0.0105)	-0.172*** (0.0495)	0.097 (0.078)
Age	0.0273*** (0.00888)	0.00149 (0.00167)	-0.003** (0.001)
Age Square/100	-0.047 (0.000299)	0.049 (0.0000367)	0.0002*** (0.000)
Male	-0.162*** (0.0246)	0.462*** (0.0119)	- -
HH Has Electricity	-0.460*** (0.0238)	-0.658*** (0.0907)	-0.257*** (0.0781)
HH Has Phone	-0.533*** (0.0375)	-0.0876 (0.120)	-0.335*** (0.112)
HH Has Internet Access	-0.639*** (0.0349)	0.0298 (0.119)	-0.229** (0.118)
Housing Ownership	0.261*** (0.0550)	0.671*** (0.0816)	0.098* (0.053)
Cons	-2.102*** (0.298)	-0.196 (0.539)	-2.654*** (0.510)
<b>Panel B: Year of Schooling - First Stage</b>			
Youngest Cohort (age<=11 in 1990)	0.0564** (0.027)	0.109*** (0.023)	0.185*** (0.041)
Mother Age	-0.040*** (0.003)	-0.020*** (0.003)	-0.009* (0.005)
Mother Age Square/100	0.0440 (0.059)	-0.032*** (0.005)	-0.0007*** (0.0001)
Household Head Male	0.560*** (0.051)	0.364*** (0.044)	- -
HH Has Electricity	1.374*** (0.064)	1.359*** (0.065)	1.304*** (0.054)
HH Has Phone	1.770*** (0.060)	1.796*** (0.062)	1.588*** (0.064)
HH Has Internet Access	2.035*** (0.083)	2.069*** (0.085)	1.913*** (0.099)
Housing Ownership	-0.894*** (0.143)	-0.970*** (0.144)	-0.748*** (0.113)
Cons	7.752*** (0.318)	7.694*** (0.310)	8.735*** (0.246)
Observation	749145	676477	124058
adj. R <sup>2</sup>	0.113	0.310	0.280
Regional FE	YES	YES	YES
HH FE	YES	YES	YES

Note: Robust standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 Coefficients with standard errors are reported in parentheses clustered at district level. The variables for type of dwelling and number of children are exclude from the result table.

**Table 2.12 The impact of mother education on mortality and labor outcomes**

Variable	(1)	(2)	(3)
	Child Mortality (Ever Born)	Currently Working	Working in Elementary Sector
Youngest Cohort (Age<=11 in 1990)	-0.016*** (0.002)	0.030*** (0.001)	0.005** (0.002)
Treatment Township	0.009** (0.003)	0.008** (0.004)	-0.100*** (0.013)
Youngest Cohort *Treatment Township	-0.016*** (0.004)	-0.002 (0.004)	-0.035*** (0.004)
Year Of schooling	0.001*** (0.000)	-0.001*** (0.000)	-0.006*** (0.000)
Log driving Distance (km)	0.001 (0.001)	0.002 (0.001)	0.001 (0.003)
Household Head Male	0.612*** (0.007)	0.007*** (0.001)	0.0507*** (0.006)
# of Children (every born)	0.298*** (0.016)	-0.465*** (0.021)	-0.130*** (0.009)
Mother Age	-0.004*** (0.000)	0.009*** (0.000)	-0.002*** (0.000)
Mother Age Square/100	0.0133*** (0.001)	-0.0290*** (0.001)	-0.0001 (0.0005)
# of Children	-0.005*** (0.001)	-0.018*** (0.001)	-0.016*** (0.003)
HH Has Electricity	-0.0106*** (0.001)	0.0113*** (0.001)	-0.0772*** (0.002)
HH Has Phone	-0.003** (0.001)	-0.005** (0.002)	0.002 (0.002)
HH Has Internet Access	0.001 (0.001)	-0.009*** (0.002)	-0.030*** (0.003)
Housing Ownership	0.412*** (0.006)	0.907*** (0.016)	0.198*** (0.015)
Observation	746101	746101	746101
adj. $R^2$	0.557	0.027	0.075
Regional FE	YES	YES	YES
HH FE	YES	YES	YES

Note: Robust standard errors in parentheses. Coefficients with standard errors are reported in parentheses clustered at district level. The variables for type of dwelling are exclude from the result table. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 2.13 The effect of education on pre-post antenatal care and delivery care**

Variable	Panel A: Pre-Antenatal Care			Panel B: Delivery Care			Panel C: Post-Antenatal care			
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(4)
	# of pregnanc y visit	With health professio nal	Use Iron pill	Tetanus injection before delivery	At hospital	With Health professional	With Health Professional	Antibiotic pills	antimotility	Given antibiotic injection
Mother Year of Schooling	0.006	0.283***	0.276***	0.245**	0.0141	0.251***	0.335***	0.168	0.306***	0.0934
Mother Age	(0.605)	(0.087)	(0.065)	(0.111)	(0.305)	(0.094)	(0.008)	(0.224)	(0.053)	(1.161)
Mother Age Square/100	0.862**	-0.021	-0.050	0.027	0.012	-0.049**	-0.092**	0.121	-0.018	0.452
# Children (under 5)	(0.422)	(0.050)	(0.035)	(0.059)	(0.066)	(0.023)	(0.040)	(0.120)	(0.092)	(0.787)
# Children (Ever born)	-1.056*	0.035	0.082*	-0.026	0.056	0.063**	0.136***	-0.188	0.018	-0.750
HH Has Electricity	(0.593)	(0.063)	(0.044)	(0.076)	(0.105)	(0.0323)	(0.043)	(0.176)	(0.117)	(1.205)
HH Has Telephone	-0.010	-0.003	-0.002	0.041	-0.094**	0.011	0.030	0.029	-0.241***	-0.073
Rural Residence	(0.343)	(0.036)	(0.043)	(0.052)	(0.039)	(0.034)	(0.084)	(0.090)	(0.077)	(0.604)
Multiple Birth	-2.614**	0.123	0.119	0.113	-0.298**	0.151**	0.201**	0.071	0.128	0.077
	(1.312)	(0.112)	(0.086)	(0.072)	(0.120)	(0.064)	(0.099)	(0.156)	(0.090)	(0.557)
	4.722**	-0.127	-0.348***	-0.095	0.330	-0.249*	-0.265	-0.147	-0.273**	0.828
	(2.287)	(0.276)	(0.087)	(0.174)	(0.250)	(0.137)	(0.167)	(0.223)	(0.125)	(1.471)
	8.411**	-0.343	-0.431*	-0.254	0.230	-0.608**	-0.627***	0.203	-1.040***	-0.018
	(3.293)	(0.251)	(0.224)	(0.438)	(0.521)	(0.252)	(0.097)	(0.797)	(0.219)	(2.707)
	-8.258*	0.205	0.587***	0.558**	-0.753	0.834***	0.568*	0.002	0.437***	0
	(4.514)	(0.420)	(0.128)	(0.269)	(0.517)	(0.051)	(0.324)	(0.298)	(0.075)	-
	1.805	-0.143	0.021	0.0004	1.041***	-0.0781	-0.0918	-	-	-

	(2.163)	(0.124)	(0.206)	(0.436)	(0.172)	(0.173)	(0.234)	-	-
Breastfeeding	0.404	-0.150	-0.264	-0.147	0.0395	-0.0921	-0.0369	0.766	-0.121
	(1.879)	(0.219)	(0.232)	(0.360)	(0.127)	(0.140)	(0.240)	(0.687)	(0.352)
Joint Family Decision	0.292	0.0377	-0.0558	0.0184	-0.0270	-0.0935	0.003	-0.012	0.253
	(0.669)	(0.088)	(0.046)	(0.093)	(0.096)	(0.063)	(0.046)	(0.154)	(0.285)
Cons	38.08*	-1.499	-3.084***	-2.718***	0.134	-3.458***	-3.218***	-1.184	-2.179**
	(20.67)	(1.779)	(0.364)	(1.020)	(2.838)	(0.244)	(0.696)	(1.528)	(0.865)
Observation	3757	3234	4452	1056	4658	4684	1781	517	524
adj. R <sup>2</sup>	0.232	0.213	0.340	0.245	0.171	0.210	0.216	0.230	.0342
Regional FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
HH FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: We instrument years of schooling by using young cohorts (1 if age ≤ 11 in 1990 and 0 otherwise). Hospital is dummy variable and include private and public hospital and other medical centers (1 if deliver at hospital and 0 if deliver at home and other places). Health professional is also dummy and include doctor, nurse, midwife and person recognized as professorial by government. HH has electricity, telephone, breastfeeding, and joint family decision are dummy (1 if “yes” and 0 if “no”). Robust standard errors in each regression (clustered at district level) are reported in parentheses. \*\*\*, \*\* and \* represent significant at 1, 5 and 10 percent respectively.

## CHAPTER THREE

### The Impact of Agricultural Loan on Farm Production and Household Consumption

#### 3.1 Introduction

Agriculture sector is a backbone of the economy in Myanmar. According to 2014 census, about 75 percent of population is living in rural area and most of them are working in agricultural sectors. The agriculture sector contributes 30 percent to gross domestic product (GDP) and 25 percent to total exports (Myanmar, 2018). Moreover, it contributes 56 percent of total employments. The agricultural sector increased by 3.2 percent annually between 2010-2011 to 2016-2017. Although various crops are cultivated across country, paddy, beans and pulses, and oilseed crops are major crops in Myanmar. However, rice production dominates and it account 45.7 percent of the harvested area and 53.5 % of production value among major corps.

In Myanmar, the majority of population are working in agricultural and most of them are smallholder farmers. Farmers generally faces lack of financial resources to purchase the agricultural inputs timely which impact productivity. Therefore, the provision of agricultural loan to farmers is important to timely purchase agricultural inputs. Myanmar, as a developing one, the development of financial institution is limited and finance to agricultural sector is also limited due to small size of banking system. Only the Myanmar Agricultural Development Bank own by government provide the agricultural credits. Limited access to agricultural loan has been seen as a major bottleneck of agricultural sector development (Ammani et al., 2010). A lot of studies also show the important of agricultural loan to increase agricultural inputs use and per acre yield (Eswaram and Kotwal, 1990; Carter, 1989 and Qureshi et al., 1996)

In developing countries, the significant improvement in agricultural sector is necessarily important to attain high economic growth rate and it can be achieved through easy access to high pay-off inputs (Kuznets, 1964, 1976). The developing countries have to handle the limited access to agricultural credit to use agricultural inputs such as chemical fertilizers, pesticide, high quality seeds, and other agricultural machineries and components. The increase in chemical fertilizer use lead to large improvement of the per acre yield (Duflo et al., 2008). In order to use the agricultural inputs optimally, access to agricultural credit play the important role in Myanmar. The

investment for agricultural inputs generally comes from two sources in Myanmar. One is from farmers' own savings and another is from borrowing from other. However, the saving of small farmers is negligible in low-income countries like Myanmar. The small farmers have limited budget to share their income for consumption and agricultural investment. About 75 % of agricultural land are owned by small farmers. Borrowing agricultural loan from the private financial institution is difficult for small farmers and also it generates more debts due to high interest rate. Access to formal agricultural credit is the major issues for agricultural development in developing countries like Myanmar. Therefore, the expansion of agricultural loan is an effective policy tool for addressing the financial issues for agricultural investment for small farmer in Myanmar.

In 2013, The government significantly increased the amount of agricultural loan. The amount of loan was 20,000 Kyats in 2011 and then it creased to 100,000 Kyat per acre for rice production farmer in 2013. However, the loan amount for other crops farmers increase only from 10,00 in 2011 to 20,000 in 2013. Farmers can access loan from government up to 10 acres. The main objective of this study is to test a hypothesis on a sharp increase in agricultural loan leads to increasing in agriculture inputs, agricultural outputs, and households' consumption. To examine the impact of government agricultural loan policy on farm inputs use, production, and households' consumption, the difference-in-differences (DID) method is applied in this study.

The structure of the paper is organized a follow. Section 3.2 provide the background of the agricultural loan program in Myanmar. Section 3.3 discuss literature of previous research on agricultural loan. The data and methodology are presented in section 3.4. In section 3.5, we discuss the impacts of the policy on agricultural inputs use and output and household's consumption calories. We check the robustness of our baseline estimates in section 3.6. We discuss the policy implication and summary of funding in conclusion, section 3.7.

### **3.2 Background of the Agricultural Loans in Myanmar**

As a developing country, the agricultural sector plays a central role for economic development and employment in Myanmar. According to 2014 census, about 75 percent of population are living in rural area and most of them are engaging in agricultural sector. Therefore, the agricultural sector is a backbone of Myanmar economy. Due to limited access to loan for agricultural farms, farmers have to borrow from private lenders whose interest rate are relatively high. This led to more burden

on farmers. Therefore, farmers could not utilize the agricultural inputs such as fertilizer, high quality seeds, pesticides, and labor for land preparation which are important to increase the agricultural productivity. Access to agricultural loan is the most important for small farmers to improve their life because they could not afford their own investment to meet the required agriculture inputs.

In order to provide the necessary loan to farmer, the first National Agricultural Bank was established by government of Myanmar in 1953 under the Ministry of Finance and Revenue, but due to limited financial condition the bank could not provide sufficient amount of loan to farmers. Then it was renamed as a Myanma Agricultural Development Bank (MADB) and transferred to under the Ministry of Agriculture and Irrigation in 1996. Therefore, the MADB play as an essential role to support the agriculture sector development in Myanmar. Government also introduced the MADB law in 1990. According to the law the MADB has to effectively support financial services to agricultural, livestock, and rural enterprises. To efficiently support the agricultural development, the 220 branch banks have been established across the country in 2013. Between 2010 and 2012 the loan portfolio sharply increased from K 20,392 million to K 116,275 million. During the period the loan portfolio increased by 470 %. The bank could provide financial assistance nearly 1.87 millions of farmers from 206 townships throughout the country in 2012.

In 1994-1996, the government started the loan scheme through MADB to farmer under which rice crop farmers received loan amount, 400 Kyats per acre and other crop farmers received from 70 to 300 Kyats per acre. The loan amount was relatively small and not enough to cover the actual cost. Besides, the loan interest rate in 1998 was 21.0 percent, which rate was extremely high for farmer and consequently it caused debt burden on farmers. Since then, the government has reduced the interest rate to relief debt burden on farmers. Before 2012, the interest rate was very high from 13.0-18.0 percent and it was significantly reduced to 8.5 percent in 2012-2013, which is relatively lower than market interest rate (12 percent). Moreover, the government increased the loan amount of per acre for rice farmers to 20,000 Kyats and for other crop farmers to 10,000 Kyats in 2010. However, the farmers are unable to invest for agricultural inputs because the loan amount does not cover the actual expenditures. Therefore, the government significantly increased the amount of agricultural loan from 20,000 to 100,000 Kyats per acre for rice farmers and 10,000 to 20,000 Kyats per acre for other crops farmers in 2013. This sharp increase in amount of agricultural loan

significantly contribute to farmers to use agricultural inputs and to reduce the financial burden for investment.

Each farmer could apply the loan amount to Myanmar Agricultural Development Bank for a maximum of 10 acres. However, the farmers do not need to apply a loan to MADB directly. The village loan screening committees are formed in each village and the MADB supervise these committees. The committees are comprised of representative from the Department of Agriculture, the Industrial Crop Department, the farmers, and the head of the village. The farmers have to submit a loan application to village level loan screening committee and then the committee has to examine the credit history of the farmers. In order to reduce credit risk, farmers have to mutually guaranteed their loan by forming a group of 5-10 farmers (Win, 2013). They also have to submit Farmer Registration Book issued by authorities to the committee. The committee have a responsibility to incite all farmer in the village to pay off their loan before due date.

### **3.3 Literature Review**

Limited access to agricultural loan can be seen as a major constrain for agriculture sector development in developing countries. Therefore, many countries, especially in developing countries, focus on expansion of formal agricultural loan to support farmers and agricultural sector development. However, a question has been raised by critics that the expansion of agricultural loan policy could not achieve the policy targets such as improving agricultural inputs, production, and income. Regarding this, a lot of studies have been done about the impact of expansion of agricultural credit policy on agricultural production, but there are no common results of the policy's impact. The positive impact of formal credit supply on agricultural production found in Nigeria (Ammani, 2012; Awe, 2013; Tasié and Offor, 2013). By contrast, the agricultural credit has no significant impact on agricultural productivity in Nigeria (Ayegba and Ikani, 2013, Akinleye et. al., 2005).

The impact of the agricultural credit policy differs across countries. Besides, the policy impact would be difference in short-term and long-term. Reyes et al. (2012) pointed out that there is on significant effect of short-term credit on farm production. Chisasa & Makina (2015) found that the agricultural credit scheme has negative impact on agricultural output in short-term, but it has a significant positive impact on output in



the long-term. Access to agricultural credit significantly contribute increasing in agricultural inputs use such as the good quality seeds, fertilizers and bio-chemical, labors, and farm machinery equipment, which all are important for agricultural development and economic development in low-income countries. Khan et al. (2011) pointed out the important of agricultural credit. He indicated that agriculture loan contributes agricultural sector development as well as other sectors development in the economy. Easy access to agricultural loan increases the agricultural inputs use and then it leads to increasing the agricultural productivity. Consequently, it generates the development of other sectors that are related with agricultural sector.

Limited access to agricultural loan is the major hinderance to development of agricultural sector (Ammani et al, 2010). Access to agricultural credit to purchase agricultural inputs such as labors, fertilizers, pesticides, and other agricultural inputs is a major constrain for agricultural productivity (Saboor, 2009 and de Castro et. al, 2012). Providing the agricultural credit to farmers can boost agricultural productivity Ahmad (2007). Therefore, agricultural credit is the determinant of agricultural development in both developing and developed countries (Kumbhakar, 1997). Anthony (2010) found the positive impact of agricultural loan on economic growth in Nigeria. Moreover, he found that the increase in agricultural production also lead to increase in export of the country. Provision of agricultural credit to the rural poor has a positive and significant impact on consumption and income in Bangladesh (Zeller et al., 2002).

A lot of research has been done to analysis the impact of credit policy on productivity in developing countries and most studies found that the farmers who received the credits from the bank have high yield pear acre compare to non-borrowers (Irfan, 1999 and Carter and Olinto 2003). Agricultural credit is important not only in developing countries but also in developed countries. Kausar (2011) found that the increase in agricultural loan leads to increase the production and then improve the living standard of farmers in Europe. Furthermore, the agricultural credit support to increase capital, to develop technology, to reduce the poverty (Siddiqi et al., 2004, Udry, 1990). Since the small farmers are unable to use fertilizer optimally in developing countries, the provision of agricultural credit contributes the increase in agricultural inputs use. The moderate fertilizer use could generate the increase in per acre yield without changing other agricultural practices (Duflo et. al, 2008). Kuznets (1976) discussed that the important role of agricultural sector for high economic growth. He mentioned that without modernizing the traditional agricultural sector, the countrywide high economic

growth could not achieve. However, the agricultural capital play major role to modernize the traditional agricultural sector. Therefore, agricultural credit is necessarily important for agricultural sector development in developing countries.

The increase in formal agricultural credit has been used as an effective policy tool to enhance the agricultural productivity in Myanmar because most farmers are unable to fully invest and to meet necessary loan timely to purchase agricultural inputs. Therefore, this paper is to analysis the impact of agricultural loan on agricultural production and household consumption. Although a lot of research has been done the relationship between agricultural loan and farm productivity, most research are signal and multiple regression analysis using logit regression (Ammani, 2012, Hussain and Taqi, 2014 and Rahman et al. 2014). The results from using logit with sample single and multiple regression could probably suffer bias due to omitted variables that do not change over time and affect the outcomes. Therefore, this paper tries to eliminate the omitted variables bias by using difference-in-differences (DID) method. Most studies only focus the impact of agricultural credit on agricultural productivity and income, while this study focus not only agricultural production, but also agricultural input use and household consumption.

### **3.4 Data and Methodology**

#### **3.4.1 Data**

The two round integrated households living condition assessment (IHLCA) surveys (2009 and 2010) and 2015 Myanmar poverty and living conditions survey (MPLCS) are used to examine the impact agricultural loan on farm production and household consumption. The integrated household living conditions assignment (IHLCA) survey was conducted by United Nation Development Program (UNDP) in December 2009 and May 2010 by cooperation with the Planning Department. It was a nationwide survey and covered sample of 18,660 households. The survey used a stratified sample design with Probability Proportionate to Estimated size with Replacement (PPES). The selected township across in 62 districts were used as the

strata in the first stage. Then, as the second stage, ward and village were selected from urban and rural within the selected townships.

The Myanmar Poverty and Living Conditions Survey (MPLCS) was conducted by the World Bank with a closer cooperation of Ministry of Planning and Finance in 2015. It is also a nationally representative survey and developed based on 2014 census sampling framework. The survey used a stratified multi-stage sample design and stratified by region, urban, and rural areas with probability proportional to size (PPS) within each stratum. Moreover, the subsample of enumeration area (EA) for the MPLCS were selected from the master sample with equal probability within each region and urban, and rural stratum.

Both surveys include plot level characteristics, basic household characteristics, consumption expenditures, and labor and employment. Since in most welfare analysis mainly focusses on household expenditure, education, health, and housing, both surveys are appropriate to use in this analysis. Although the sample size for MPLCS survey is small compare to IHLCA, it also included almost all questions covered in IHLCA surveys. Data for annual average rainfall, and average temperature were collected form General Administration Department. The household's and housing characteristic including land ownership, household's consumption, and expenditure are summarized in Table 3.1.

### **3.4.2 Methodology**

The limited access to credit becomes a major bottleneck for farmers to use agricultural inputs optimally in Myanmar. Therefore, the government significantly increased the amount of agricultural loan in 2013. The amount of loan was 20,000 Kyats in 2011 and then it creased to 100,000 Kyat per acre for rice production farmer in 2013. However, the loan amount for other crops farmers increase only from 10,00 Kyats in 2011 to 20,000 Kyats in 2013 per acre. Farmer with land use certificate can access

agricultural loan annually. Farmers can access loan from government up to 10 acres. We hypothesized that rice farmers use more agricultural inputs, boots agriculture outputs and increase households' consumption comparing to other crops farmers after significant increasing in agricultural loan.

To examine the impact of government loan policy on farm production and households' consumption, the difference-in-difference (DID) method is applied in this study. To validate our DID estimation we assume farm land cannot easily switch rice to other crops. We provide the validity of this assumption by two points. First, the 2012 Farmland Law was enacted in Myanmar. According to the law farmers shall not change the originally cultivated crop with other kind of corps without permission. Second, since the soil type and the nature of cultivation system for rice and other crops is totally different. Moreover, paddy land or rice land need to retain water while other crops no need to retain water to grow. Therefore, farmer cannot easily switch rice cultivation to other crops cultivations. Therefore, we have confident of the validity of this assumption.

We investigate the impact of policy on production by using the plot level data. We also compare average change in per acre yield of rice plot to other crops plots. Then we examine the policy impact on agriculture inputs use. Finally, we explore the impact of policy on household consumption by comparing pre-post and rice cultivating households and other corps cultivating households.

$$Y_{iht} = \beta_0 + \beta_1 Post + \beta_2 Treat + \beta_3 Post * Treat + \beta_4 \varphi_{iht} + \beta_5 V_{hdt} + \mathcal{R}_{dt} + \delta_h + \varepsilon_{iht} \quad (1)$$

Where i, h, and t represent plot, household, and year respectively.  $Y_{iht}$  denotes natural log of per care yield. "post" is dummy variable (1 if the year 2015 and 0 otherwise). Treat is also dummy variable (1 if rice plots and 0 other crops plots).  $\varphi_{idt}$  indicates the plot characteristics such as land tenure, harvested season, and access to irrigation.  $V_{ht}$  represent the vector of household characteristics such as total land acres owned by household, # of children (age under 5), # of elder person (age 65+), dummy for agricultural input use, and household head characteristics including education, gender, and age, marital status, religious, mother tongue.  $\mathcal{R}_t$  indicates the regional characteristics such as average annual rainfall, average annual temperature, and average annual humid.  $\delta_j$  indicates regional and year fixed effect.  $\varepsilon_{iht}$  is the error term.

### **3.5 Result and Discussion**

#### **3.4.1 The impact of agricultural loan policy on farm input use and production**

In this section we discuss the estimation results of the impact of formal agricultural credit expansion policy on inputs and outputs. The impact of policy on crop of per acre yield is described in Column 1 of Table 3.2. The coefficient of post shows significant positive meaning that the crops yield per acre increase by 3.461 percent after expansion of formal agricultural credit. The coefficient of Post\* Rice Cultivated HH(Yes=1) gives the impact of policy on per care yield. It shows that the rice crop per acre yield increase by 0.6 percent after significant expansion of agricultural loan in Myanmar. The result is significant at 1 percent level. Since the small farmers in Myanmar generally face difficulties with finance for agricultural inputs. They have to borrow from unofficial private borrowers whose interest rate is relatively high compare to that of government loan. Borrowing from private borrowers lead the credit burden for small farmers in Myanmar. Before 2012, the loan amount for farmers are very low and it is unable to meet the requirement. Generally, the average expenditure of per acre for rice firms is range from 0.2 to 0.4 million Kyats based on quality of crop, but the government loan was only 20,000 in 2011, which amount was relatively low and uncovered the per acre expenditure. When the government significantly increased the amount of agricultural loan farmers can increase the use of agricultural inputs. Therefore, the sharp increase in amount of formal agricultural loan has a positive and significant effect on per acre yield.

Table 3.1 of column 2 to 4 presents the effect of policy on the agricultural input use. Column 2 show the impact of policy on the use of chemical fertilizer. The coefficient of Post (After expansion of credit) shows positive and significant effect on chemical fertilizer. We find that the probability of chemical fertilizer increased by 36.7 percentage after expansion of agricultural loan. Similarly, the use of pesticide and hire labor increase by 50.6 percent and 45.1 percent respectively. All results are statistically significant at 1 percent level. The coefficient of rice cultivating household are positive, but only the use of chemical fertilizer is statistically significant at 5 percent level. The interaction of effect of Post\* Rice Cultivated HH(Yes=1) are positive in all outcomes, but the use of pesticide is statistically insignificant. The results show that the rice cultivated household used more chemical fertilizer, pesticide, and labor after

significantly increasing formal agricultural loan. Therefore, we could see that the rice farmers use more agricultural inputs and then generate more outputs comparing to other crops farmers. The results indicate that the use of chemical fertilizer, pesticide, and labor per day increase 46.2 percent, 31.6 percent, and 36.6 percent respectively.

The regression results also indicate the important of role of harvested season, agricultural land acre that own by household, access irrigation water, and household head education for agricultural inputs use and outputs. Most importantly, the results point out the important of household head education for per acre yield, and agricultural inputs use. The results show that the more educated household head use more agricultural inputs and then generate more per acre yield. This is probably due to the more educated person are more knowledgeable on agricultural business and input use. Moreover, the result show that access to irrigation water is significantly important for per acre yield and agricultural input use. We find that farmers use more agricultural inputs if the plots access irrigation water. Although various crops are cultivated across country paddy, beans and pulses, and oilseed crops are major crops in Myanmar. However, rice production dominates and it account 45.7 percent of the harvested area and 53.5 % of production value among major corps. Therefore, access to irrigation is important to cultivate in all seasons and to increase agricultural inputs use and per acre yield.

In Myanmar most farmers are small land holders and most of them have the less finance resources for agricultural input use. Due to the fact that they acquire loan from private and other farmers to meet necessary investment for agricultural inputs use. Generally, there are two types of source of loan, which are borrowing money from creditors (private official and unofficial creditors) and borrowing the crops from other farmers. The interest rate of private loan is relatively higher than that of loan from government. To our best experience, the interest rate of private loan is 20 % and sometime even higher than 20 %. This creates the debt burden for farmers. Borrowing crop from other farmers is informal type of loan. For instance, if a farmer borrows 50 baskets of paddy before the planting period, he has to pay back 75-100 baskets by the time of harvest. Both type of loan gives extra burden for farmers because of higher interest rate. Moreover, they are unable to store the crops until the market price is increased. Since the government significantly increase the loan amount of rice farming

comparing to other crops farming, the policy has more and significant benefits for rice farming households. The interest rate of government agricultural loan is only 8 % which rate is considerably low compare to other, this reduces financial burden for small holder farmers. Therefore, we find that after a significantly increase the amount of agricultural loan, farmers use more agricultural inputs and boost the production, but grater increase in rice farmers comparing to other crops farmers.

### **3.4.2 The impact of agricultural loan on household consumption calories**

To our best knowledge, most research focused only on the impact of agricultural credit policy on productivity. In this study we examine the impact of policy not only on agricultural inputs use and per acre yield, but also on household consumption calories. Table 3.3 shows the impact of formal agricultural loan expansion on household consumption calories. Total consumption calories and consumption calories by type of foods are used as the major outcomes for consumptions calories. Surprisingly, we found the coefficient of Post (After credit expansion) is negative for all outcomes. Similarly, the consumption calories for treated household which is rice cultivated household is negative. This is probably due to the existing characteristic differences among household.

Our main interest of outcomes is the interaction effect of Post\* Rice Cultivated HH(Yes=1) which show the policy effect on household consumption calories. Colum 1 shows the impact of policy on household total consumption calories. The result indicates that total consumption calories of rice cultivating household increase by 10.2 percentage after sharp increase in agricultural loan. The result is statistically significant at 1 percent level. Colum 2 to 5 show consumption calories by type of food groups.

Column 2 show the policy impact on rice consumption calories and it indicates that the consumption calories of rice cultivated household significant decrease by 35.6 percentage after the policy change. As an agricultural country, every household in Myanmar use rice as a major food for their daily life even in poor family. When household increase their income, they consume more on fruit, vegetable, meat, and fish and less consume on rice. When household's income is increased, they may change their consumption pattern from inferior goods to normal goods. Therefore, we found the negative effect of policy on rice consumption calories in rice cultivating household. Column 3 indicates that the policy effect on oil and fats consumption of rice farming

household. However, the effect of magnitude is very small and statistically insignificant. Column 4 shows the policy impact on consumption calories of meat and fish by rice farming households. It shows that the consumption of calories increases by 13.2 percent in rice farming households after policy introduction compare to other crops cultivating households. The result is statistically significant at 10 percent level. Finally, column 5 shows the estimation result of the impact of the loan policy on fruits and vegetable consumption by rice cultivating households. We find the significant and positive effect of policy on consumption calories of rice farming household in fruits and vegetables. The result is statistically significant at 5 percent level and it indicates that the consumption calories increase by 15.3 percent. Therefore, we find that the policy has a significant and positive impact on household consumption calories.

We also find important effect of other variable on household consumption such as land tenure, agricultural land own by household, household's head education level, number of household member, number of children whose age five and under, and number of older person (age>65) in the family. These variables are significant impact on household consumption calories. Almost all effect is economically and statistically significant. Based on empirical evidence, we can conclude that the sharp increase in agricultural loan has more benefits for rice cultivating household comparing to other crops such as various beans, groundnut, sesame, sun-flower, other oil crops, cotton, maize, Mustard, jute, onion, chili, and sugarcane.

### **3.6. Robustness Check**

The difference-in-differences estimate the policy impact by comparing the change in outcomes over time between treatment and control groups. It is one of the most popular methods in quasi-experimental research design and applied economics (Meyer 1995; Angrist and Krueger 2005; Bertrand, Duflo, and Mullainathan 2004; Athey and Imbens 2006). It can eliminate any differences between treatment and control group that are constant over time. In case of the difference in outcomes between treatment and control groups is due to time, place, policy, and other variable, applying the triple DID method could provide more accurate result and reduce bias (Berck & Villas-Boas, 2016). The difference between two difference-in-difference is the idea of the triple DID estimator. In order to have a causal interpretation, the two parallel trend assumption is not necessary to hold in triple DID because the difference between two biased DID estimators will be canceled each other out as long as the bias is the same in



both estimators (Olden & Møen, 2020).

The idea of triple DID in this paper is based on the Kim & Kwon (2014), which they studied the effect of extension of benefit coverage for cancer patients on health care utilization across different income groups in South Korea. They identified the triple DID based on cancer patients (treatment), liver disease (control), and income group (low and high). They found that the extension of NHI benefits coverage led to an increase in the utilization of outpatient services across all income groups, but with a greater increase for the low-income groups, among cancer patients. In this paper, we implement the additional DID based on the small-scale farmer and large-scale farmer. However, the general and operational definition of smallholder is still debate and it is different across countries (Khalil et. al., 2017). In this paper, we defined the smallholder farmer as those who are operating a land of 2 ha or less based on Hazell et. al. (2009); IFAD (2009); Dalberg (2012); FAO SOFA e SOFI 2014 and 2015; World Bank 2003. We could analysis whether the credit expansion policy benefit for large scall farmer or small scall farmer. We assume a farmer with large acre of crop land will have more benefit from the policy. To estimate the policy impact, we use the following equation:

$$Y_{iht} = \beta_0 + \beta_1 Post + \beta_2 Treat + \beta_3 smallscale\ farmer_{it} + \beta_3 Post * Treat + \beta_4 Post * smallscale\ farmer_{it} + \beta_5 Treat * smallscale\ farmer_{it} + \beta_5 Post * Treat * smallscale\ farmer_{it} + \beta_4 \varphi_{iht} + \beta_5 V_{ht} + \mathcal{R}_{dt} + \delta_h + \varepsilon_{iht} \quad (2)$$

Where i, h, and t represent plot, household, and year respectively.  $Y_{iht}$  denotes natural log of per care yield. “post” is dummy variable (1 if the year 2015 and 0 otherwise). Treat is also dummy variable (1 if rice plots and 0 other crops plots). Small-scale farmer is dummy variable ( 1 if farmer own crop land less than 2 hectares and zero otherwise).  $\varphi_{iht}$  indicates the plot characteristics such as land tenure, harvested season, and access to irrigation.  $V_{ht}$  represent the vector of household characteristics such as total land acres won by household, # of children (age under 5), # of elder person (age 65+), dummy for agricultural input use, and household head characteristics including education, gender, and age, marital status, religious, mother tongue.  $\mathcal{R}_t$  indicates the regional characteristics such as average annual rainfall, average annual temperature, and average annual humid.  $\delta_j$  indicates regional and year fixed effect.  $\varepsilon_{iht}$  is the error term.

The regression results of equation (2) are reported in Table 3.4 and Table 3.5. The coefficient of triple DID term “post \* Treated Household \* small-scale farmer” give the impact of the agricultural loan policy on per acre yield, agricultural inputs use and household’s food consumption calories. The result showed that the agricultural loan policy leads to an increase in agricultural inputs use, per acre yield of crop production and household consumption calories in rice production farmers compare to other crop farmers, but with a greater increase for the large-scale farmers. The result for agricultural inputs uses and household consumption calories are similar to our baseline estimates. Although the triple DID estimation results are slightly different compare to baseline estimates, they are robust, consistent and statistically significant.

### **3.7 Conclusion**

This paper analysis the impact of formal agricultural loan on farm input use and production. Moreover, we also examine the policy impact on household consumption calories. In 2013, the government significantly increased the amount of loan for rice cultivating farmers. The loan amount per acre of rice farmers was 20,000 Kyats in 2011 and the amount increased up to 100,000 Kyats in 2013. However, the loan amount per acre of other crops farmers such as beans, groundnut, sesame, sun-flower, other oil crops, cotton, maize, Mustard, jute, onion, and chili increased only from 10,00 Kyats in 2011 to 20,000 Kyats in 2013. Government set a difference amount of loan based on type of crops. We try to examine the impact of loan policy on agricultural input use, production, household consumption calories among rice cultivating households and other crops cultivating households.

The finding indicates that the policy has significantly increase per acre yield of rice plots comparing to other crops plots. Moreover, it has a positive effect on chemical fertilizer use, pesticides use, and labor use during agricultural activities in rice cultivating household. We also find that the significant increase in loan amount for rice farming leads to increase agricultural inputs use and then increase the per acre yield. Since the number of hired labor per day significantly increase after policy introduction, we could induce that policy probably has a benefit not only for rice farmers itself, but also for rural landless households through increase in the labor demand. Moreover, we examine the impact of policy on household consumption calories. The results indicate that the policy has a positive and significant effect on total consumption calories. When

we examine the impact of policy on different kind of food groups, we also found positive effect of policy on all food groups except rice consumption calories. Therefore, we conclude that the government agricultural loan policy has a significantly benefits for rice cultivating households comparing to other crop cultivating households.

We also provide the robustness check by using triple difference-in-differences methods. As an additional difference-in-difference group we use the scale of crop land owned by farmers. We defined the small-scale farmer who won the agricultural land 2 hectares and less based on literatures. We find the agricultural loan policy less benefit for small-scale farmers compare to large-sale farmers. The results indicate that the impact of policy lead to an increase in per acre yield of crop production in rice production farmers compare to other crop farmers, but with a greater increase for the large-scale farmers.

All estimation results indicate the positive effect of government loan policy on agricultural inputs use, production, and household's consumption calories. Therefore, the further expansion of agricultural credit should be made by government because the current loan amount is not enough to cover the actual cost of per acre. The average cost of per acre for rice farming is range from 200,000 Kyats to 400,000 Kyats and the current loan amount is only 100,000 Kyat in 2013 which is relatively low comparing to actual expenditure. Therefore, the farmers still have to rely on informal lender which interest rate are higher than government lending rate. Moreover, the loan amount for other crops should be increased in order to meet the actual cost of per acre. Currently, the government only provide the agricultural credit on limited number of crops and does not provide for large scale farmers engaging in agricultural business such as rubber, fruit, and vegetables. Although the current interest rate (8 %) is fair, government should adjust the time for paying back the credit because farmer have to sell crops soon after the harvesting period to pay back government loan on time. Therefore, they could not store the crops until the market price increase. Since the findings indicate that farmers actually utilize the agricultural loan for agricultural inputs use, further expansion of agricultural credit would be an effective policy tool for increasing agricultural productivity and improving household welfare in Myanmar.

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## Appendix C

**Table 3.1 Descriptive statistics**

Variable	Obs	Mean	Std.Dev.	Min	Max
<b>Panel A: Plot Level Characteristics</b>					
Crops yield per acre (Kilogram)	12,527	199.473	2189.864	0	113449
Harvested Season (Wet==1)	16488	.348	.476	0	1
Land Type (Le==1)	16446	.514	.5	0	1
Access Irrigation Wager (Yes==1)	16410	.385	.487	0	1
Land tenure (Own==1)	16446	.922	.267	0	1
<b>Panel B: Household Characteristics</b>					
# of HH Members	16482	5.416	2.209	1	19
Primary and below		.558	.497	0	1
Secondary		.252	.434	0	1
Post-Secondary		.190	.392	0	1
# Children (age<=5)	16482	.529	.789	0	6
# Elder Person (age>65)	16482	.487	.722	0	4
Age of Household Head	16482	32.826	20.439	0	99
<b>Marital Status</b>					
Single	16,280	.374	.484	0	1
Married	16,280	.411	.492	0	1
Widowed	16,280	.081	.273	0	1
Divorced	16,280	.005	.073	0	1
Separated	16,280	.007	.086	0	1
<b>Religious</b>					
Buddhist	16,489	.884	.320	0	1
Animist	16,489	.004	.066	0	1
Hindu	16,489	.004	.064	0	1
Muslim	16,489	.038	.192	0	1
Christian	16,489	.069	.253	0	1
Other	16,489	.001	.023	0	1
<b>Mother Tongue</b>					
Kachin	16,489	.013	.114	0	1
Kayah	16,489	.004	.063	0	1
Kayin	16,489	.032	.175	0	1
Chin	16,489	.024	.154	0	1
Mon	16,489	.022	.147	0	1
Myanmar	16,489	.700	.458	0	1
Rakine	16,489	.046	.209	0	1
Shan	16,489	.070	.254	0	1
Other	16,489	.0003	.0185	0	1
# Agricultural acre HH own	16413	4.546	8.313	.02	240
Chemical Fertilizer Use (Yes==1)	16486	.593	.491	0	1
Organic Fertilizer Use (Yes==1)	16486	.359	.48	0	1
Pesticide Use (Yes==1)	16486	.444	.914	0	99



# of hired labor (per-day)	16257	5.593	46.975	0	2540
<b>Panel C: Log of Calories Consumption</b>					
Total Consumption	16445	9.693	.735	5.928	13.86
Rice	13341	10.922	.676	4.314	17.583
Oil	15885	8.741	.835	3.583	12.796
Meat and Fish	15718	8.204	.822	2.495	10.919
Fruit and Vegetable	16417	8.093	.764	-.39	11.312

**Table 3.2 Policy impacts on agricultural input use and output**

VARIABLES	(1)	(2)	(3)	(4)
	Log of Crops yield per acre (Kilogram)	Use Chemical fertilizer	Use Pesticide	Log of Hired labor (per- day)
Post (After expansion of credit)	3.461*** (0.228)	0.367*** (0.0359)	0.506*** (0.0366)	4.509*** (0.240)
Rice Plot (Yes=1)	-0.0171 (0.0775)			
Post* Rice Plot (Yes=1)	0.671*** (0.236)			
Rice Cultivated HH (Yes=1)		2.122** (87.96)	81.81 (81.71)	0.0770 (0.0526)
Post* Rice Cultivated HH(Yes=1)		0.462* (0.252)	0.316 (0.238)	0.366*** (0.120)
Land tenure (Own=1)	0.00842 (0.0645)	-0.000317 (0.0158)	-0.0162 (0.0171)	0.0202 (0.0451)
Access Irrigation Water (Yes=1)	0.0789 (0.0523)	0.0973*** (0.0144)	0.132*** (0.0161)	0.136*** (0.0396)
Harvested Season (Wet==1)	-0.170** (0.0765)	-0.212*** (0.0202)	-0.147*** (0.0205)	-0.0205 (0.0371)
Log of Agricultural Land Acre HH own	-0.294*** (0.0530)	-0.00104 (0.00624)	0.0139* (0.00719)	-0.0672*** (0.0181)
Secondary Education	0.122*** (0.0364)	0.0291*** (0.00872)	0.0366*** (0.0110)	0.0292 (0.0303)
Post-Secondary Education	0.187*** (0.0528)	0.0490*** (0.0128)	0.0423*** (0.0144)	0.115*** (0.0369)
# of HH Members	0.00856 (0.00856)	0.00747*** (0.00198)	-0.000229 (0.00175)	-0.0221*** (0.00771)
# Children (age<=5)	-0.0288 (0.0246)	-0.0264*** (0.00844)	-0.0155** (0.00746)	0.0252 (0.0167)
# Elder Person (age>65)	0.00269 (0.0239)	-0.00412 (0.00596)	0.00295 (0.00587)	-0.00527 (0.0216)
Age of Household Head	0.00175 (0.00177)	0.000410 (0.000347)	0.000709** (0.000319)	0.00181 (0.00115)
Married	-0.0411 (0.0476)	-0.00601 (0.0103)	-0.0103 (0.0117)	-0.0277 (0.0362)
Widowed	-0.0973 (0.0696)	-0.0175 (0.0188)	0.0127 (0.0218)	-0.0388 (0.0681)
Divorced	-0.487 (0.556)	0.0346 (0.0577)	-0.0679 (0.0496)	0.311* (0.167)
Separated	-0.185 (0.267)	-0.00457 (0.0397)	-0.0832** (0.0396)	-0.437*** (0.158)
Animist	-0.378 (0.262)	-0.199** (0.0897)	-0.159 (0.131)	-0.554** (0.252)
Hindu	-0.626*** (0.166)	-0.00416 (0.0446)	0.210*** (0.0797)	-0.00818 (0.171)

Muslim	0.163 (0.144)	-0.0328 (0.0392)	-0.0205 (0.0400)	0.226 (0.139)
Christian	-0.0535 (0.111)	-0.186*** (0.0428)	-0.0701** (0.0333)	-0.0609 (0.105)
Other	1.586*** (0.549)	0.0382 (0.139)	-0.0843 (0.0973)	0.768*** (0.160)
Kayah	-0.245 (0.209)	0.0745 (0.0718)	-0.202* (0.122)	-0.116 (0.236)
Kayin	0.0516 (0.171)	0.0175 (0.0665)	-0.0552 (0.0566)	-0.448*** (0.158)
Chin	0.376* (0.224)	-0.0649 (0.0816)	-0.126** (0.0549)	-0.444* (0.225)
Mon	0.273 (0.275)	0.0315 (0.107)	-0.0846 (0.0587)	-0.652*** (0.177)
Myanmar	0.171 (0.175)	0.0522 (0.0618)	0.0350 (0.0530)	-0.258 (0.161)
Rakine	0.537** (0.222)	-0.0384 (0.108)	0.000722 (0.0785)	0.193 (0.251)
Shan	0.389** (0.177)	-0.119 (0.0931)	-0.0647 (0.0794)	-0.389** (0.191)
Other	0.236* (0.142)	-0.0498 (0.0615)	-0.0315 (0.0569)	-0.187 (0.129)
Constant	1.817*** (0.207)	0.374*** (0.0699)	0.281*** (0.0790)	-1.380*** (0.153)
Observations	9,661	12,875	12,875	9,440
Adjusted R-squared	0.376	0.324	0.270	0.687
Regional FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Group Specific Time Trend	YES	YES	YES	YES

Note: Coefficient with standard error are reported in parentheses cluster at township level. The periods are 2010, and 2015. Post is a dummy variable which equals zero for the year 2010, and one for the year 2015. The dummy for treated plot equals one for rice plot and zero for other crops (various bean, groundnut, sesame, sun-flower, other oil crops, cotton, maize, Mustard, jute, onion, chili, and sugarcane). The dummy for treated households equals one for rice-cultivating households and zero for other crops cultivating households. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3.3 Policy effects on rice farming household consumption calories**

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Log Consumption Calories (Per Week)				
	Total Consumption	Rice	Oil and Fats	Meat and Fish	Fruit and Vegetable
Post (After credit expansion)	1.306*** (0.0764)	-0.865*** (0.213)	-0.916*** (0.165)	-0.359** (0.141)	-0.585*** (0.157)
Rice Cultivated HH (Yes=1)	-0.0465*** (0.0164)	-0.00866 (0.0237)	-0.0515*** (0.0166)	-0.00865 (0.0191)	-0.0562*** (0.0191)
Post* Rice Cultivated HH(Yes=1)	0.102*** (0.0334)	-0.356* (0.188)	0.00985 (0.0852)	0.132* (0.0723)	0.153** (0.0634)
Land tenure (Own=1)	0.0628*** (0.0225)	0.0308 (0.0263)	0.0467* (0.0247)	0.0812** (0.0341)	0.0278 (0.0281)
Access Irrigation Water (Yes=1)	0.00289 (0.0159)	-0.00296 (0.0133)	-0.000133 (0.0182)	0.0254 (0.0164)	-0.00837 (0.0215)
Log of Agricultural Land Acre HH own	0.0323*** (0.00686)	0.0265*** (0.00964)	0.0678*** (0.00946)	0.0565*** (0.00918)	0.00141 (0.00902)
Secondary Education	0.0327*** (0.0113)	-0.0367** (0.0143)	0.0559*** (0.0163)	0.0328 (0.0199)	0.0155 (0.0162)
Post-Secondary Education	0.0425*** (0.0158)	-0.119*** (0.0206)	0.0927*** (0.0204)	0.0589** (0.0241)	0.0607*** (0.0205)
# of HH Members	0.106*** (0.00387)	0.156*** (0.00427)	0.0984*** (0.00326)	0.112*** (0.00403)	0.0986*** (0.00381)
# Children (age<=5)	-0.0400*** (0.00750)	-0.056*** (0.013)	-0.0787*** (0.0110)	-0.0306*** (0.0111)	-0.0332*** (0.0104)
# Elder Person (age>65)	0.0240*** (0.00667)	-0.0178*** (0.00669)	0.0158 (0.0102)	0.000668 (0.0117)	0.0259*** (0.00892)
Age of Household Head	-0.000967** (0.000422)	-0.000824 (0.00050)	0.000170 (0.000571)	-0.00124** (0.000555)	0.000203 (0.000615)
Married	0.0240 (0.0180)	-0.0237 (0.0162)	-0.00985 (0.0189)	0.0461** (0.0214)	0.00557 (0.0185)
Widowed	0.00666 (0.0292)	-0.0766** (0.0340)	-0.0941** (0.0362)	0.0307 (0.0417)	-0.0502 (0.0350)
Divorced	-0.0592 (0.0755)	-0.0264 (0.108)	-0.00172 (0.109)	-0.115 (0.129)	-0.116 (0.124)
Separated	-0.105 (0.0667)	-0.0323 (0.0707)	-0.123 (0.0848)	-0.0777 (0.0795)	-0.169* (0.0989)
Animist	0.198 (0.189)	0.0194 (0.249)	-0.0679 (0.202)	0.0254 (0.124)	0.232 (0.170)
Hindu	-0.246*** (0.0863)	0.186 (0.312)	-0.0487 (0.107)	-1.270*** (0.193)	-0.0401 (0.199)
Muslim	-0.0163 (0.0984)	-0.0492 (0.0722)	-0.0748 (0.0630)	-0.120 (0.116)	-0.0288 (0.103)

Christian	0.00281 (0.0390)	-0.0209 (0.112)	-0.217*** (0.0618)	0.0460 (0.0512)	-0.152*** (0.0582)
Other	0.110 (0.107)	0.147 (0.120)	-0.159 (0.246)	-0.696*** (0.182)	-0.529 (0.364)
Kayah	-0.197 (0.149)	0.00868 (0.180)	-0.285*** (0.0953)	-0.260 (0.187)	-0.405*** (0.129)
Kayin	0.0110 (0.0919)	0.167 (0.131)	0.0235 (0.0715)	0.127 (0.124)	-0.0785 (0.110)
Chin	-0.155 (0.128)	0.0409 (0.148)	-0.441*** (0.125)	0.0315 (0.137)	-0.0180 (0.178)
Mon	-0.234** (0.0998)	0.0801 (0.176)	0.159* (0.0905)	-0.121 (0.125)	-0.241** (0.122)
Myanmar	-0.0100 (0.0982)	0.143 (0.161)	0.155** (0.0738)	-0.00231 (0.122)	-0.0151 (0.118)
Rakine	0.0421 (0.109)	0.0703 (0.192)	-0.351 (0.229)	0.131 (0.143)	0.122 (0.137)
Shan	-0.0187 (0.101)	-0.104 (0.192)	-0.0963 (0.0832)	-0.125 (0.117)	-0.272** (0.108)
Other	-0.0206 (0.0920)	-0.107 (0.273)	-0.0968 (0.0657)	-0.0887 (0.0966)	-0.244** (0.102)
Constant	8.958*** (0.104)	9.846*** (0.135)	7.827*** (0.106)	7.136*** (0.104)	7.308*** (0.104)
Observations	12,847	10,690	12,511	12,335	12,833
Adjusted R-squared	0.549	0.348	0.391	0.224	0.233
Regional FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
HH Specific Time Trend	YES	YES	YES	YES	YES

Note: Coefficient with standard error are reported in parentheses cluster at township level. The periods are 2010, and 2015. Post is a dummy variable which equals zero for the year 2010, and one for the year 2015. The dummy for treated households equals one for rice-cultivating households and zero for other crops cultivating households. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3.4 Robustness check using triple DID**

VARIABLES	(1)	(2)	(3)	(4)
	Log of Crops yield per acre (Kilogram)	Use Chemical fertilizer	Use Pesticide	Log of Hired labor (per- day)
Post (After credit expansion)	3.097*** (0.218)	-0.456*** (0.0356)	0.498*** (0.0365)	0.615*** (0.0685)
Rice Plot (Yes=1)	-0.00372 (0.0706)			
Post* Rice Cultivated HH(Yes=1)	1.726*** (0.227)			
Rice Cultivated HH(Yes=1)		-0.00253 (0.0139)	-0.00173 (0.0192)	0.0227** (0.0102)
Post* Rice Cultivated HH(Yes=1)		0.126*** (0.0336)	0.0919*** (0.0315)	0.508*** (0.138)
Smallholder farmer	-0.468*** (0.108)	0.00366 (0.0213)	0.0294* (0.0172)	0.0324 (0.0200)
Smallholder farmer* Rice Plot (Yes=1)	1.177*** (0.106)	0.0128 (0.0242)	-0.0262 (0.0266)	0.0387*** (0.0130)
Smallholder farmer* Rice Cultivated HH(Yes=1)		0.0128 (0.0242)	-0.0262 (0.0266)	0.0387*** (0.0130)
Post * Smallholder farmer* Rice Plot (Yes=1)	-0.621*** (0.147)			
Post * Smallholder farmer* Rice Cultivated HH(Yes=1)		-0.0143* (0.0346)	-0.00507 (0.0333)	-0.778*** (0.148)
Constant	1.954*** (0.203)	0.744*** (0.0606)	0.278*** (0.0797)	-0.109** (0.0527)
Observations	9,664	9,366	12,869	12,680
Adjusted R-squared	0.419	0.435	0.269	0.195
Regional FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
HH Specific Time Trend	YES	YES	YES	YES

Note: Coefficient with standard error are reported in parentheses cluster at township level. The periods are 2010, and 2015. Post is a dummy variable which equals zero for the year 2010, and one for the year 2015. The dummy for treated plot equals one for rice plot and zero for other crops (various bean, groundnut, sesame, sun-flower, other oil crops, cotton, maize, Mustard, jute, onion, chili, and sugarcane). The dummy for treated households equals one for rice-cultivating households and zero for other crops cultivating households. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3.5 Robustness check using triple DID**

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Total Consumption	Rice	Oil and Fats	Meat and Fish	Fruit and Vegetable
Post (After expansion of credit)	1.308*** (0.0769)	- 0.717*** (0.0936)	-0.888*** (0.0679)	0.240*** (0.0678)	-0.498*** (0.0536)
Rice Cultivated HH (Yes=1)	-0.0166 (0.0176)	-0.0227 (0.0193)	-0.0399** (0.0179)	0.0705*** (0.0199)	-0.0339*** (0.0129)
Smallholder farmer	0.0234 (0.0214)	0.0352* (0.0198)	0.0510*** (0.0172)	0.00818 (0.0302)	0.00220 (0.0189)
Post* Rice Cultivated HH(Yes=1)	0.108*** (0.0357)	-0.445** (0.200)	0.0300 (0.0908)	0.205*** (0.0769)	0.179*** (0.0652)
Smallholder farmer * Rice Cultivated HH(Yes=1)	0.0195 (0.0261)	-0.0119 (0.0374)	0.0157 (0.0314)	0.106*** (0.0366)	0.00268 (0.0156)
Post * Smallholder farmer * Rice Cultivated HH(Yes=1)	-0.0527 (0.0527)	0.323 (0.324)	-0.166 (0.156)	-0.323** (0.142)	-0.0598 (0.115)
Constant	8.946*** (0.108)	9.822*** (0.137)	7.800*** (0.103)	7.057*** (0.101)	7.296*** (0.0664)
Observations	12,825	10,674	12,494	12,315	12,811
Adjusted R-squared	0.546	0.350	0.391	0.221	0.233
Regional FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
PlotYear FE	YES	YES	YES	YES	YES

Note: Coefficient with standard error are reported in parentheses cluster at township level. The periods are 2010, and 2015. Post is a dummy variable which equals zero for the year 2010, and one for the year 2015. The dummy for treated households equals one for rice-cultivating households and zero for other crops cultivating households. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1