Essays on Poverty Reduction in Myanmar

By

Kyu Khin Gar

Dissertation

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

IN DEVELOPMENT POLICY

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ABSTRACT

ESSAYS ON POVERTY REDUCTION IN MYANMAR

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This dissertation studies the effect on poverty in Myanmar of policies such as relaxing rice export licensing restrictions and implementing the national minimum wage. In addition, this study discovers the effect on poverty of traditional betel-quid chewing.

Chapter one studies the impact of export liberalization on household welfare, using the policy of relaxing rice export licensing restrictions. The study mainly exploits the difference-in-differences (DD) method to identify the policy impact. Results show that the policy has a positive impact on rice production, through increased use of agricultural inputs such as labour and chemical fertilizer. Increased rice production leads to higher consumption among rice-cultivating households. However, other households - such as rural landless households, urban households, and non-export-crops cultivating households reduce consumption due to higher rice prices. Thus, only rich rice-cultivating households benefit from the policy and adverse effects are concentrated on poor households. We conclude, therefore, that the rice export liberalization policy hurts household welfare at the aggregate level.

Chapter two studies the impact of the national minimum wage introduction on enterprise-level employment in Myanmar, using the difference-in-differences method. Results suggest that the minimum wage introduction raises enterprises' average-monthly labour cost, which leads to decreased employment and then to increased investment in machinery and equipment. We find no discernible effects on profit as enterprises raise labour productivity. Small enterprises also take the burden of higher labour costs resulting from the minimum wage introduction, although they are legally exempt from enforcement.

Chapter three examines the impact of chewing betel-quid on poverty incidence, using Myanmar data. To address the potential endogeneity in a household's decision on chewing betel-quid, we use household and community characteristics as instruments. 2SLS results suggest that chewing betel-quid exacerbates poverty through the direct channel - crowding-out effects of betel-quid consumption and associated health expenditure - and the indirect channel - loss of participation in the household workforce due to illness.

Keywords: Export liberalization; Rice; Household welfare; Minimum wage; Labour cost; Employment; Betel-quid; Poverty; Myanmar

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CHAPTER ONE

IMPACT OF EXPORT LIBERALIZATION ON HOUSEHOLD WELFARE: EVIDENCE FROM RELAXING LICENSING RESTRICTION

1.1 Introduction

The agricultural export restriction policies implemented in many countries after the global food crisis in 2007-08 - including imposing export bans or embargoes, taxes, quotas, and license restrictions - was to ensure food security, reduce domestic food prices, stabilize markets and protect consumer welfare (Abbott, 2011). Nevertheless, export restriction policies were short run policies and may not provide desired outcomes in the medium to long term (Aragie, Pauw, & Pernechele, 2018; Diao, Kennedy, Mabiso, & Pradesha, 2016; Porteous, 2017) and lead to more price fluctuations in domestic markets (K. Anderson & Nelgen, 2012).

Existing empirical evidence suggests that market liberalization improves the welfare of poor households through stabilizing prices in the long run (Ahmed, 1988; Myers, 2006; Winters, McCulloch, & McKay, 2004). The more farmers engage with export markets, the more benefit they will get through higher prices and production (Balat, Brambilla, & Porto, 2009; Hertel & Reimer, 2005). However, the higher food prices associated with export liberalization policies is a matter of concern because higher food prices will reduce real income and consumers' welfare, particularly in poor households (Swinnen, 2011).

The effect of agricultural market liberalization on household welfare is never clear although trade theorists have studied on the subject for a long time (Hoekman, Michalopoulos, Schiff, & Tarr, 2001; Litchfield, Mcculloch, & Winters, 2003). A general conclusion is that net welfare gains of export liberalization policy relies on net sale position of households' benefits, while net buyers - rural landless households and urban households - lose (J. E. Anderson & Van Wincoop, 2004; Mellor, 1978).

Some research has investigated the effect of export restriction policies, but a disproportionate number of articles study the effect of export liberalization. Coello (2009) studies the impact of import tariff reductions by importing countries on the welfare of farmers in exporting countries. Results show that a 1% decrease in tariffs in importing countries leads a 0.17% increase in production and a 124% increase in the average income of households cultivating export crops. Minot & Goletti (1998) investigate the impact of eliminating rice export quotas in Vietnam on household welfare by using a multimarket spatial-equilibrium model. Findings reveal that the policy of removing rice export quotas would raise prices but the incidence and severity of poverty would reduce.

This paper investigates the effects of relaxing agricultural export licensing restrictions on production and household welfare by holding import policies constant. Further, in several respects we build on the two research findings discussed above. First, we study the policy impacts on both producer, rice-cultivating households, and consumer households, rural landless households, urban households and non-export-crops cultivating households. Second, we explore the underlying mechanism of policy impacts on rice-cultivating households. Finally, we explore the differential impacts of export liberalization on different types of households.

To investigate the impact of relaxing export licensing restrictions on rice-cultivating households, we hypothesize that rice farmers will expand production by increasing use of agricultural inputs in response to higher farm gate prices for rice. Increased rice production then leads to higher consumption in rice-cultivating households. To study the impact on other households, we hypothesize that increased rice sector labour demand will create employment for rural landless households and then study whether the gains from employment growth would help rural landless households to offset higher rice price associated with the export liberalization.

The study mainly uses a difference-in-differences approach to identify the policy impacts by using three household surveys. Results indicate that the policy has a positive effect on rice production through the increase in agricultural inputs used. The increase in rice production further leads to higher consumption in rice-cultivating households. Although the policy creates employment for rural landless households, the gain from employment growth is not large enough to offset the higher staple food prices associated with export liberalization. The policy also harms welfare of urban households and non-export-crops cultivating households.

The structure of the paper proceeds as follows. We provide a detailed overview of the institutional context of the rice market and export liberalization policies in Myanmar in section 1.2. Section 1.3 presents the estimation framework and data we used in this study. In section 1.4, we describe the impacts of the policy on production and consumption of rice-cultivating households followed by the differential impacts on different types of household in section 1.5. Section 1.6 turns to the issue of identification assessment. We discuss the policy impact on household welfare at the aggregate level in section 1.7, and section 1.8 concludes.

1.2 Institutional Background

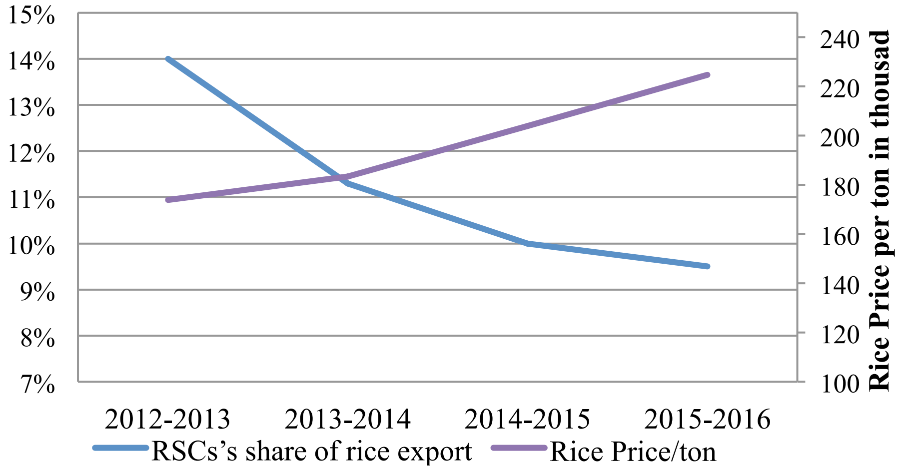
Agriculture is the core of Myanmar's economy. 55.3% of the national labour force is employed in the agriculture sector, and 77.8% of agriculture labour works in the rice sector. (Myanmar, Mininistry of Labour Immigration and Population, 2017). Agriculture is 10.09% of exports, and rice accounts for 9.1% of the total agricultural exports. Rice accounts for approximately 50% of total food intake in lower-income families and 25% in families with higher incomes (The World Bank, 2017).

As rice is a staple food in Myanmar, the rice market has been distorted over decades by different policies. Myanmar has implemented broad-based structural market reforms in agriculture since the early 2000s. During the first market liberalization, from 1988 to 2002, pulses and maize markets were liberalized but rice markets remained under government control. In the second agricultural market liberalizations, in 2003-2008, government abandoned compulsory procurement, withdrew from rice exporting, and allowed private investors to participate in the rice export market.

Immediately after the global food crisis in 2007-08, government restricted rice exports by imposing constraints on licensing processes. In 2008, rice export licenses were granted only to Rice Specialized Companies (RSCs) involved in the rice supply chains development and conducting contract farming with rice farmers. To be eligible for an export license, RSCs had to submit a contract farming record to the Ministry of Commerce with the approval of the local authority. Requirements of contract farming included providing quality seeds, fertilizers and mechanized services to rice farmers at low interest rates.

In April 2011, government abandoned the policy of granting export licenses to RSCs. After the changes, any trader could get an export license regardless of contract-farming records. Thus, RSCs lost privileges in rice exports and the market became more competitive, with RSCs share falling sharply as many traders entered the export market and farm gate prices for rice increased as shown in **Figure 1-1**.

Figure 1-1: RSCs' Export Share and Farm Gate Price



Source: Central Statistical Organization of Myanmar

1.3 Data

We use data from three household surveys conducted by the United Nation Development Program (UNDP) and the World Bank. UNDP conducted two-round household surveys - Integrated Household Living Conditions Assessment (IHLCA) in 2009 and 2010. The IHLCA surveys are nationwide quantitative surveys, which collected detailed information on household demographic characteristics, housing, education, health, consumption expenditures, household assets, employment, business, and finance from 18,660 households. The survey's first round was conducted in December 2009 and the second round in May 2010. The survey used a stratified sampling design with 62 districts and two townships across all district as the first-stage-sampling units. Wards from urban areas and villages from rural areas were randomly taken from the selected townships in accordance with the numbers of households in the second stage. Finally, to select twelve households from each ward or village in the selected township, the survey uses Probability Proportionate to Estimated size with Replacement (PPES).

World Bank conducted the Myanmar Poverty and Living Conditions Survey (MPLCS) in 2015. The MPLCS is also a nationally representative survey and the sample design was developed based on the sampling frame on 2014 Census pre-enumeration list data. The survey used a stratified multi-stage sample design and the probability of proportional to size (PPS) was used for EAs. The sample within the EAs was selected from master sample by using random systematic sampling with equal probability and EAs' coverage are the same as the district level. The questionnaires in the MPLCS survey were based on the IHLCA.

To study the effects of rice export liberalization policy on production, we use plot information such as type of crops, quantity harvested, size of the plot, crop harvested by season, land tenure types, and access to irrigation. For household welfare, we use information such as household consumption expenditure. The plot level information and households' socio-economic characteristics are summarized in **Table 1.1** of panels A and B respectively.

Table 1-1:Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Panel A: Plot level				
Crops yield per acre (Kilogram)	740.99	668.75	0	4076.8
Dummy for harvest season (Wet season=1)	0.434	0.496	0	1
Dummy for land type (Lae=1)	0.318	0.466	0	1
Dummy for access to irrigation (Yes=1)	0.257	0.437	0	1
Dummy for land tenure (Own=1)	0.595	0.491	0	1
Observations		14187		
Panel B: Household level				
Per capita food expenditure per day (Kyats)	2472.743	1433.075	26.874	35343.81
Per capita non-food expenditure per day (Kyats)	207.508	1170.698	0	88046.96
Per capita total expenditure per day (Kyats)	2679.568	1922.256	26.874	90525.43
Dummy for chemical fertilizer use (Yes=1)	0.657	0.475	0	1
# of hired labour used (Person-days)	48.51	126.88	0	2760
# of acre of agricultural land, a household own	8.205	10.610	0.1	180.5
Household head gender (Male=1)	0.788	0.409	0	1
Household head education (Years of schooling)	5.641	3.513	0	19
# of household members	1.538	1.537	1	18
# of children aged <=5	0.321	0.579	0	6
# of seniors aged 65+	0.301	0.570	0	3
# of household members got sick in recent 3 months	0.549	0.970	0	11
Average annual rainfall at regional level (millimeter)	2333.884	2072.573	633	20229
Mean maximum temperature at regional level (Celsius)	33.087	2.378	23.1	35.2
Mean elevation at regional level (Meter)	216.637	379.745	11	1570
Dummy for rural landless households	0.282	0.450	0	1
Dummy for urban households	0.255	0.436	0	1
Dummy for rice-cultivating households	0.211	0.408	0	1
Dummy for export-crops cultivating households	0.108	0.310	0	1
Dummy for non-export-crops cultivating households	0.144	0.351	0	1
Dummy for paddy region (Yes= A region in which the share of rice sown acre is more than 10% of total rice sown acre in the country)	0.328	0.469	0	1
Observations		16771		

Notes: 1 US$ approximately equals to 1,300 Kyats (Local Currency) in 2010.

1.4 Effects on Rice-cultivating Households

As the rice export licensing policy affects only the rice sector, we first explore the effects of rice export liberalization on production and consumption expenditures of rice-cultivating households. We hypothesize that rice farmers will expand production by increasing use of agricultural inputs, and then the increased rice production leads to higher spending on food and non-food consumption.

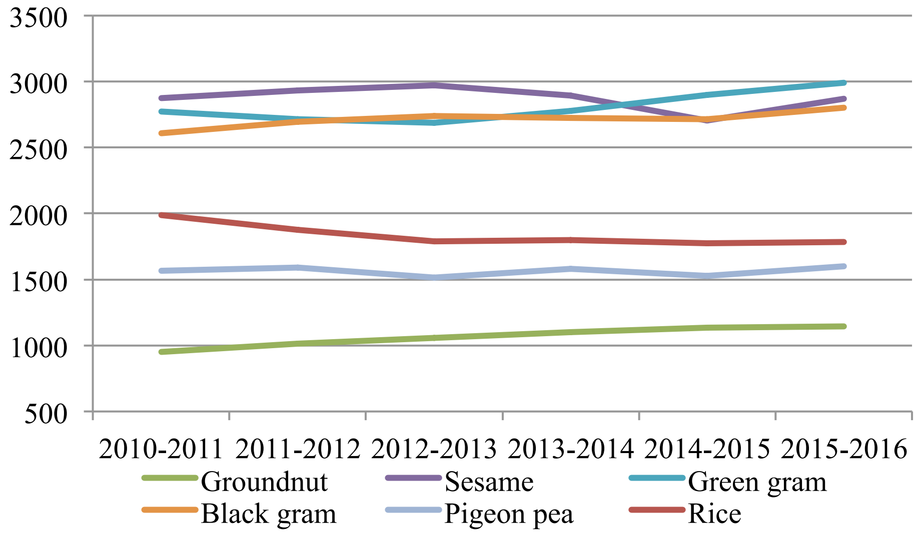
To explore the policy impact on production, we used the plot-level data. Our estimation strategy is to compare the relative change in yield per acre of rice plot and the plots cultivated at least of the five export crops—that is, groundnut, green gram, sesame, pigeon pea, and black gram. We can plausibly use the five export crops as a reference because the export market for the five export crops has been liberalized since 2002 and the policy affects only the rice market. To investigate the effects on agricultural input use and household consumption, we use household level data. We compare agricultural input use and household consumption in the pre-policy intervention to post policy intervention between rice-cultivating households and households cultivating at least one of the five export crops (hereafter export-crops cultivating households).

The validity of our identification strategy relies on an assumption that implies farmers will not switch crop after the policy change. One possible argument is that when rice farm gate prices increase, other crops farmers might switch to rice if the return from cultivating rice is higher than other export crops. Since we use the pooled cross-section data, we cannot control for the potential endogeneity in farmers' cropping decisions. In practice, it is less likely to be the case for a number of reasons e.g., differences in crop nature, evidence from national statistics of crops sown acre, and the estimates from Ordinary Least Squared (OLS) regression.

Firstly, the nature of rice is very different from each of the five export crops because rice is a water intensive crop but the export crops used in this study are water sensitive crops. The soil content of rice plots must contain at least 50% clay texture to be able to hold water for a certain period of time. The export crops can only be cultivated at plots with good drainage, therefore, those plots must contain sandy and loam soil content. The clay texture plots tend to be poorly drained, which can cause crops' root rot and blossom fall.

Secondly, we analyse the trends in crops sown area during the study period (2010-2015) by using national statistics. As shown in **Figure 1-2**, rice-sown acre at national level slightly decreased while the sown acre of export crops remained unchanged after RSCs lost export preference from government.

Figure 1-2: National Sown Acres for Selected Crops



Source: Myanmar Central Statistic Organization

Finally, we investigate whether farmers switch to rice by conducting before and after analysis with ordinary least squared (OLS) estimates. The OLS estimates show that there is no significant change in rice-sown acre at the household level before and after the policy change (Reported in appendix table A-1)

1.4.1 Effects on Rice Output and Inputs

We hypothesize that the rice market became more competitive after the policy intervention and rice farm gate prices increased as shown in **Figure 1-1**. As farmers are profit maximisers, higher rice prices are a good incentive to expand production by using more agricultural inputs. To identify the policy impact on consumption in rice-cultivating households, we first investigate the effect on rice production by using plot level data. As the policy affects only the rice market, this allows us to apply a difference-in-differences approach. To explore the causal impact on rice production, we compare rice yield per acre with five export crops by taking advantage of time variations. We use the following plot level equation to examine the policy impact on rice production:

$$Y_{ihjt} = \beta_0 + \beta_1 Post + \beta_2 Treat_{Plot} + \beta_3 Post * Treat_{Plot} + X'_{ihjt}\beta_4 + Z'_{hjt}\beta_5 + I'_{jt}\beta_6 + \delta_j + \varepsilon_{ihjt}, \quad (1.1)$$

where i, h, j and t denotes plot, household, district, and year respectively. "Y_{ihjt}" denotes the natural log rice output per acre. "$Post$" is a dummy variable, which equals one for the year 2015 and 0 otherwise. "$Treat\_Plot$" is a dummy variable in which 1 specifies rice plots, and 0 takes at least one of the five export-crops plots. "X_{ihjt}" denotes plot characteristics including land type, access to irrigation, tenure type, harvest season; "Z'_{hjt}" represents household characteristics including the natural log of total acres of land a household owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, # of household members who were sick in the last three months, dummy for agricultural input use; and "I'_{jt}" indicates regional characteristics including the annual mean level of rainfall, mean level of maximum temperature and mean level of elevation. In addition, we control for district-year two-way fixed effects "δ_j". "ε_{ihjt}" denotes the random disturbance.

Column (1) of **Table 1.2** shows estimates from equation (1.1) and results indicate that rice output per acre increases after rice export licensing restrictions has been relaxed. The coefficient of the interaction term "*Post * Treat_Plot*" in column (1) indicates that rice production per acre increased 71.7 percent on average in 2015 compared to the yield per acre of five export-crops plot.

Agricultural specialists agree that the key to agricultural productivity is the use of agricultural inputs such as chemical fertilizers. The yield gap between Asia and Africa can be clarified by the different levels of agricultural input use (Morris, Kelly, Kopicki, & Byerlee, 2007). Poor farmers are present bias although they are rational profit optimizers; therefore, they fail to make use of the seemingly profitable investment in fertilizers (Duflo, Kremer, & Robinson, 2011).

To explore a causal mechanism underlying the increase in rice production, we analysed the relative increase in agriculture input use, such as labour and chemical fertilizer, pre-policy and post-policy intervention between rice-cultivating households and export-crops cultivating households. We use the following equation to estimate the effects on household agricultural input use and consumption expenditure:

$$Y_{hjt} = \beta_0 + \beta_1 Post + \beta_2 Treat\_HH + \beta_3 Post * Treat\_HH + X'_{hjt}\beta_4 + I'_{jt}\beta_5 + \delta_j + \epsilon_{hjt}, \quad (1.2)$$

where h, j and t denote household, district, and year respectively. "Y_{hjt}" denotes a set of outcome variables such as the dummy for household chemical fertilizer use, the natural log of number of hired labourers measured in person-days, the log of household total expenditure, food consumption and non-food consumption expenditure, which are adjusted with the household age composition and household size (economies of scale). "$Post$" is an indicator that takes one for the year 2015, and 0 otherwise. "$Treat\_HH$" is a dummy variable in which one specifies rice households, and 0 indicates export-crops cultivating households. "X_{hjt}" represents household characteristics including the natural log of total acres of land a household owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, # of household members who were sick in the last three months, and "I'_{jt}" includes regional characteristics including the annual mean level rainfall, the mean level maximum temperature, and the average elevation. In addition, we control for district-year two-way fixed effects "δ_j".

Estimates for agricultural input use are reported in columns (2) and (3) of **Table 1.2.** We discover consistent results with prior research, which suggest agricultural productivity is positively correlated to labour and agricultural inputs (Amare, Denno Cisse, Jensen, & Shiferaw, 2014).

Table 1-2: Impacts on Rice Output and Inputs

	(1) Log of yield per acre	(2) Dummy for chemical fertilizer use	(3) Log of number of hired-labour
Post (After relaxing restrictions)	-0.052	0.615***	2.736***
	(0.309)	(0.105)	(0.705)
Dummy for Treated plot (Rice plot=1)	1.078***		
	(0.155)		
Post * Treated plot (Rice plot=1)	0.717**		
	(0.320)		
Dummy for Treated HH		-0.014	0.274***
(Rice-cultivating HH=1)		(0.041)	(0.095)
Post * Dummy for Treated HH		0.119*	1.366***
		(0.061)	(0.329)
Plot controls	Yes	No	No
Household controls	Yes	Yes	Yes
Region controls	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes
Observations	8324	5041	5041

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations in column (1) is a plot and in columns (2) and (3) households. The periods are 2010 and 2015. The dependent variable in column (1) is the natural log of yield per acre, in column (2) is a dummy variable that equals one if the household uses chemical fertilizer and zero otherwise, and in column (3) is the nature log of hired labour measured in person-day. "Post" is an indicator, 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 at least one of five other export crops (Groundnut, sesame, black gram, green gram, and pigeon pea). The dummy for treated households equals one for rice-cultivating households and zero for export- crops cultivating households.
"Plot controls" includes dummy for land type, dummy for access to irrigation, dummy for land tenure type, and dummy for harvest season. "Household controls" includes the natural log of total acre of land owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, # of household members who were sick in the last three months, and dummy for agricultural inputs use. "Regional controls" includes log of annual mean level rainfall, mean level maximum temperature, and average elevation. In all regressions, we control for district-year two-way fixed effects. Columns (2) and (3) exclude dummy for household agricultural inputs use from "Household controls".
** p<0.10, ** p<0.05, *** p<0.01.*

The coefficient of the interaction "*Post * Treat_HH"* in column (2) indicates that the probability of chemical fertilizer use in rice-cultivating households increase 11.9 percent relative to export-crops cultivating households after the policy intervention. Column (3) reports estimates for the hired-labour use, which is measured by person-day. The coefficient of interest of the interaction term in column (3) shows that hired labour in rice-cultivating households increased by 136.6 percent relative to their counterparts after the policy intervention.

1.4.2 Effect on Consumption Expenditure

To explore the effect on consumption expenditure, we use the Difference-in-Differences framework. We compare the relative change in household total expenditure, food expenditure and non-food expenditure before and after the policy intervention between rice-cultivating households and export-crops cultivating households.

Total expenditure on household consumption is calculated by adding the spending on food and non-food consumption. Food expenditure is calculated by multiplying the total quantity of food items consumed by a household and the price deflated by Paasche price index (PPI). The PPI represents the variation of both price and quantity consumed over space and time. Non-food expenditures include the household's non-food consumption expenditures and rent expenditures, but exclude spending on health from non-food because it is most often a shock response and generally does not enhance a household's welfare.

It is essential to adjust for household composition and size (scale economies) to compare spending across households. Household composition adjustment takes into account that children in a household consume less than adults because they have lower caloric needs and they have more restricted items to consume. To adjust the economies of scale across households, we take account of the "public goods" aspect of some items consumed by households e.g., housing, television, etc., whereby consumption by one household member does not reduce the amount available to another person in the same household. We use equation (1.3) to adjust the household adult equivalent scales for household food consumption expenditure:

$$AEF_j = (MA_j + \alpha_1 FA_j + \alpha_2 C_j)^{\theta}, \quad (1.3)$$

where "AEF_j" is the number of adults equivalent for food consumption expenditure in household "j", "MA_j" denotes the number of male-adults aged 15+ in household "j", "FA_j" presents female-adults aged 15+ in household "j", "C_j" denotes the number of children aged <=14 in household "j", "α_1" represents the cost of a female adult relative to that of a male adult, "α_2" represents the cost of a child relative to that of a male adult, "θ" is an elasticity of adult equivalents with respect to effective size. α_1,α_2, and θ are set to 0.9, 0.7 and 0.9 respectively based on nutrition norms (Deaton & Zaidi, 2002).

In order to compare non-food consumption expenditure across households, we use equation (1.4) to adjust the household economies of scale:

$$AENF_j = (A_j + \alpha C_j)^{\theta}, \quad (1.4)$$

where "$AENF_j$" is the number of adult equivalents for non-food consumption expenditure in household "j", "A_j" denotes the number of adults aged 15+ in household "j", "C_j" denotes the number of children aged <=14 in household "j", "α" represents the non-food cost of a child relative to that of a male-adult, "θ" is an elasticity of adults equivalent with respect to effective size between 0 and 1. α and θ are set to 0.3 and 0.9 respectively based on nutrition norms (Deaton & Zaidi, 2002).

Table 1-3: Effects on Rice-cultivating Household Consumption

Dependent variables are natural log of household expenditure	(1) Total expenditure	(2) Food expenditure	(3) Non-food expenditure
Post (After relaxing restrictions)	1.494***	1.446***	2.611***
	(0.075)	(0.078)	(0.108)
Dummy for Treated HH	-0.319***	-0.325***	0.001
(Rice-cultivating HH=1)	(0.058)	(0.059)	(0.029)
Post * Dummy for Treated HH	0.133**	0.120*	0.095
	(0.065)	(0.068)	(0.084)
Household controls	Yes	Yes	Yes
Region controls	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes
Observations	5305	5305	5305

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations is a household. The periods are 2010 and 2015. "Post" is an indicator variable, which equals zero for the year 2010, one for the year 2015. The dummy for treated households equals one for rice-cultivating households and zero indicates export-crops cultivating households. The dependent variables in columns (1)-(3) are the natural log of total expenditure, food expenditure and non-food expenditure respectively, which are adjusted for household composition and household size (economies of scale).
"Household controls" include the natural log of total acres of land owned, household head's education and sex, # of household members, # of children aged <=5, number of seniors aged 65+ and # of household members who were sick in the last three months. "Regional controls" include log of the annual mean level rainfall, the mean level maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01.*

We use equation (1.2) to explore the impacts of the export liberalization policy on household consumption and the results are presented in **Table 1.3**. Columns (1)-(3) provide estimates of household total expenditure, food expenditure and non-food expenditure. In all regressions, we control for household characteristics including the natural log of total acres of land owned, household head's education and sex, number of household members, number of children aged <=5, number of seniors aged 65+, number of household members who were sick in the last three months; and regional characteristics including the annual mean level rainfall, mean level maximum temperature and the average elevation. In addition, we control for district-year two-way fixed effects in all regressions.

The coefficient of the interaction "*Post * Treated HH"* in column (1) reveals that total expenditure in rice-cultivating households increase 13.3 percent relative to export-crops cultivating households after relaxing rice export licensing restrictions, in column (2) indicates that household expenditures on food increase 12 percent, however, there is no impact on non-food consumption relative to their counterparts after the policy change. The efforts to increase production in a household with a higher composition of rice relative to other crops may not be the same as a household with lower rice composition. To allow the differential impact of policy on crops composition, we use a continuous treatment - acres of plot that is cultivable rice a household owns (Reported in appendix table A-2). Results are consistent with our baseline estimates.

1.5 Effect on Different Types of Household

In this section, we investigate the policy impact on agricultural employment in rural landless households. Then, we study whether the gain from employment growth is large enough to offset the higher food prices associated with export liberalization, particularly in rural landless households. We also study the impacts of rice export liberalisation on other households, such as urban households and non-export-crops cultivating households.

1.5.1 Effect on Employment in Rural Landless Households

The spillover effects of an agricultural policy are crucial to economic growth (World Bank, 2008). Hornbeck and Keskin (2015) note that wages for agricultural workers increase due to increased production and McCulloch, Winters, and Cirera (2001) suggest that trade liberalization tends to create job opportunities if the policy affects a labour-intensive sector and will increase wages and employment.

We hypothesize that the increase in rice sector labour demand due to increased production will create employment for rural landless households. To investigate the effect on employment in rural landless households, we use equation (1.5):

$$Y_{hjt} = \beta_0 + \beta_1 Post + \beta_2 Treat_{hh} + \beta_3 Post * Treat_{hh} + X'_{hjt}\beta_4 + I'_{jt}\beta_5 + \delta_j + \epsilon_{hjt}, \quad (1.5)$$

where "h" denotes a household in district "j" and "t" represents year. "$Post$" is an indicator that takes one for the year 2015 and 0 otherwise. "$Treat_{hh}$" is a dummy variable in which one specifies rural landless households, and 0 indicates export-crops cultivating households. In all regressions, we control for district-year two-way fixed effects "δ_j". "X_{hjt}" includes a set of household characteristics and "I'_{jt}" indicates regional characteristics.

Table 1.4 presents estimates from equation (1.5). The coefficient of the interaction term "*Post × Treat_hh*" indicates that agricultural working days in landless households increase by 60.3 percent relative to export-crops cultivating households after the policy change.

Table 1-4: Effects on Employment in Rural Landless Households

	(1) Log of number of agricultural working days
Post (After relaxing restrictions)	0.900***
	(0.099)
Dummy for treated HH (Rural landless HH=1)	-1.618***
	(0.052)
Post * Treated HH	0.603***
	(0.106)
Household controls	Yes
Region controls	Yes
District-year two-way FE	Yes
Observations	6540

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations is a household. The periods are 2010 and 2015. "Post" is an indicator variable, which equals zero for the year 2010, one for the year 2015. The dummy for treated households equals one for rural landless households and zero for export-crops cultivating households. The dependent variable is the log of number of agricultural working days in rural landless households. "Household controls" include the natural log of total acres of land owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, and # of household members who were sick in the last three months. "Regional controls" include the log of the annual mean level rainfall, the mean level maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01.*

1.5.2 Effect on Consumption Expenditure of Different Types of Households

There is much empirical research that investigates the impacts of export liberalization policy, however, there is no general consensus on the policy impacts on household welfare. One of the key underlying mechanisms of the impact of export liberalization policy on household welfare is the price change (Deaton, 1989). In the case of increased prices resulting from export liberalization, net sellers (e.g., rice-cultivating households) would be better off while net buyers (e.g., urban households and rural landless households) would be worse off (Mellor, 1978; Swinnen, 2011).

On the other hand, agricultural expansion may create employment especially for rural landless households (Irz, Lin, Thirtle, & Wiggins, 2001). A number of empirical studies identified the connection between agricultural development and household welfare through employment growth in both the agricultural and non-agricultural industries (Coxhead & Warr, 1991; De Franco & Godoy, 1993). As we found, export liberalization creates employment for rural landless households and they may benefit from employment growth. Nevertheless, higher staple food prices associated with export liberalization may offset the gain from employment growth. To investigate whether gains from employment growth outweigh the losses from higher prices, we explore the policy impact on consumption expenditures in rural landless households. In addition, we explore the effects on consumption expenditure in urban households and non-export-crops cultivating households by using the following equation:

$$Y_{hjt} = \beta_0 + \beta_1 Post + \beta_2 RL_{hh} + \beta_3 U_{hh} + \beta_4 R_{hh} + \beta_5 NExp_{hh} + \beta_6 Post * RL_{hh} + \beta_7 Post * U_{hh} + \beta_8 Post * R_{hh} + \beta_9 Post * NExp_{hh} + X'_{hjt}\beta_{10} + I'_{jt}\beta_{11} + \delta_j + \epsilon_{hjt}, \qquad (1.6)$$

where h, j, and t denote household, district, and year respectively. "$Post$" is an indicator that takes one for the year 2015 and 0 otherwise. RL_{hh}, U_{hh}, R_{hh} and $NExp_{hh}$ are dummy variables in which one specifies rural landless households, urban households, rice-cultivating households, and non-export-crops cultivating households respectively, and 0 indicates export-crops cultivating households (Detailed information for household classifications are reported in appendix table A-3). "X_{hjt}" indicates household characteristics and "I_{jt}" is a set of regional characteristics. In all regressions, we also control for district-year two-way fixed effects "δ_j".

A possible threat to the identification strategy is that the increase in rice prices may affect the consumption expenditure of export-crops cultivating households used as a reference group in this study. If this is the case, the baseline estimates will be biased. However, our assumption - that the effect of higher rice prices on consumption expenditure of the reference household is negligible- is plausible for a number of reasons.

Firstly, although rice-cultivating households benefit from the production expansion they also consume rice, so the increase in rice prices may negatively affect them. As we apply the Difference-in-Differences setting to estimate the policy impacts, the negative effects on both treated group and control group will cancel each other out. Secondly, we compare the distribution of total expenditures of export-crops cultivating households before and after export liberalization to assess whether the increase in rice prices affects the consumption expenditures. The distributions of total expenditures of export-crops cultivating households are very similar before and after the export liberalization as shown in **Figure 1-3**.

Estimates from equation (1.6) are reported in **Table 1.5**. The specification in columns (1)-(3) presents the effects of the export liberalization policy on household total expenditures, food expenditures and non-food expenditures respectively. The coefficients of the first interaction "*Post * Treated HH (Rural landless HH)"* in columns (1)-(3) indicates that total consumption expenditures, food expenditures and non-food expenditures in rural landless households decrease by 40.20 percent, 39.3 percent, and 67.6 percent respectively relative to export-crops cultivating households after the policy intervention.

Table 1-5: Effects on Household Consumption

	(1) Log of total expenditure	(2) Log of food expenditure	(3) Log of non-food expenditure
Post (After relaxing restrictions)	1.064***	1.172***	-0.603***
	(0.075)	(0.082)	(0.136)
Dummy for treated HH (Rural landless HH=1)	0.217***	0.193***	0.006
	(0.052)	(0.050)	(0.107)
Dummy for treated HH (Urban HH=1)	0.150**	0.119*	0.092
	(0.059)	(0.059)	(0.078)
Dummy for treated HH (Rice-cultivating HH=1)	-0.415***	-0.410***	-0.161**
	(0.062)	(0.062)	(0.066)
Dummy for treated HH (Non-export-crops cultivating HH=1)	0.129***	0.071	0.715***
	(0.048)	(0.047)	(0.085)
Post * Treated HH (Rural landless HH)	-0.402***	-0.393***	-0.676***
	(0.071)	(0.073)	(0.138)
Post * Treated HH (Urban HH)	-0.248**	-0.230**	-1.031***
	(0.094)	(0.099)	(0.123)
Post * Treated HH (Rice-cultivating HH)	0.203***	0.193***	0.143
	(0.068)	(0.072)	(0.114)
Post * Treated HH (Non-export-crops cultivating HH)	-0.556***	-0.491***	-0.783
	(0.075)	(0.068)	(0.572)
Household controls	Yes	Yes	Yes
Region controls	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes
Observations	16771	16768	16771

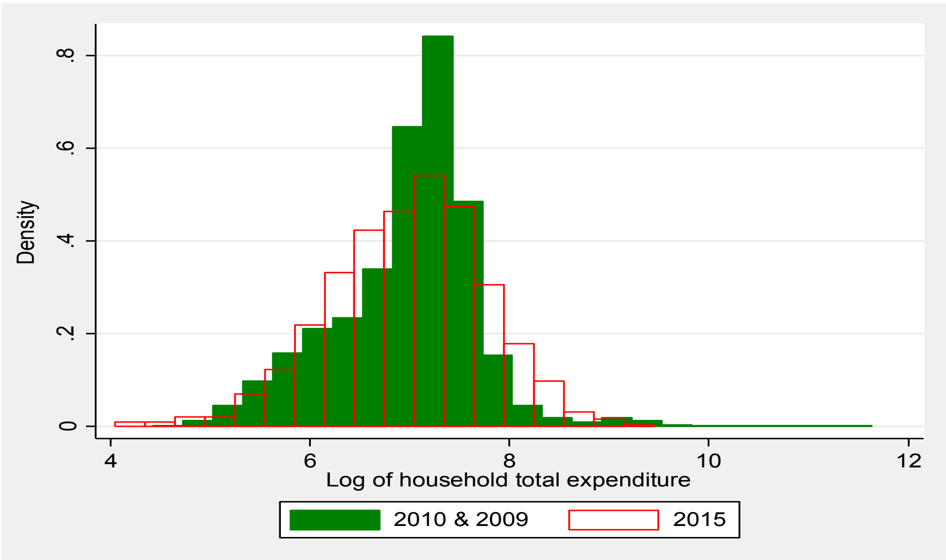
Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations is a household. The periods are 2010 and 2015. "Post" is an indicator, which equals zero for the year 2010, and one for the year 2015. The dummy for treated households equals one for rice-cultivating households, rural landless households, urban households, and non-export-crops cultivating households and zero indicates the export-crops cultivating households. The dependent variables in columns (1)-(3) are the natural log of total expenditure, food expenditure, and non-food expenditure respectively, which are adjusted for household composition and household size (economies of scale).
"Household controls" include the natural log of total acres of land owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, and # of household members who were sick in the last three months. "Regional controls" include the log of the annual mean level rainfall, the mean level of maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01.*

Findings suggest that benefits from new agricultural employment is not large enough to offset the higher food price. Since farm income is lumpy and has a significant time gap, rural households may need to depend on non-farm revenue to ease consumption and spending (Bryceson, 1999; Ellis, 1998; Masanjala, 2006).

The coefficient of the interaction "*Post * Treated HH (Urban HH)*" shows that total consumption expenditures, food expenditures and non-food expenditures in urban households decrease on average by 24.80 percent, 23 percent and 103.10 percent respectively. Total expenditure and food expenditure in non-export-crops cultivating households also decrease by 55.60 percent and 49.10 percent respectively, however, there is no impact on non-food expenditure.

We find consistent results for the impact on rice-cultivating households. The coefficient for *Post * Treated HH (Rice households)* indicates that total expenditures, and food expenditures increase by 20.30 percent, and 19.30 percent respectively, but there is no significant impact on non-food consumption.

Figure 1-3: Distribution of Total Expenditure in Export-crops cultivating Households (Comparison between before and after export liberalization)



1.6 Assessing the Identification Strategy

1.6.1 Falsification Test

The validity of our baseline estimates depends on the assumption of a parallel trend of the outcome variable between the treatment group and control group. It means that the difference in outcome variables between the 'treatment' and 'control' group would be constant over time in the absence of treatment.

Table 1-6: Falsification Test

	(1)	(2)	(3)	(4)	(5)	(6)
	Log of crop yield per acre	Input Use		Consumption Expenditure		
		Dummy for chemical fertilizer use (Yes=1)	Log of number of hired labour	Log of total expenditure	Log of food expenditure	Log of non-food expenditure
Post * Treated plot (Rice plot=1)	0.259 (1.50)					
Post * Treated HH (Rice-cultivating HH)		-0.113 (0.070)	-0.264 (0.181)	-0.006 (0.047)	0.008 (0.042)	0.056 (0.094)
Post * Treated HH (Rural landless HH)				-0.046 (0.046)	-0.024 (0.041)	-0.279 (0.174)
Post * Treated HH (Urban HH)				-0.078 (0.054)	-0.046 (0.046)	-0.278 (0.233)
Post * Treated HH (Non-export-crops HH)				-0.013 (0.048)	0.012 (0.042)	-0.154 (0.167)
Plot controls	Yes	No	No	No	No	No
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Region controls	Yes	Yes	Yes	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16498	10919	10701	30530	30529	29715

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations in column (1) is a plot and columns (2)-(6) is a household. The periods are 2009 and 2010. "Post" is an indicator, which equals zero for the year 2009 and one for the year 2010. The dummy for treated plot equals one for rice plot and zero for at least one of five other export crops (Groundnut, sesame, black gram, green gram, and pigeon pea). The dummy for treated households equals one for rural landless household, urban household, rice-cultivating households and non-export-crop cultivating households respectively, and zero indicates export-crops cultivating households. The dependent variable in column (1) is the natural log of yield per acre, in column (2) is the dummy for household chemical fertilizer use, in column (3) is the natural log of number of hired labour measured in Person-days and in columns (4)-(6) are the natural log of total expenditure, food expenditure, and non-food expenditure respectively, which are adjusted for household composition and household size (economies of scale).
"Plot controls" includes dummy for land type, dummy for access to irrigation, dummy for land tenure type, and dummy for harvest season. "Household controls" includes the natural log of total acre of land owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, and # of household members who got sick in last recent three months. "Regional controls" includes the log of the annual mean level rainfall, the mean level of maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01*

To support the validity of our baseline estimates, we conduct a falsification test by introducing a pseudo policy change in 2010 instead of 2011. We use two household surveys conducted before the policy intervention. If there is an existing difference between treatment group and control group before the policy intervention, the pseudo policy change must catch the difference between the two groups and the coefficient of the interaction term would be statistically significant. We find no evidence of difference in main outcomes between the treatment group and control group in the pre-policy intervention. The results are presented in **Table 1.6**.

1.6.2 Robustness Check

The Difference-in-Differences (DD) estimation method is widely used to measure the impact of a policy change on the outcome variables of interest. By using the DD estimation method, we can eliminate endogenous effects of time and place on the outcome variables. If the outcome variable is determined by different variations such as policy affected groups, time and places, we can apply the triple difference-in-differences (DDD). The DDD estimation method can reduce bias and provide accurate estimates of the policy change.

To implement a triple Difference-in-Differences setting, we follow the paper by Bleakley (2007), which studied the impact of the eradication of hookworm disease on economic performance in the American South. They identified treatment with the variations in the pre-treatment infection rates across regions. The idea is that pre-program intervention areas with higher levels of hookworm infection will benefit more compared to low-infection areas. In our study, we implement additional treatment and control groups based on the intensity of rice-sown acres in a region. We defined a treated region, in which the share of regional rice sown acreage is above 10 percent of national rice sown acre (hereafter rice region) in 2010. We assume a region with higher intensity of rice-sown area will benefit more from the export liberalization policy. We use the following equation to estimate the policy impact:

$$Y_{hjt} = \beta_0 + \beta_1 Post + \beta_2 Treat + \beta_3 T_{region} + \beta_4 Post * Treat + \beta_5 Post * T_{region} + \beta_6 Treat * T_{region} + \beta_7 Post * Treat * T_{region} + X'_{hjt}\beta_8 + I'_{jt}\beta_9 + \delta_j + \epsilon_{hjt}, \quad (1.7)$$

where h, j, and t indicate household, district, and year respectively. "$Post$" is an indicator that takes one for the year 2015 and 0 otherwise. "Treat" is a dummy variable in which, in column (1), one indicates the rice plot and zero indicates at least one of the five export-crops plot, in columns (2)-(6) one denotes rural landless households, urban households, rice-cultivating households and non-export-crops cultivating households and zero indicates export-crops cultivating households. T_{region} is a dummy variable where 1 indicates rice regions and 0 otherwise. "X'_{hjt}" denotes household characteristics including the natural log of total acres of agricultural land a household owned, household head's education and sex, number of household members, number of children aged <=5, number of seniors aged 65+, number of household members who were sick in the last three months; and "I'_{jt}" indicates regional characteristics including the log of the annual mean level of rainfall, the mean level of maximum temperature and the average elevation. In addition, we control for district-year two-way fixed effects "δ_j" in all regressions.

The estimates from equation (1.7) are reported in **Table 1.7**. The coefficients of the triple interaction term "*Post * Treated household * Treated region"* indicates the impacts of export liberalization policy on rice production, agricultural inputs use, total consumption expenditure, food expenditure, and non-food expenditure. The estimates in triple DD setting are slightly different with baseline estimates but they are robust, consistent and statistically significant.

In addition, we conduct another robustness check by using information from all three household surveys. **Table 1.8** reports the robustness checks of the baseline estimates. Results verify that the estimates by using information from all three surveys support the validity of the baseline estimates.

Table 1-7: Robustness Check (Triple DID)

	(1)	(2)	(3)	(4)	(5)	(6)
		Input Use		Consumption Expenditure		
	Log of crop yield per acre	Dummy for chemical fertilizer use (Yes=1)	Log of number of hired labour	Log of total expenditure	Log of food expenditure	Log of non-food expenditure
Post * Treated region * Treated plot	1.191***					
	(0.410)					
Post * Treated region * Treated HH (Rice HH=1)		0.224**	1.159**	0.430***	0.414***	0.242*
		(0.111)	(0.517)	(0.124)	(0.137)	(0.140)
Post * Treated Region * Treated HH (Rural landless HH=1)				-0.371***	-0.430***	-0.500**
				(0.099)	(0.110)	(0.189)
Post * Treated Region * Treated HH (Urban HH=1)				-0.355**	-0.255**	-1.146***
				(0.136)	(0.121)	(0.188)
Post * Treated Region * Treated HH (Non-export-crop HH=1)				-0.289***	-0.274**	-0.168
				(0.102)	(0.109)	(0.104)
Plot controls	Yes	No	No	No	No	No
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Region controls	Yes	Yes	Yes	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18183	11980	11785	34178	34177	33363

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations in column (1) is a plot and columns (2)-(6) is a household. The periods are 2009, 2010 and 2015. "Post" is an indicator, which equals zero for the years 2009 and 2010, and one for the year 2015. The dummy for treated plot equals one for rice plot and zero for at least one of five other export crops (Groundnut, green gram, sesame, black gram and pigeon pea). The dummy variable for treated region equals one if the share of rice sown acres in a region is above 10% of total rice sown acre of the country. The dummy for treated households equals one for rural landless household, urban household, rice-cultivating households, and non-export-crops cultivating households respectively, and zero indicates export-crops cultivating households. The dependent variables in column (1) is the natural log of yield per acre, in column (2) is the dummy for household chemical fertilizer use, in column (3) is the natural log of number of hired labour measured in person-days, and in columns (4)-(6) are the natural log of total expenditure, food expenditure and non-food expenditure respectively, which are adjusted for household composition and household size (economies of scale).

"Plot controls" includes dummy for land type, dummy for access to irrigation, dummy for land tenure type, and dummy for harvest season. "Household controls" includes the natural log of total acre of land owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, and # of household members who were sick in the last three months. "Regional controls" include the log of the annual mean level rainfall, the mean level of maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.

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

Table 1-8: Robustness Check

	(1)	(2)	(3)	(4)	(5)	(6)
		Input Use		Consumption Expenditure		
	Log of crop yield per acre	Dummy for chemical fertilizer use (Yes=1)	Log of number of hired labour	Log of total expenditure	Log of food expenditure	Log of non-food expenditure
Post * Treated plot (Rice plot=1)	0.989*** (3.99)					
Post * Treated HH (Rice HH)		0.101** (0.048)	1.214*** (0.354)	0.310*** (0.062)	0.238*** (0.077)	0.058 (0.090)
Post * Treated HH (Rural landless HH)				-0.266*** (0.066)	-0.277*** (0.068)	-0.743*** (0.121)
Post * Treated HH (Urban HH)				-0.159* (0.083)	-0.182* (0.098)	-1.173*** (0.118)
Post * Treated HH (Non-export-crops cultivating HH)				-0.314*** (0.067)	-0.361* (0.191)	-0.906* (0.454)
Plot controls	Yes	No	No	No	No	No
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Region controls	Yes	Yes	Yes	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18183	11980	11785	34178	34177	33363

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations in column (1) is a plot and columns (2)-(6) is a household. The periods are 2009, 2010 and 2015. "Post" indicator variable, which equals zero for the years 2009 and 2010, and one for the year 2015. The dummy for treated plot equals one for rice plot and zero for at least one of five other export crops (Groundnut, green gram, sesame, black gram and pigeon pea). The dummy for treated households equals one for rural landless households, urban households, rice-cultivating households and non-export-crops cultivating households respectively, and zero indicates the export-crops cultivating households. The dependent variable in column (1) is the natural log of yield per acre, in column (2) is the dummy for household chemical fertilizer use, in column (3) is the natural log of the number of hired labour measured in person-days and in columns (4)-(6) are the natural log of total expenditure, food expenditure and non-food expenditure respectively, which are adjusted for household composition and household size (economies of scale).
"Plot controls" include dummy for land type, dummy for access to irrigation, dummy for land tenure type, and dummy for harvest season. "Household controls" include the natural log of total acres of land owned, household head's education and sex, # of household members, # of children aged <=5, number of seniors aged 65+, and # of household members who were sick in the last three months. "Regional controls" include the log of the annual mean level of rainfall, the mean level of maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01*

1.6.3 Heterogeneous Effects of Export Liberalization

To explore the differential effects of higher food prices on poor and non-poor households, we perform extra experiments. We partition households into five quintiles based on household total expenditure. **Table 1.9** reports the heterogeneous effects of the export liberalization policy on household expenditures. The findings show the impact of export liberalization masks significant differences on household socio-economic conditions. The coefficient of the interaction term "*Post * Treated HH"* indicates that the negative effects are mostly concentrated in poor households which is consistent with previous studies (Ivanic & Martin, 2008; Wodon & Zaman, 2009) and richer rice-cultivating households only benefit from the export liberalization policy (Nicita, 2009).

Table 1-9: Heterogeneous Effects on Household Expenditure

	(1) 1st Quintile	(2) 2nd Quintile	(3) 3rd Quintile	(4) 4th Quintile	(5) 5th Quintile
Panel A: The dependent variable is the natural log of household food expenditure					
Post * Treated HH (Rural landless HH)	-0.403***	-0.403***	-0.187*	-0.051	0.242
	(0.074)	(0.074)	(0.096)	(0.081)	(0.292)
Post * Treated HH (Urban HH)	-0.340***	-0.340***	-0.021	0.096	0.002
	(0.083)	(0.083)	(0.095)	(0.092)	(0.089)
Post * Treated HH (Rice-cultivating HH)	0.091	0.091	0.145	0.180**	-0.002
	(0.086)	(0.086)	(0.099)	(0.070)	(0.137)
Post * Treated HH (Non-export-crop cultivating HH)	-0.249***	-0.249***			
	(0.079)	(0.079)			
N	3213	3213	4044	4446	4634
Panel B: The dependent variable is the natural log of household non-food expenditure					
Post * Treated HH (Rural landless HH)	-0.357*	-0.357*	0.090	-0.326***	-0.284
	(0.208)	(0.208)	(0.182)	(0.101)	(0.213)
Post * Treated HH (Urban HH)	-0.223	-0.223	-0.314	-0.509***	-0.532**
	(0.200)	(0.200)	(0.219)	(0.124)	(0.216)
Post * Treated HH (Rice-cultivating HH)	-0.184	-0.184	0.086	0.042	0.016
	(0.137)	(0.137)	(0.107)	(0.091)	(0.227)
Post * Treated HH (Non-export-crop cultivating HH)	0.800	0.800			
	(0.514)	(0.514)			
N	3628	3628	4200	4581	4698
Panel C: The dependent variable is the natural log of household total expenditure					
Post * Treated HH (Rural landless HH)	-0.479***	-0.479***	-0.216**	-0.041	-0.148
	(0.076)	(0.076)	(0.094)	(0.074)	(0.181)
Post * Treated HH (Urban HH)	-0.308***	-0.308***	-0.049	0.094	0.039
	(0.081)	(0.081)	(0.091)	(0.087)	(0.077)
Post * Treated HH (Rice-cultivating HH)	0.077	0.077	0.116	0.181***	0.085
	(0.083)	(0.083)	(0.095)	(0.064)	(0.117)
Post * Treated HH (Non-export-crop cultivating HH)	-0.303***	-0.303***			
	(0.075)	(0.075)			
Household controls	Yes	Yes	Yes	Yes	Yes
Region controls	Yes	Yes	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	3215	3215	4045	4446	4634

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The dependent variables in panels (A)-(C) are the natural log of food expenditure, non-food expenditure and total household expenditure respectively, which are adjusted for household composition and household size (economies of scale). We partition households into five quintiles based on total consumption expenditure. "Household controls" include the natural log of total acres of land owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, and # of household members who were sick in the last three months. "Regional controls" includes the log of the annual mean level rainfall, the mean level of maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01*

1.7 Welfare Analysis

The causal impacts of the policy observed by using empirical techniques are only intermediate inputs. The ultimate question of interest is: what is the welfare impact of the policy? To calculate the net welfare impact of the relaxation of export licensing restrictions, we run regressions on the absolute value of the household consumption expenditures instead of the natural log (Reported in appendix table A-4).

The findings indicate that the total household expenditure per capita per day in rice-cultivating households increased by 684.838 Kyats on average while for rural landless households, urban households, and non-export-crops cultivating households it decreased by 647.984 Kyats, 384.332 Kyats, and 669.541 Kyats respectively. We weight total consumption expenditure by using the percentage of different households in the economy—that is, 28% rural landless households, 25% urban households, 21% rice-cultivating households, 15% non-export-crops cultivating households, and 11% export-crops cultivating households to calculate the net welfare impact of the policy. Overall, per capita consumption expenditure per day decreased on average by 234.134 Kyats (approximately 0.18 USD) after the policy intervention. (Reported in appendix table A-5 for detailed calculations). To calculate the net welfare impact, we assume the higher rice prices may not affect consumption expenditure of reference households. If it is not the case, the negative impacts of the export liberalization policy are underestimated; however, we found a minimum negative welfare impact of the policy.

Our findings in this paper contradict the results of Minot and Goletti's paper. One of the possible explanations is that if the domestic price is lower than the world price before the export liberalization, then the suppliers will be able to sell their product worldwide at the world price after the export liberalization. As long as the world price is higher than the domestic price, suppliers will continue to sell in the world market rather than the domestic market until domestic prices reach world prices. As rice is a staple food and the price elasticity of demand is close to zero in Myanmar, domestic demand may not change at higher prices. The percentage of rice households is 21 percent of the total households in the economy; therefore, losses in consumer surplus may outweigh gains in producer surplus.

Even rice producers, particularly smallholder farmers, may not benefit as they are not net sellers. Smallholder rice farmers cannot increase production, as shown in the heterogeneous analysis of rice production (Reported in appendix table A-6). We also found consistent results in the heterogeneous analysis of agricultural inputs use that indicate small-holder farmers do not increase agricultural input use after the policy intervention (Reported in appendix table A-6). In developing countries, small farms are generally poor. They have limited working capital to invest in agricultural inputs to increase production, although they are aware the return from such investments is high (Duflo et al., 2011). When many Asian countries moved rapidly towards agricultural industrialization, small farms were regarded as a major obstacle to this process (Fan & Chan-kang, 2005). Therefore, the policy hurts household welfare at the aggregate level as the proportion of net sale households in the economy is well below the proportion of net buyer households.

1.8 Conclusion

This study examines the effect of relaxing rice export licensing restrictions on household welfare. As the policy affects only the rice sector, this setting allows us to implement a different-in-differences setting to study the impacts of the rice export liberalization policy.

The higher rice farm gate price associated with export liberalization policy is a good incentive for rice farmers to expand production through increasing use of labour and chemical fertilizer. According to our estimates, rice yield per acre increased by 71.7 percent on average after the policy change followed by higher use of hired labour and chemical fertilizers. The increase in production leads to increases in household consumption in rice-cultivating households. However, the benefits from the policy mostly accrue to rich households because only larger-scale farmers can invest more in agricultural inputs.

Although the policy creates employment for rural landless households, the gain from employment growth is not large enough to cover higher food prices associated with the export liberalization. Moreover, the higher rice prices harm rural landless households, urban households and non-export-crops cultivating households and the adverse effects are mostly concentrated on poor households. Findings indicate that after the policy intervention, per capita consumption expenditure per day decreases by 234.134 Kyats (approximately 0.18 US$) on average due to the higher rice prices. The evidence from the triple difference-in-differences setting and using information from all three household surveys confirms the validity of the baseline estimates.

Our findings indicate that the rice export liberalization policy hurts household welfare at the aggregate level, which contradicts the findings of Minot and Goletti's paper that studied the impacts of removing rice export quotas in Vietnam. Findings of this study fill the gap of Minot and Goletti by indicating that rice-cultivating-households, which are not in net sales position (even small net purchases) hurt because of higher rice prices, and small-holder farmers generally do not have capital to expand production. Findings in this study also provide the reassurance of the distributional results. For example, poor households lose more relative to non-poor households. The rural-landless households are vulnerable although the policy creates employment for them because the gain from employment growth is not large enough to cover higher food prices. In addition, results demonstrate the distributional effects on different types of household such as rural-landless households, urban households, rice-cultivating households, export-crops cultivating households and non-export-crops cultivating households.

A policy application of this study is that an export liberalization policy needs to be integrated with wider agricultural development policies such as agricultural modernization and agricultural inputs subsidy programs so that farmers can increase production to meet the higher demand resulting from the export liberalization policy. It is also important to be aware of the distributional effects of the policy on different types of households, particularly poor households in vulnerable situations, generally devoting more than 65 percent of their total expenditures to food.

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Appendix A

Assessment for Cropping Pattern Changes

We run OLS regression to assess the changes in rice-sown acres before and after policy intervention. We use the following equation to investigate whether farmers switch crops after the policy intervention:

$$Y_{hjt} = \beta_0 + \beta_1 Post + X'_{hjt}\beta_2 + \delta_j + \varepsilon_{hjt}, \quad (A.1)$$

where h, j, and t indicate household, district, and year respectively. Outcomes variable is rice-sown acres of a household. "Post" is an indicator that takes one for the year 2015 and 0 takes otherwise. X_{hjt} indicates household characteristics including household head's education and sex, # of household members, # of children aged <=5, number of seniors aged 65+, and # of household members who were sick in the last three months.

Table A- 1: Regression on Sown Acres

	(1) Rice sown acre
Post (After relaxing restrictions)	0.709
	(0.802)
Household controls	Yes
Region controls	Yes
District-year two-way FE	Yes
Observations	4,202

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts).
** p<0.10, ** p<0.05, *** p<0.01*

Table A- 2: Impacts on Rice-cultivating Household Consumption

	(1) Log of household expenditure
Post* Acre of rice plot a household own	0.004**
	(0.002)
Plot controls	No
Household controls	Yes
Region controls	Yes
District-year two-way FE	Yes
Observations	8324

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations is households. The periods are 2010 and 2015. The dependent variable is the log of household consumption expenditure. "Household controls" include the natural log of acres owned, household head's education and sex, # of household members, # of children aged <=5, # of seniors aged 65+, # of household members who were sick in the last three months, and dummy for agricultural inputs use. "Regional controls" include the log of the annual mean level rainfall, the mean level maximum temperature, and the average elevation. In all regressions, we control for district-year two-way fixed effects.
** p<0.10, ** p<0.05, *** p<0.01.*

Table A- 3: Classification of Household Types

Household Types	Descriptions
Rural landless households	• Households located in rural areas but do not own any type of agricultural land
Urban households	• Households located in urban area and do not own any type of agricultural land
Rice-cultivating households	• Households cultivate rice, at the same time they may cultivate other crops including one of the five export crops—that is, ground nut, sesame, green gram, black gram, and pigeon pea
Export-crops cultivating households (Reference)	• Households cultivate at least one of the five export crops—that is, ground nut, sesame, green gram, black gram, and pigeon pea, and do not cultivate rice at all
Non-export-crops cultivating households	• Households cultivate crops excluding rice, ground nut, sesame, green gram, black gram, and pigeon pea

Table A- 4: Effect on Different Types of Household (Absolute Value)

	(1) Total expenditure	(2) Food expenditure	(3) Non-food expenditure
Post (After relaxing restrictions)	930.729***	292.961**	119.346**
	(148.036)	(122.463)	(49.012)
Post * Treated HH (Rural landless HH)	-647.984***	-563.760***	-81.380***
	(154.457)	(147.900)	(19.734)
Post * Treated HH (Urban HH)	-384.332**	-212.233	-172.984***
	(174.549)	(166.979)	(40.977)
Post * Treated HH (Rice-cultivating HH)	684.838***	605.682***	79.059***
	(143.084)	(141.081)	(20.100)
Post * Treated HH (Non-export-crops cultivating HH)	-669.541**	-480.041**	-186.811**
	(260.464)	(207.349)	(72.697)
Household controls	Yes	Yes	Yes
Region controls	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes
Observations	16771	16768	16771

Notes: Coefficients with standard errors are reported in parentheses, clustered at district level (62 districts). The unit of observations is a household. The periods are 2010 and 2015. "Post" is an indicator, which equals zero for the year 2010, one for 2015. The dummy for treated households equals one for rural households, urban households, rice-cultivating households, non-export-crops cultivating households and zero for export-crops cultivating households.

"Household controls" include: the natural log of total acres of land a household owned, household head's education and sex, # of household members, # of children aged <=5, number of seniors aged 65+, and # of household members who were sick in the last three months. "Regional controls" include the log of the annual mean level rainfall, mean level maximum temperature, and the average elevation. In all regression, we control for district-year two-way fixed effects.

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

Table A- 5: Calculation on Aggregate Welfare Impact

No	**HH Types**	**Coefficient**	**HH Composition in Economy (%)**	Aggregate Welfare Impact
1	Rural landless HH	-647.984	28	-18143.552
2	Urban HH	-384.332	25	-9608.300
3	Rice-cultivating HH	684.838	21	14381.598
4	Non-export-crops cultivating HH	-669.541	15	-10043.115
5	Export-crops cultivating HH	0	11	0
			100	-23413.369
	Per capita consumption expenditure per day			-234.134
	Per capita consumption expenditure per day (USD)			-0.180

Table A- 6: Heterogeneous Analysis of Rice Output and Input

	(1)	(2)	(3)	(4)	(5)	(6)
	Production			Chemical Fertilizer		
	Acre<=3	3<Acres<=12	Acre>12	Acre<=3	3<Acres<=12	Acre>12
DD estimate	0.338	0.392***	1.830**	-0.019	0.217***	0.184*
	(0.310)	(0.171)	(0.685)	(0.079)	(0.072)	(0.102)
Plot controls	Yes	Yes	Yes	Yes	Yes	Yes
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Region controls	Yes	Yes	Yes	Yes	Yes	Yes
District-year two-way FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6102	4231	556	1698	2991	1159

Note: We use restricted samples, in column (1), which has less than 3 acre (Small-scale farms defined by Myanmar agriculture census in 2010), in column (2) which has less than 12 acres (Small and medium farms defined by FAO) and in column (3), which has larger than 12 acres.

CHAPTER TWO

IMPACT OF MINIMUM WAGE INTRODUCTION ON EMPLOYMENT: EVIDENCE FROM MANUFACTURING ENTERPRISES IN MYANMAR

2.1 Introduction

Despite the large number of empirical studies on the subject in the literature, the effect of minimum wages is still controversial, particularly questions about whether minimum wages reduce employment. Proponents of the minimum wage insist that the policy has no adverse impacts on employment (Card & Krueger, 1995; Dube, Lester, & Reich, 2010; Stewart, 2004), but opponents suggest that minimum wages reduce employment because of the higher burden of labour costs associated with the minimum wage (Alatas & Cameron, 2013; Gindling & Terrell, 2007; Lordan & Neumark, 2018; Neumark & Wascher, 2008).

Many studies in existing literature have explored the impacts of the policy, but most of the studies focus on evidence from developed countries. The nature and structure of labour markets in developed countries may be very different from developing countries, so findings in existing literature cannot provide the evidence for a well-defined conclusion as to who bears the burden of higher wages in developing countries (Harrison & Leamer, 1997; Lemos, 2009). We have some evidence from developing countries but it may not be possible to generalize results to other countries. In addition, the impacts of first ever introduction of minimum wages may differ from the incremental increases. In order to fill the gap in existing literature with evidence from a developing country, this study investigates the impacts of minimum wage introduction in Myanmar on employment, investment, productivity, and profit through the use of enterprise level panel data.

Implementation timing and the initial wage rate enable this research to use a Difference-in-Differences (DID) approach to explore the causal impacts of the introduction of the minimum wage. Wage distribution data pre-policy intervention is used to classify treatment enterprises, which are affected by the policy and control enterprises which are not.

Firstly, this paper studies compliance of the enterprises with the implementation of the minimum wage by exploring the impacts on labour cost per employee. The results suggest that the labour cost of policy-affected enterprises increased by 72.2% after enforcement. Second, this paper investigates how the enterprises reacted to the policy, for example, by: reducing employment to bear the burden of higher labour cost; increasing investment in capital; or raising productivity. Finally, this research discusses the effects of the introduction of the minimum wage on small-enterprises, which are legally exempt from enforcement.

We find significant evidence of job losses in post-policy implementation, which contradicts previous papers in literature that studied the effects of minimum wage introduction in Korea and the United Kingdom (Baek & Park, 2016; Stewart, 2004) but support the findings from the study of the introduction of the minimum wage in Germany (Caliendo, Schröder, & Wittbrodt, 2018). Policy-affected enterprises increase investment in machinery and equipment as a substitute for labour. We then investigate whether enterprises increase labour productivity to share a burden of higher labour costs. We use the Gross Value Added (GVA) per employee [(Profits+Remuneration)/Labour] to study the policy impact on labour productivity (Riley & Rosazza Bondibene, 2017). Results suggest that the productivity increases in policy-affected enterprises after the minimum wage introduction.

The effect of the minimum wage may differ due to the initial minimum wage rate and situation of the labour market. If the original wage rate is lower than the marginal labour product, then the increase in wages can provide benefits to employees and, at the same time, enterprises can still profit even at the higher wage rate (Rebitzer & Taylor, 1995). Finally, this article explores the impacts of the policy on enterprise profits. Findings indicate that there is no significant adverse impact on enterprise profit, which contradicts evidence from developed countries (Draca, Machin, & Reenen, 2011). Findings also suggest that despite samll-enterprises being legally exempt from enforcement, they also have to take the burden of higher labour cost.

The organisation of the study proceeds as follows. The institutional context of the national minimum wage introduction in Myanmar and the enterprise surveys used in this study are discussed in section 2.2. Section 2.3 discusses the identification approach used to explore the causal effects of the introduction of minimum wage, and then discuss the results in chapter 2.4. Section 2.5 describes the effects on small-enterprises followed by section 2.6, conclusion.

2.2 Institutional Context and Data

2.2.1 Institutional Context

In Myanmar, parliament enacted the first-ever national minimum wage law in March, 2013. The main purpose of law is to raise wages to meet the basic needs of employees and their families. In addition, it is aimed to increase the capacity of workers and to encourage competitiveness in terms of development of skills. In accordance with the law, the National Committee for Minimum Wage proposed a wage rate at Kyat 3,600 per day for 8 hours working time per day, taking account of the average living cost of a person in the country and the wage of government staff at the lowest rank.

On 29 June 2015, the government of Myanmar announced a minimum wage of 3,600 kyats (about 2.6 US$) per day following a year of consultations between unions, government and employers. The International Trade Union Confederation (ITUC) and employers criticised the proposed rate. Local unions called for higher pay at 4,000 kyats per day while employers said that even the proposed minimum wage was unsustainable for business and they could not afford more than 2,500 kyats per day.

Enforcement began on 1st September 2015, for all employees in the country except those in small and family-run businesses with a workforce of 15 workers or less. For noncompliance, the law stipulates a penalty for employers up to 300,000 Kyats (US$ 337 equivalent) and up to 6 months in prison.

2.2.2 Data

This study uses the Myanmar Enterprise Survey (ES) panel dataset conducted in 2014 and 2016 by the World Bank. The survey is an enterprise-level survey that collects information from the sample of non-agriculture, formal private sector enterprises. Information about enterprise characteristics includes: annual sales volume, annual costs of raw materials and labour and capacity utilization. Data was collected from 556 enterprises in both rounds.

The Enterprise Survey includes information from both manufacturing and service sectors but excludes all public and utility sectors, and enterprises with 100% government ownership. The sample was weighted by the population size; collecting more sample enterprises in regions with a larger population. The survey used the stratified random sampling at three stages: industry type, enterprise size, and region. The industry stratification includes: manufacturing, retail, and other services industries. The enterprises are divided into three groups: small enterprises (5-19 workers), medium-sized enterprises (20-99 workers) and large enterprises (100 workers or more). The regional stratification includes: Yangon, Mandalay, Bago, Taunggyi and Monywa. The survey is not nationally representative as data is collected from the enterprises located in five regions out of 15 in Myanmar.

Table 2-1: Summary Statistics

Variable	Mean	Std.Dev	Min	Max
Average monthly labour cost per employee (Kyats)	128656.5	134981.6	2702.703	1500000
Number of employees per enterprise	241.349	379.540	16	2000
Annual investment on machinery and equipment (Kyats in million)	5350	50000	0	480000
Enterprise annual profits (Kyats in million)	1990	18000	-81000	240000
Dummy for small enterprises (Yes=1)	0.231	0.423	0	1
Dummy for medium enterprises (Yes=1)	0.360	0.481	0	1
Dummy for large enterprises (Yes=1)	0.398	0.491	0	1
Dummy for enterprises located in large cities (Yes=1)	0.812	0.392	0	1
# of years since enterprise established	17.308	12.057	0	75
Dummy for export enterprises (Yes=1)	0.720	0.450	0	1
Dummy for access to credit (Yes=1)	0.787	0.411	0	1
# of operating hours per week	58.826	23.032	24	168
Dummy for having internationally recognized certificate (Yes=1)	0.902	0.297	0	1
Annual sales volume (Kyats in million)	7150	73600	17.50	960000
Annual cost on electricity (Kyats in million)	28.30	49.70	0	350
Annual cost on raw materials (Kyats in million)	588	1700	0	12000
Observations		**186**		

Notes: 1 US$ approximately equals to 1,350 Kyats (Local currency) in 2015.

Enterprises with 15 employees or less in 2014 are excluded from the baseline study because they are exempt from enforcement. In addition, this paper uses information from only manufacturing enterprises observed in both surveys to control endogenous exit and entry of enterprises and to follow up the variation in the number of employees. The summary statistics of the main variables used in this research are described in **Table 2.1.**

2.3 Identification Strategy

2.3.1 Defining Treatment and Comparison Enterprises

The strategy used in this study to analyze the effects of the minimum wage introduction is to compare the outcome variables in policy-affected enterprises relative to their counterparts. This paper exploits the fact that the enterprises in which the average monthly labour cost per employee in 2014 is less than the minimum wage rate to define a policy-affected enterprise. The position of wage distribution allows this study to design a DID framework. The treatment indicator is denoted as T=1 for the enterprises in which average monthly labour cost per employee in 2014 (AW_{2014}) is less than the 2015 minimum wage (MW) rate and T=0 for enterprises in which the average labour cost is higher than the 2015 minimum wage rate (AW_{2014}>MW).

The enterprise average monthly labour cost per employee is a good proxy to identify enterprises, whether they are mostly affected or not by the minimum wage because the ratio of low wage employees tapers off rapidly after the policy introduction (Baek & Park, 2016; Draca et al., 2011).

Enterprises with 15 employees or less in 2014 are excluded from the baseline study because they are exempt from enforcement. To eliminate the potential endogeneity due to the exit and entry of enterprises, this paper uses information from enterprises observed in both surveys. Bootstrap-based cluster standard errors are used to study the impacts of the minimum wage introduction, and it can be expressed by equation (2.1):

$$Y_{it} = \beta_0 + \beta_1 Post + \beta_2 Treat + \beta_3 Post * Treat + X'_{it}\beta_4 + \theta_j + \epsilon_i, \qquad (2.1)$$

Where, ‘i’ indicates enterprises and ‘t’ indexes time periods, which are 2014 and 2016. In this setting, information from enterprises, which have more than 15 employees and observed in both surveys are used. “Post” is a dummy variable in which ‘1’ indicates for the year 2016 and 0 otherwise. “Treat” is defined as follows; (i) the dummy variable in which ‘1’ indicates the enterprise in which average monthly labour cost per employee at 2014 is less than the minimum wage rate, '0' otherwise, (ii) a continuous treatment variable indicating the absolute difference between the average monthly labour cost per employee in 2014 and the 2015 minimum wage rate where the labour cost is lower than the minimum wage as shown in equation (2.2); otherwise, 'Treat' takes zero.

The outcomes of interest, denoted as $\mathbf{Y_{it}}$ are the natural log of enterprise monthly average labor cost per worker, the log of the number of employees, the natural log of investment on machinery and equipment, the log of Gross Value Added (GVA) per employee, and the natural log of enterprise profit. The equation also includes the region-year two-way fixed effects "$\boldsymbol{\theta_j}$". "$\mathbf{X'_{it}}$" denotes the enterprise-level characterstics including the dummies for the different size of enterprises, which includes three groups: small-enterprise (employee<20), medium-enterprise (20<=employee<100) and large-enterprise (employee>100), the size of the population of the city where the enterprise located, the dummy for export enterprises, the dummy for access to credit, the log of the annual sale, the log of the number of operating hours per week, number of years since enterprise established, the log of the annual cost on the raw materials, and the log of the annual cost of electricity.

2.3.2 Defining Continuous Measure of Treatment

The policy-affected enterprises are obliged to pay the minimum wage rate at least, therefore, the impacts on the enterprises in which pre-policy average labour cost is far below the minimum wage rate may be very different from enterprises in which the average labour cost is just below the 2015 national minimum wage rate. In order to allow differential effects among enterprises in the treatment group, this paper uses continuous treatment, which is the absolute gap between the pre-policy wage and the 2015 minimum wage rate and defined as follows:

$$\text{Treatment Intensity}_i = \begin{cases} \ln(\text{AWage}_{i,2014} - \text{MWage}) & \text{if AWage}_{i,2014} < \text{MWage} \\ 0 & \text{if AWage}_{i,2014} > \text{MWage} \end{cases} \quad (2.2)$$

Where $AWage_{i,2014}$ is the pre-policy average labour cost of the enterprise "i" and MWage is the 2015 minimum wage rate. The treatment intensity equals zero for the enterprises in the control group. The coefficients of the interaction term "Post and Treat" in equation (2.1) will capture the impacts of the minimum wage introduction.

This paper uses an additional continuous treatment, i.e. a negative log of the pre-policy average wage for all enterprises to study the effects of the policy by using equation (2.3) (Baek & Park, 2016; Draca et al., 2011):

$$Y_{it} = \beta_0 + \beta_1 Post + \beta_2(-1 * ln\_PrepolicyWage) + \beta_3 Post * \left(-1 * ln_{PrepolicyWage}\right) + X'_{it}\beta_4 + \theta_j + \in_i, \quad (2.3)$$

Where, "Treat" is defined as a continuous treatment variable indicating the negative log of the pre-policy wage (The negative log is used to indicate the coefficients that are consistently defined with the results from the low-wage dummy) for all enterprieses in the sample. The outcomes of interest, denoted $\mathbf{Y_{it}}$ are the natural log of enterprise monthly average labour cost per worker, the log of the number of employees, the log of investment in machinery and equipment, the log of Gross Value Added (GVA) per employee, and the natural log of enterprise profit. Estimates from equation (2.3) are presented in Panel C of **Table 2.2**.

2.4 Results

This section discusses empirical findings of the minimum wage effects on the enterprise average monthly labour cost per employee, employment, investment on machinery and equipment, productivity, and profit.

2.4.1 Main Results

Estimates from equation (2.1) are reported in panel A of **Table 2.2**. Columns (1)–(5) provide estimates of the natural log of the enterprise-level monthly average labour cost per employee, the log of number of employees, the log of investment in machinery and equipment, the log of GVA per employee, and the log of enterprise's profit respectively. All specifications include region-year two-ways fixed effects and enterprise-level characteristics including dummies of different sizes of enterprise, the population of the cities where the enterprise located, # of years since enterprise established, dummy for export enterprises, dummy for access to credit, the log of the number of operating hours per week, the log of the annual sales, the log of the annual raw material cost, and the log of the annual electricity cost.

The coefficients of the interaction term "Post and Treat" in **Table 2.2** describe the estimates from a difference-in-differences approach. "Treat" in Panel A is discrete category which indicates policy-affected enterprises, in Panel B represents a continuous treatment which indicates the absolute difference between the average monthly labour cost per employee in 2014 and the 2015 minimum wage rate if the labour cost per employee in 2014 is lower than the 2015 minimum wage; otherwise, Treatment takes zero, in Panel C indicates the negative log of pre-policy labour cost for all enterprises in the sample.

Coefficients in Column (1) of Panel A indicate that the average-monthly labour cost per employee in policy-affected enterprises increased by 72.2% relative to their counterparts after the policy intervention, in Panel B indicates 0.085 percentage points increase if the gap between the pre-policy wages and the minimum wage in an enterprise is one percent higher, and in Panel C mentions one percent lower in pre-policy wage is associated with 0.912 percentage point increase in average labour cost. As the magnitude of the coefficients is large, the absolute value of average labour cost is used to assess the economic sensibility of the findings. The average labour cost in policy-affected enterprises increased by 50853 Kyats (approximately 37.5 US$) per month, and the one percent higher gap between pre-policy wage and the minimum wage rate is associated with a 5445 Kyats (approximately 4 US$) increase in average labour cost. (Reported in appendix table B-1). Another possible explanation why the magnitude of the estimates are large is that some enterprises paid much lower wage rates e.g., 10 US$ per month in pre-policy interventation, however, after the policy implemenation they have to pay the minimum wage rate, which is about 86 US$ per month.

Estimates in Column (2) indicate the effects on employment and Panel A reveals that policy-affected enterprises reduce employment by 41.9%, Panel B indicates 0.044 percentage points decrease if one percent higher in the absolute gap between the labour cost in 2014 and the 2015 minimum wage, and in Panel C presents one percent lower in pre-policy wage is associated with 0.282 percentage point decrease in employment. This paper uses the information of both full-time and part-time employees in this setting. As the policy may have differential impact on different types of job tenure, the restricted samples such as only full-time employees is used to explore the differential effects of the policy. Results are consistent with the baseline estimates (Reported in columm 2 of appendix table B-1) Therefore, the findings in this paper suggest that enterprises reduce employment to bear the higher burden of labour cost, which contradicts empirical studies indicating limited impacts on employment (Baek & Park, 2016; Draca et al., 2011; Hirsch, Kaufman, & Zelenska, 2013; Stewart, 2004), but supports empirical findings of the minimum wage introduction in Germany in 2015 (Caliendo et al., 2018).

Table 2-2: Impacts of Minimum Wage Introduction

	(1) Log of labour cost per employee	(2) Log of # of employee	(3) Log of investment	(4) Log of GVA per employee	(5) Log of profit
Panel A: Treat= Low-wage enterprise dummy					
Post x Treat	0.722***	-0.419**	1.605**	0.146**	-0.150
	(0.154)	(0.201)	(0.729)	(0.068)	(0.263)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	142	142	84	139	142
Panel B: Treat= ln(AW_{2014} – MW) for low wage enterprise					
Post x Treat	0.085***	-0.044**	0.160**	0.014*	-0.009
	(0.017)	(0.020)	(0.074)	(0.007)	(0.019)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	142	142	76	139	142
Panel C: Treat= - ln(Pre-policy average wage)					
Post x Treat	0.912***	-0.282*	2.730*	0.082*	-0.040
	(0.086)	(0.168)	(1.491)	(0.045)	(0.092)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	142	142	76	140	142

Notes: Coefficients are reported with bootstrap-based cluster standard error in parentheses. All regressions use information from enterprises, which have more than 15 employees and observed in both surveys. “Post*Treatment” is the interaction between Post and Treat, where Post is an indicator for the year 2016 and “Treat” in Panel A equals one if the monthly average labour cost per worker of enterprise “i” in 2014 is lower than the 2015 minimum wage rate; otherwise, Treat takes zero, in Panel B, “Treat” takes the log of absolute difference between the monthly average labour cost per worker in 2014 and the 2015 minimum wage if the labour cost in 2014 is less than the 2015 minimum wage; otherwise, Treat takes zero, in Panel C, “Treat” is defined as the negative log of pre-policy labour cost for all enterprises in the sample.
“Enterprise controls” includes dummies for the different size of enterprises, dummy for the size of the population of the city where enterprise is located, # of years since enterprise established, dummy for export enterprises, dummy for access to credit, # of operation hours per week, the log of the annual sale, the log of the annual raw material cost, and the log of the annual electricity cost. In all regression, this study controls for the district-year two-way fixed effects.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

This paper finds consistent results which show enterprises increase their investment in machinery and equipment to replace the higher cost workers after the minimum wage introduction (Neumark & Wascher, 2008). The coefficient of the interaction term “Post and Treatment” in Column (3) of Panel A reveals that investment in machinery and equipment increases by 160.50 percent relative to comparison enterprises after the policy implementation, Panel B indicates a 0.16 percentage points increase if there is a one percent higher absolute gap between the labour cost in 2014 and the 2015 minimum wage, and

Panel C represents a one percent lower pre-policy wage associated with a 2.73 percentage point increase in investment in machinery and equipment.

The estimates in column (4) of Panel A describe the impacts on labour productivity, which is the gross value added (GVA) per employee [(Profits+Remuneration)/Labour]. Findings indicate that labour productivity in policy-affected enterprises increase by 14.6 percent relative to the enterprises which are not affected by the policy after the minimum wage introduction. Estimates in Panel B indicate that one more percent higher gap between the pre-policy wage and the minimum wage is assocaited with 0.014 percentage point increase in labour productivity and in Panel C, one percent lower pre-policy wage is associated with 0.082 percentage point increase in labour productivity.

The coefficients of the interaction terms in Column (5) of each of Panel A, Panel B, and Panel C show that there is no discernible effect on enterprise profit. One of the possible explanations is that enterprises may pass on the burden of higher labour cost on their product prices to maintain the same profit level, but this study cannot show empirical evidence because of data limitations.

2.4.2 Robustness Checks

A set of robustness checks is conducted to support the validity of the baseline estimates. Samples are trimmed into different groups based on average labour cost to discover the sensitivity of the effects of the minimum wage introduction. Firstly, the excluded samples from the study are enterprises in which average labour costs in 2014 are just 20% below or above the minimum wage rate. Estimates are reported in Panel A of **Table 2.3**. Secondly, samples in first and last quintiles of average labour cost are excluded because the effects on enterprises in which pre-policy labour cost is very far from the minimum wage rate might be very different from the enterprises in which average labour cost is well above the minimum wage. Estimates are presented in Panel B of **Table 2.3**.

"Treat" in Panel A and Panel B are a discrete variable indicating low wage enterprises. The size of coefficients in all specifications are quite different from the baseline estimates; however, estimates support the robustness of the baseline results.

Table 2-3: Robustness check

	(1) Log of labour cost per employee	(2) Log of # of employee	(3) Log of investment	(4) Log of GVA per employee	(4) Log of profit
Panel A: Treat= Low-wage enterprise dummy (Subsamples: Exclude enterprises in which AW_{2014} is just below or above MW)					
Post x Treat	1.217***	-0.823***	1.751**	0.154*	-0.273
	(0.242)	(0.264)	(0.876)	(0.081)	(0.357)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	99	99	68	101	99
Panel B: Treat= Low-wage enterprise dummy (Subsamples: Exclude enterprises in first and last quintiles)					
Post x Treat	0.478***	-0.467**	0.258***	0.128**	0.031
	(0.090)	(0.227)	(0.019)	(0.63)	(0.064)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	94	94	46	94	94

Notes: Coefficients are reported with bootstrap-based cluster standard error in parentheses. All regressions use the information from enterprises which have more than 15 employees and are observed in both surveys. "Post*Treat" is the interaction between Post and Treat, where "Post" is an indicator for the year 2016. "Treat" in Panel A and B takes one if the monthly average labour cost per worker of enterprise "i" in 2014 is less than the 2015 minimum wage; otherwise, "Treat" takes zero. In Panel A, enterprises in which average labour cost in 2014 is just below or above the minimum wage rate in 2015 are excluded, in Panel B, enterprises in first and last quintiles of the average labour cost are excluded from the study.
"Enterprise controls" include dummy for the different size of enterprises, dummy for the size of the population of the city where enterprise located, # of years since enterprise established, dummy for export enterprises, dummy for access to credit, # of the operation hours per week, the log of the annual sale, the log of the annual raw material cost, and the log of the annual electricity cost. In all regression, this paper controls for district-year two-way fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

As this study uses a Difference-in-Differences approach, the validity of baseline estimates mainly depends on the parallel trend assumption in pre-policy intervention. In the absence of the policy intervention, the trends in outcome variables in treatment group and control group would go parallel over time. The data do not support conduct of a falsification test by implementing a pseudo policy in pre-policy intervention to prove the parallel trend assumption in outcome variables, as there is only one survey in pre-policy intervention. An additional robustness check, therefore, by using the Propensity Score Matching (PSM) method, which does not rely on the parallel trend assumption is conducted.

The purpose is to study the impact of minimum wage introduction on wage, employment, investment, productivity, and profit by comparing policy-affected enterprises (denote T=1) in which the pre-policy wage is lower than the 2015 minimum wage rate relative to enterprises in which the pre-policy wage is higher than the minimum wage rate (denote T=0). Then, the outcomes for policy-affected enterprises are defined Y_1 and the outcome for enterprises not affected by the policy that uses (T=0) as Y_0. If the mean value of outcomes between the policy-affected enterprises and their counterparts are compared, the results would probably be biased due to the sample selection problem. To eliminate the sample selection problem, this paper makes the assumption the selection is only made by using the observable characterisitcs of enterprises, and all observable variables influence enterprise wage distribution and enterprise performance are simultaneously observed. This study matches the policy-affected enterprises and their conterparts on their propensity scores, which are the probabilities that indicate the pre-policy wage is lower than the 2015 minimum wage rate conditional on covariates. Under these assumptions, this study uses equation (2.4), to estimate the average treatment effects on the treated (ATE) as:

$$ATT = E[Y_{i1}|T = 1, P(X_i)] - E[Y_{i0}|T = 0, P(X_i)], \quad (2.4)$$

where $[Y_{i1}|T = 1, P(X_i)]$ stands for the outcomes in the ith enterprise which is affected by the policy, under conditions X_i. The term $[Y_{i0}|T = 0, P(X_i)]$ stands for the outcomes in the ith enterprise which is not affected by the policy under the same conditions X_i. The estimates described in **Table 2.4** are quite different from the baseline estimates, but all are still significant and consistent with the baseline estimates.

Table 2-4: Robustness Check (Propensity Score Matching)

	(1) Log of labour cost per employee	(2) Log of # of employee	(3) Log of investment	(4) Log of GVA per employee	(5) Log of profit
ATE	0.369***	-0.263*	1.922*	0.062*	-0.039
	(0.093)	(0.138)	(1.157)	(0.035)	(0.102)
Number of treated enterprises	48	48	25	48	48
Number of control enterprises	25	25	17	25	25

Notes: Coefficients estimated with Nearest-neighbour Matching method are reported with standard error in parentheses. All specifications use information from enterprises, which have more than 15 employees.
* p<0.10, ** p<0.05, *** p<0.01

2.5 Effects on Exempted Enterprises

Countries like Korea and Myanmar initially excluded small enterprises from enforcement of the minimum wage introduction as a protection policy. Small enterprises in many countries continue to demand exemption from enforcement of the incremental increases or introduction of minimum wages. Although it is widely debated in many countries, there is limited empirical research on whether the exemption policy can protect small enterprises.

This paper exploits the policy variation based on the enterprise size to discover the effects of the minimum wage introduction on legally exempt enterprises. Enterprises, which have 15 employees or less are legally exempt from enforcement but they may have to raise wages to maintain employee satisfaction and motivation. Generally, both small-enterprises and other enterprises are located in the same industrial zones and job turnover rate in Myanmar is high. If this is the case, then minimum wage implementation may affect on small-enterprises although they are legally exempt from enforcement.

To explore the minimum wage impacts on small-enterprises, information from enterprises, which have 15 employees or less are used. **Table 2.5** describes estimates from equation (2.1). “Treat” in Panel A is a binary variable indicating low wage enterprises, in which the pre-policy wage is less than the 2015 minimum wage rate, in Panel B it takes the log of the absolute difference between the labour cost in 2014 and the 2015 minimum wage for the low wage enterprises, otherwise "Treat" is zero, in Panel C it indicates the negative log of pre-policy wages.

Table 2-5: Impacts on Exempted Enterprises

	(1) Log of labour cost per employee	(2) Log of # of employee	(3) Log of investment	(4) Log of GVA per employee	(5) Log of profit
Panel A: Treat= Low-wage enterprise dummy					
Post x Treat	0.684***	-0.220	-1.360	0.008	-0.001
	(0.143)	(0.164)	(2.048)	(0.016)	(0.002)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	128	129	49	126	129
Panel B: Treat= ln (AW_{2014} – MW) for low wage enterprise					
Post x Treat	0.073***	-0.023	-0.113	0.0009	-0.001
	(0.014)	(0.017)	(0.226)	(0.001)	(0.004)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	128	129	49	126	129
Panel C: Treat= - ln(Pre-policy average wage)					
Post x Treat	0.812***	-0.148	-0.798	0.025	0.002
	(0.093)	(0.146)	(2.820)	(0.015)	(0.001)
Enterprise controls	Yes	Yes	Yes	Yes	Yes
Region-year two-way FE	Yes	Yes	Yes	Yes	Yes
Observations	126	125	47	127	126

Notes: Coefficients are reported with bootstrap-based cluster standard error in parentheses. All regressions use the information from enterprises, which have 15 employees or less and are observed in both surveys. "Post*Treat" is the interaction between Post and Treat where "Post" is an indicator for the year 2016 and "Treat" in Panel A, equals one if the monthly average labour cost per worker of enterprise "i" in 2014 is lower than the 2015 minimum wage; otherwise, "Treat" takes zero, in Panel B takes the log of the absolute difference between the 2014 labour cost and the 2015 minimum wage if the labour cost in 2014 is less than the minimum wage; otherwise, "Treat" takes zero. "Treat" in Panel C indicates the negative of log of pre-policy average labour cost per employee for all enterprises in the sample.
"Enterprise controls" include dummies for the different size of enterprises, dummy for the size of the population of the city where enterprise is located, # of years since enterprise established, dummy for export enterprises, dummy for access to credit, # of operation hours per week, the log of the annual sales, the log of the annual raw material cost, and the log of the annual electricity cost. In all regression, the study controls for district-year two-way fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

The coefficient in Column (1) of Panel A indicates that the average labour cost in exempt enterprises increased by 68.4 percent after the minimum wage introduction, in Panel B shows that a one percent higher gap between the pre-policy wage and the minimum wage is associated with 0.073 percentage points increase in labour cost, and in Panel C denotes that one percent lower pre-policy wage is associated with 0.812 percentage points increase in labour cost. However, there is no statistically significant impact on employment, investment, productivity and profit of enterprises. Findings suggest that although small enterprises are legally exempt from enforcement, they also have to raise labour cost.

A possible explanation why this study does not find discernible effects on employment and profit in small enterprises is that the employees in small enterprises may get fewer hours of work although they are earning more per hour, or they may pass on the burden of higher wages on the price of their products.

2.6 Conclusion

Most of the studies in the existing literature focus on evidence from developed countries and explore economic impacts of incremental increases in existing minimum wages. In contrast, this study explores the effects of the minimum wage introduction in Myanmar by using enterprise level data. The timing of minimum wage introduction and the initial minimum wage rate enable us to adopt a Difference-in-Differences approach to study the policy impacts.

Results indicate that the policy-affected enterprises increase the average monthly labour cost per employee by 72.2%. To bear the burden of higher wage rate, enterprises reduce employment by 41.9%. The investment in machinery and equipment in the policy-affected enterprises increases by 160.5% to substitute the higher cost labour and also raise labour productivity. Although the small enterprises, with 15 employees or less, are legally exempt from enforcement, they also have to bear the burden of higher labour cost resulting from the national minimum wage introduction.

To briefly summarize the findings of this paper: the minimum wage introduction in Myanmar has inevitable adverse consequences for employment, so government may need comprehensive empirical evidence on the minimum wage introduction to inform its first increase but government already increased minimum wages from 3600 Kyats to 4800 Kyats in 2018 without the benefit of any empirical evidence on the consequences of its introduction of the minimum wage. To mitigate the adverse effects on employment, government should implement policies to support enterprises e.g., grants or fiscal incentives.

Although this study finds reliable results, it still has limitations. First, the results can only reveal the short-term effects of the minimum wage introduction because the survey in the post-policy intervention was conducted just after one and a half years of enforcement. Second, with only one survey in the pre-policy intervention this study cannot conduct a pseudo experiment to support the validity of the identification assumption of the baseline estimation. Finally, as this paper studies only the enterprises observed in both surveys, to eliminate potential heterogeneity due to the enterprises' entry and exit, it has a limited number of observations.

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Appendix B

Table B- 1: Impacts of Minimum Wage Introduction

	(1) Labour cost per employee	(2) Log of # of full-time employee
Panel A: Treat= Low-wage enterprise dummy		
Post x Treat	50853.345**	-0.494**
	(19846.273)	(0.225)
Enterprise controls	Yes	Yes
Region-year two-way FE	Yes	Yes
Observations	142	142
Panel B: Treat= ln(AW_{2014} – MW) for low wage enterprise		
Post x Treat	5445.846***	-0.050**
	(1956.345)	(0.023)
Enterprise controls	Yes	Yes
Region-year two-way FE	Yes	Yes
Observations	142	142
Panel A: Treat= - ln(Pre-policy average wage)		
Post x Treat	29464.978**	-0.305*
	(14871.698)	(0.173)
Enterprise controls	Yes	Yes
Region-year two-way FE	Yes	Yes
Observations	142	142

Notes: Coefficients are reported with bootstrap-based cluster standard error in parentheses. All regressions use information from enterprises, which have more than 15 employees and are observed in both surveys. "Post*Treatment" is the interaction between Post and Treat, where Post is an indicator for the year 2016 and "Treat" in Panel A equals one if the monthly average labour cost per worker of enterprise "i" in 2014 is lower than the 2015 minimum wage rate; otherwise, Treat takes zero, in Panel B, "Treat" takes the log of absolute difference between the monthly average labour cost per worker in 2014 and the 2015 minimum wage if the labour cost in 2014 is less than the 2015 minimum wage; otherwise, Treat takes zero, Panel C is the negative log of pre-policy labour cost of all enterprises in the sample.

"Enterprise controls" include dummies for the different size of enterprises, dummy for the size of the population of the city where enterprise is located, # of years since enterprise established, dummy for export enterprises, dummy for access to credit, # of operation hours per week, the log of the annual sale, the log of the annual raw material cost, and the log of the annual electricity cost. In all regression, this study controls for the district-year two-way fixed effects.

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

CHAPTER THREE

SUBSTANCE ADDICTION AND POVERTY: EVIDENCE FROM CHEWING BETEL-QUID IN MYANMAR

3.1 Introduction

To a majority of the poor, substance addiction and poverty go hand in hand. The relationship between substance addiction and poverty has strong reverse causality. Poverty develops different values of life for the poor, reduces rational control and keeps them in a vulnerable condition (Banerjee & Duflo, 2007; Carvalho, Meier, & Wang, 2016; Spears, 2011). The poor may be aware of the adverse consequences of substance addiction but they may maximize utility at the moment of consumption to satisfy a pleasure appetite. Therefore, using an addictive substance, like smoking tobacco, is more prevalent amongst the poor than the rich (Bobak, Jha, Nguyen, & Jarvis, 2000).

On the other hand, empirical findings suggest that drugs, like marijuana and cocaine, can increase the probability of being poor (Kaestner, 1998). Empirical evidence in substance addiction literature indicates the economic burden of alcohol consumption (Thavorncharoensap et al., 2009) and tobacco consumption (Ekpu & Brown, 2015; Wendy, 2001). Addiction to a substance like smoking tobacco, can have negative effects on household welfare in several ways, such as loss of productivity and missed working days due to smoking-related diseases and deaths (Jones & Efroymson, 2011), and smoking-attributable medical spending (Cowan & Schwab, 2011; Liu et al., 2006; Xin et al., 2009). The direct economic costs of smoking is also a major financial burden for low-income families (John, 2008; John, Ross, & Blecher, 2012; John et al., 2011)

This paper examines the impacts of chewing betel-quid on household welfare. Betel nut has been regarded as the world's fourth most widely consumed addictive substance after alcohol, nicotine and caffeine and it is estimated that about 600 million people chew betel regularly (Wu et al., 2015). The betel-quid is widely consumed in central, south, south-east Asia and South Pacific Islands. It is chewed as a quid, which is wrapped in betel leaves, slaked lime, and tobacco. In Myanmar, 18% of women and 59% of men aged between 15 and 49 years chew betel-quid, and 2 in 5 men and 1 in 5 women chewed 10 or more pieces of betel-quid every day (Ministry of Health and Sports (MoHS) and ICF, 2017).

Chewing betel-quid has a strong link to chronic diseases such as oral cancer (Lin et al., 2008; Wen et al., 2010), metabolic syndrome (Yen et al., 2006), hypertension (Heck et al., 2012), and obesity (Chang et al., 2006; Lin et al., 2009), as well as lower life expectancy (Lan et al., 2007; Wu et al., 2015). Although betel-quid consumption and the prevalence of betel-quid related diseases are high in many countries, surprisingly, there is no reliable empirical paper in the literature that investigates the economic impact of chewing betel-quid.

In isolating the causal effect of chewing betel-quid on poverty, we have many empirical challenges such as reverse causality between chewing betel-quid and poverty, unobserved characteristics, and measurement error. To address the potential endogeneity in household decision-making on chewing betel-quid, we exploit household and community characteristics as instruments.

We construct instrumental variables by exploiting laws, geo-climatic suitability of betel-nut cultivation and customs of religion to discover the impacts of chewing betel-quid on poverty. In Myanmar, basic education (up to a lower secondary level) is free and compulsory under constitutional law, and chewing or selling betel-quid has been strictly prohibited by law in school since 2006, therefore, we use the number of school children (up to a lower secondary level) in a household as an instrument for the quantity of household betel-quid consumption.

We conduct a robustness check by using an additional instrument - dummy for the existence of a public health facility in the same village/ward in which a household lives. Anti-betel-quid campaigns, such as hanging vinyl posters to discourage chewing betel-quid as shown in **Figure 3-1**, are usually initiated by a public health care centre. Therefore, we assume that the existence of a health care centre in the same village/ward in which a household lives will influence the household's decision on betel-quid consumption.

A wide range of economic research commonly uses instruments such as household characteristics including: number of presence of children (Jones, Miller, & Salkever, 1999; Van Ours, 2004), religiosity (Auld, 2018; Kaestner, 1991, 1994; Register & Williams, 2019; Renna, 2007), and laws and policies as instruments to examine the relationships between the use of addictive substances (e.g. tobacco, alcohol, marijuana, cocaine) and their consequences (e.g., criminal activity, reduced incomes, enhanced use of health facility, reduced education) (French & Popovici, 2008).

We conduct additional robustness check by implementing instrumental variables with the interaction between household's religious affiliation and geo-climatic suitability of betel-nut cultivation. As the betel nut can only be cultivated in certain geo-climatic conditions(Staples & Bevacqua, 2006), we assume that the regions where betel nut is cultivable, consumption is higher. As Buddhists believe betel-quid is an essential delicacy, particularly in social and religious ceremonies, they tend to consume betel-quid more than in other religions.

Secondly, this paper turns to the analysis of the underlying channels of the effect of chewing betel-quid on poverty. To estimate the economic cost of chewing betel-quid, we follow established ways of estimating the cost of addiction to substances like alcohol, smoking, and illicit drugs in previous studies. Costs have been divided into two main categories: (i) direct costs - health care, research and prevention, crime and law enforcement, property damage or loss, administration, welfare or social work, addicted substance; and (ii) indirect costs - early mortality costs, decreased productivity costs due to absenteeism, job loss or early retirement costs (Thavorncharoensap et al., 2009). As a direct channel, we use spending on betel-quid consumption, i.e. an opportunity cost limiting the budget available for household spending on other goods and services, and household medical expenditure. In addition, we examine the losses of employment due to illness as an indirect channel. (Thavorncharoensap et al., 2009)

The structure of the paper is as follows. In the following section, we present data and the way of implementing of different poverty measures. Section 3.3 describes the OLS regression of household betel-quid consumption on poverty incidences. In section 3.4, we provide detailed explanations on instrumental variables, its results for poverty incidences and the underlying mechanism are described in section 3.5, and the assessment for the identification strategy is described in section 3.6. Section 3.7 concludes.

3.2 Data and Poverty Measures

3.2.1 Data

We use information from a nationally representative household survey conducted by the United Nations Development Program (UNDP). In 2009 and 2010, UNDP conducted two rounds of surveys for the Integrated Household Living Conditions Assessment (IHLCA). In this study, we use the 2009 survey only because 2010 survey does not contain the education information, which is used as a main instrument in this paper.

The IHLCA household survey collected information from 18660 households. The survey used a stratified sampling design with 62 districts and two townships as first stage sampling units. In the second stage, wards or villages were randomly taken from the selected township in accordance with the numbers of households. Finally, twelve households were randomly selected from each ward or village by using Probability Proportionate Estimated Size with Replacement (PPES).

We use the quantity of household betel-quid consumption, food consumption expenditure, non-food consumption expenditure and demographic characteristics to study the impact of betel-quid consumption on poverty. **Table**

3.1 presents summary statistics of the main variables used in this paper.

3.2.2 Poverty Incidences

We use three different measures of poverty incidence: the food poverty incidence measured on household food consumption expenditure, the relative poverty incidence measured on the aggregate expenditure on food and non-food commodities, and the absolute poverty incidence measured by using the international poverty line—US$ 1.9 per day. Poverty lines such as food poverty line and relative poverty line are defined by UNDP and are calculated by using information of the Integrated Households and Living Condition Assessment surveys (IHLCA 2009-2010).

The food poverty line is defined based on the reference households' average food spending, which is the quantity of cash needed to pay for a food basket that meets the family members' minimum caloric demands. The reference households are those in the second quartile of total consumption expenditure.

It is important to adjust the composition of households by age and size to be able to compare spending on food consumption across households, as children in a family consume less than adults. We use equation (3.1) to adjust the household adult equivalent scales:

$$\mathrm{AEF_j} = \left(\mathrm{MA_j} + \alpha_1 \mathrm{FA_j} + \alpha_2 \mathrm{C_j} \right)^{\theta}, \tag{3.1}$$

Where, "$\mathrm{AEF_j}$" is numbers of adult equivalent for food consumption expenditure in household "j", "$\mathrm{MA_j}$" denotes number of adult-males aged 15+ in household "j", "$\mathrm{FA_j}$" presents number of adult-females aged 15+ in household "j", "$\mathrm{C_j}$" denotes number of children aged<=14 in household "j", "α_1" represents costs of a female adult relative to those of a male adult, "α_2" represents costs of a child relative to those of a male adult, "θ" presents the elasticity of adult equivalent with respect to effective size. α_1,α_2, and θ are set to 0.9, 0.7 and 0.9 respectively based on nutrition norms (Deaton & Zaidi, 2002). We, then define the dummy variable for poverty incidence in which "1" indicates an adult in a household “j”, which is below the poverty line, “0” otherwise.

The relative poverty line is defined on the basis of minimum food spending to meet caloric demands, plus reasonable non-food spending to meet fundamental needs, which is calculated by using information of a reference household. In order to compare non-food consumption expenditure across households, we use equation (3.2) to adjust the household economies of scale and to take account of the public goods aspects of some commodities. In addition, children usually have a more limited list of products they consume.

$$\mathrm{AENF_j} = (\mathrm{A_j} + \alpha \mathrm{C_j})^{\theta}, \qquad (3.2)$$

Where, “$\mathrm{AENF_j}$” describes the number of adult equivalent for non-food expenditure in household “j”, “$\mathrm{A_j}$” denotes number of adults aged 15+ in household “j”, “$\mathrm{C_j}$” denotes number of children aged <=14 in household “j”, “α” represents non-food cost of a child relative to that of a male adult, “θ” is elasticity of adult equivalents with respect to effective size between 0 and 1. α and θ are set to 0.3 and 0.9 respectively based on nutrition norms (Deaton & Zaidi, 2002). We, then define the dummy for relative poverty incidence based on the household aggregate expenditure in which “1” indicates an adult in a household “j”, which is below the relative poverty line, “0” otherwise.

The absolute poverty incidence is calculated by using the international poverty line of US$ 1.9 per day. We define dummy variables for the poverty incidence in which “1” denotes total expenditure per day of a person in household “j”, which is below US$ 1.9 (1900 Kyats- local currency unit) and “0” otherwise.

Table 3-1: Summary Statistics

	Mean	Std Dev	Min	Max
Dummy for food poverty incidence (Below poverty line=1)	0.463	0.499	0	1
Dummy for poverty incidence (Below poverty line=1)	0.439	0.496	0	1
Dummy for absolute poverty incidence (Below poverty line=1)	0.714	0.281	0	1
Log of per capita food consumption expenditure per day (Kyats)	6.626	0.636	0.273	11.087
Log of per capita total expenditure per day (Kyats)	7.021	0.625	3.507	11.472
Log of household health expenditure in six months (Kyats)	1.500	3.558	0	23.942
Log of household's working days per week	0.879	0.409	0	3.091
# of HH members who have chronic illness	0.127	0.465	0	9
Log of quantity of household betel-quid consumption per month (Kg)	0.879	1.543	0	7.314
# of HH members currently attending school (up to a lower secondary level)	0.929	1.078	0	8
Dummy for existence of public health facility in the same village/ward (Yes=1)	0.088	0.284	0	1
Buddhist household in betel-nut suitable regions	0.239	0.426	0	1
Non-Buddhist households in betel-nut suitable regions	0.036	0.185	0	1
Households in betel-nut non-suitable region (Omitted category)	0.720	0.446	0	1
Gender of household head (Female=1)	0.202	0.401	0	1
Education attainment of household head	5.252	2.769	0	13
# of household members	5.104	2.237	1	23
# of children aged <=5	0.326	0.593	0	5
# of seniors aged 65+	0.306	0.578	0	4
Dummy for rural household (Yes=1)	0.703	0.457	0	1
Observations		**18567**		

Notes: 1 US$ is approximately equal to 1000 Kyats (Local currency) in 2009.

3.3 Chewing Betel-quid and Poverty: OLS Estimates

3.3.1 OLS Estimates

Table 3.2 reports estimates from the ordinary least-squares (OLS) regression of different measures of poverty incidence. To estimate the effects of betel-quid consumption on poverty, we use equation (3.3):

$$Y_i = \beta_0 + \beta_1 ln\_betel_i + X_i' \beta_2 + \delta_j + \epsilon_i, \qquad (3.3)$$

where, "i" denotes a household and $\mathbf{Y_i}$ represents the food poverty incidence, the relative poverty incidence, and the absolute poverty incidences. "$\mathbf{ln\_betel_i}$" represents the log of quantity of household betel-quid consumption per month. '$\mathbf{X_i'}$' includes # of household members, # of children aged<=5, # of seniors aged 65+, dummy for rural household, household head's education and gender. "$\boldsymbol{\delta_j}$" denotes the dummies for fifteen administrative regions.

The dependent variables in Columns (1)–(3) are dummy variables for the poverty incidences in which one indicates that a household is below the poverty line, and zero takes otherwise. The coefficients of the log of quantity of household betel-quid consumption represent the effects of chewing betel-quid on poverty. Estimates show a negative impact on the food poverty incidence and relative poverty incidence, but no effects on the absolute poverty incidence.

We cannot interpret the OLS estimates as causal effects of chewing betel-quid on poverty for a number of reasons. First, the estimate may be biased due to a potential reverse causality problem, for example, the poor generally have lower education and awareness of health, so tend to consume betel-quid more and it leads them into deep poverty. The linear regression model may also be incorrectly specified because a household in extreme poverty may not have enough resource to spend on betel-quid. Moreover, there will be omitted factors, which may be correlated with betel-quid consumption and poverty. Finally, respondents are asked to recall the quantity of betel-quid consumed in the last thirty-days, and some respondents have difficulties recalling accurately the quantity consumed in the last month. All of these problems will be solvable if we have instruments for the quantity of household betel-quid consumption.

Table 3-2: OLS Regression

	(1) Dummy for food poverty incidence	(2) Dummy for relative poverty incidence	(3) Dummy for absolute poverty incidence
Log of quantity of household betel-quid consumption	-0.028***	-0.011***	-0.001
	(0.004)	(0.004)	(0.002)
Household Controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Observations	15098	15098	15098

Notes: OLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. The dependent variables in columns (1)–(3) are dummies for poverty incidence, which equals one if a household is below the poverty line, zero if otherwise.

"Household controls" include # of household members, # of children aged<=5, # of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.

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

3.4 Chewing Betel-quid and Poverty: 2SLS Estimates

3.4.1 Instrumental variables

The approach we use to investigate the causal impact of chewing betel-quid on poverty is using instruments that are correlated with the quantity of household betel-quid consumption, but uncorrelated with other unobserved household characteristics that are important to household socio-economic characteristics. We use the number of school children (up to a lower secondary level) in a household (Jones et al., 1999; Van Ours, 2004) as an instrument for the quantity of household betel-quid consumption.

The validity of the instrument - numbers of school children in a household - relies on an assumption that implies the household decision to send children to school is independent of other household characteristics, e.g., household wealth and distance from school, but strongly correlated with the decision of household's betel-quid consumption. As basic education (up to a lower secondary level) in Myanmar is free and compulsory under the constitutional law (Myanmar Ministry of Information, 2008), we assume that the decision to send children to school is exogenous to other household characteristics. As the gross enrolment rate in basic education increased to 99.7 percent after enforcement, we assume that most households send their children to school and the law is enforced well.

We also assume that the household decision to consume betel-quid may be adversely influenced by the number of school children in a household for a number of reasons. In 2006, chewing betel-quid was banned in schools and public health care centres by law to control consumption. Furthermore, betel-nut shops were banned from selling within 50 meters of school by law (The State Peace and Development Council, 2006). In addition, eighty School Health Teams under the supervision of the Public Health Department visit schools to educate students and teachers regarding betel-quid related diseases. We assume that school children may share knowledge gained from school with their parents at home and it will increase the awareness of betel-quid related diseases. According to the social power theory, children may influence their parents' decisions like food purchasing or consumption (Carrillo, Gonzalez-Sparks, & Salcedo, 2018; Turner, Kelly, & McKenna, 2006); therefore, school children may encourage their parents to stop or reduce betel-quid consumption.

We use equation (3.4) to investigate the causal impact of chewing betel-quid on poverty by using the two-stage least squares. The log of quantity of household betel-quid consumption, "lnbetel" is regarded as endogenous, and then modeled as:

$$\mathrm{lnbetel_i} = \beta_0 + \beta_1 Z'_i + X'_i\beta_2 + \delta_i + \epsilon_i, \quad (3.4)$$

where, variable "Z_i" stands for the instruments we used in this study. $\mathbf{X'_i}$ describes the "Household controls" including # of household members, # of children aged<=5, # of seniors aged 65+, dummy for rural household, and household head’s education and gender. $\boldsymbol{\delta_i}$ denotes the dummies for fifteen regions.

3.4.2 The Validity of the Instrument

The validity of our main instrument - the number of school children (up to a lower secondary level) in a household - depends on the assumption that implies the instrument is uncorrelated with the household’s other substance use e.g., smoking, and alcohol consumption. As tobacco and alcohol are also strictly prohibited in the school environment, the number of school children might negatively influence household alcohol consumption or smoking and it would lead the household to a better economic condition. We explore the relationship between the instrument and household’s other addictive substance use e.g., tobacco and alcohol, with OLS regression (Reported in appendix table C-1) to assess the possibility of these concerns. Estimates show no correlation between the number of school children (up to a lower secondary level) in a household and household’s smoking or alcohol consumption.

A possible explanation why we do not find the link between the instrument and other addictive substances, such as alcohol consumption and smoking, but find a negative relationship with betel-quid consumption is that alcohol is not religiously and socially accepted, and people even in very remote areas may be aware of the effects of smoking on health. However, chewing betel-quid is still believed to be a cultural and traditional delicacy and the awareness of betel related diseases is still very low in Myanmar. Therefore, the knowledge conveyed by school children might increase the awareness of betel-quid related diseases and encourage parents and other household members to stop and reduce chewing betel-quid.

We also assume that the number of household members currently attending school is uncorrelated with the household conditions of being below poverty lines. Nevertheless, the assumption for the exclusion restrictions will be invalid if the households in extreme poverty do not send their children to school although the basic education (up to a secondary level) is free and compulsory. However, the validity of our assumption for exclusion restrictions can be supported with two reasons. Firstly, the law stipulates that basic education is not only compulsory but also free; therefore, households do not need to spend at all on education if the children are below the secondary level. Gross enrolment rate in basic education increased to 99.7 percent after enforcement and it shows the law is enforced well.

Secondly, if there is a direct relationship between the number of school children and the conditions of being below poverty lines, the poorer a household is, the lower probability of sending children to school. Then it leads to more betel-quid consumption and higher probability of being below poverty lines. However, the OLS estimates in **Table 3.2** suggest that it is less likely to have a direct relationship between our main instrument and poverty because the results indicate that non-poor households consume betel-quid more relative to the poor. We conduct an additional check by adding the instrument in the regressions directly together with the endogenous variable; the results indicate that there is no relationship between the instrument and poverty. (Reported in appendix table C-3 & C-4)

3.5 Main Results

3.5.1 Poverty Incidence

Table 3.3 reports the two-stage least-square estimates. Panel A reports 2SLS estimates of equation (3.3) and Panel B describes a prevailing first-stage connection between the instrument and the log of quantity of household betel-quid consumption of equation (3.4). The dependent variables in columns (1)–(3) are dummy variables for the food poverty incidence, relative poverty incidence and absolute poverty incidence respectively. In all specifications, we control for the dummies for fifteen regions. In addition, we control for household characteristics including number of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, education and gender of the household head.

Coefficients of the log of quantity of household betel-quid consumption, reported in columns (1)–(3) of Panel A are positively correlated with poverty and statistically different from zero, which is consistent with the findings of previous studies of tobacco use (John et al., 2012, 2011; Liu et al., 2006). Estimates indicate that if a household consumes one percent more of betel-quid in a month, the probability of being below the food poverty line, relative poverty and absolute poverty line increase 0.697 percentage points, 0.581 percentage points and 0.175 percentage points on average respectively.

The two-stage least-squares estimates indicate that all the observed negative correlations between the quantity of household betel-quid consumption and poverty in OLS regressions are due to omitted-variables bias and the point estimates turn to positive ones when these biases are controlled for. Sagan test results in **Table 3.5** of Panel B show that the assumption for exclusion restriction is valid.

The direction and magnitude of 2SLS estimates are different from OLS estimates for a number of reasons. Firstly, the poor generally have lower education and awareness of betel-quid related diseases, so they tend to consume more relative to the non-poor. On the other hand, households in extreme poverty may not have enough resources to spend on betel-quid and it may lead to less consumption. Due to the reversed causality problem, the OLS estimates indicate the negative correlation and it reflects the fact that non-poor households may consume betel-quid more relative to poor. When we use the instrument for the quantity of betel-quid consumption, the estimates are purged of all bias caused by the reversed causality and incorrectly specified linear regression model. Secondly, and most importantly, the OLS estimates might correlate with the error term, as we cannot control for factors like weather shock, primary income source, and assets ownership, which are important to household economic conditions. The OLS estimates might be biased due to the omission of important confounding variables.

Table 3-3: 2SLS Estimates for Poverty Incidences

Dependent Variable= Dummy for Poverty Incidence (Below poverty line=1)	(1) Food poverty incidence	(2) Relative poverty incidence	(3) Absolute poverty incidence
Panel A: Two-stage least squares			
Log of quantity of household betel-quid consumption	0.697***	0.581***	0.175**
	(0.229)	(0.193)	(0.077)
Household controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Panel B: First-stage for the log of quantity of household betel-quid consumption			
# of school children (up to a lower secondary level) in a household	-0.046***	-0.046***	-0.046***
	(0.012)	(0.012)	(0.012)
Household controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
F-test	12.349	12.349	12.349
Observations	15098	15098	15098

Notes: 2SLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. The dependent variables in columns (1)–(3) are dummies for poverty incidence, which equals one if a household is below the poverty line, zero takes otherwise. We use # of school children (up to a lower secondary level) in a household as an instrument for the log of quantity of household betel-quid consumption.
"Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.
*p<0.10, **p<0.05, ***p<0.01

3.5.2 Channels

We also explore the underlying mechanisms of how chewing betel-quid affects poverty through both the direct channel - crowding-out effects of betel-quid consumption and associated health expenditure - and the indirect channel - loss of participation in the household workforce due to illness.

Panel A of **Table 3.4** reports 2SLS results and Panel B the corresponding first stage. Our findings support the previous studies in literature that found spending on an addictive substance like tobacco and alcohol crowds out household's expenditure on vital needs (Busch et al., 2004; John et al., 2012; Thomson et al., 2002). Columns (1)–(2) report the estimates of crowding-out effects of betel-quid expenditure on household food expenditure and total expenditure respectively. Coefficients of the natural log of household betel-quid consumption suggest that food expenditure and non-food expenditure decrease 0.378 percentage points and 0.863 percentage points on average respectively if a household chews one percent more betel-quid in thirty days.

Table 3-4: 2SLS Estimates for Underlying Channels

	(1)	(2)	(3)	(4)	(5)
	Direct Channel			**Indirect Channel**	
	Log of food expenditure	Log of total expenditure	Log of health expenditure	Log of working days	# of HH members with chronic illness
Panel A: Two-stage least squares					
Log of quantity of household betel-quid consumption	-0.378*	-0.863***	1.974*	-2.402***	0.224**
	(0.215)	(0.287)	(1.027)	(0.676)	(0.108)
Household Controls	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Panel B: First-stage for log of quantity of household betel-quid consumption					
# of school children (up to a lower secondary level) in a household	-0.050***	-0.046***	-0.046***	-0.045***	-0.046***
	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)
Household Controls	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
F-test	14.465	12.328	12.349	11.463	12.349
Observations	15031	15095	15098	14903	15098

Notes: 2SLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. The dependent variable in columns (1)–(2) are the natural log of household food consumption expenditure and aggregate food and non-food expenditure, which are adjusted for household composition and household size (economies of scales), in column (3) is the natural log of household health expenditure, in column (4) is the natural log of household's working days, in column (5) is # of household members who have chronic illness. We use # of school children (up to a lower secondary level) in a household as an instrument for the log of quantity of household betel-quid consumption.

"Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.

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

Estimates on the natural log of household health expenditure reported in Column (3) indicate that the 1.974 percentage points increase in household health expenditure is associated with one percent increase in the quantity of betel-quid consumption. In Column (4), estimates for the natural log of the household's working days per week are reported. The data are collected from the respondents who are aged between 15 and 65 and not currently attending school. The result suggests that one percent more of chewing betel-quid is linked with 2.402

percentage points decrease in the household's working day. In line with the evidence in literature mentioned that chewing betel-quid causes chronic diseases, we discover a positive and statistically significant impact on the number of household members suffering from chronic disease, which is presented in Column (5).

3.6 Robustness Check

In order to conduct robustness checks, we use a dummy variable for the existence of a public health facility in the same village/ward in which a household lives as an instrument for the quantity of household betel-quid consumption.

In Myanmar, the decision to implement a public health facility mainly depends on the size of the locality and the distance from an existing health care center. Therefore, we assume that the existence of a public health care center in the same village/ward in which a household lives is exogenous to household characteristics and other regional economic factors that may influence the outcome variables. In addition, as the pictorial warning can effectively change behaviour such as intention to quit and quit attempts like, the pictorial warning on cigarette packs (Brewer et al., 2016), most public health care centres in Myanmar conduct poster campaigns as shown in **Figure 3-1** to reduce betel-quid consumption. Therefore, households in the same village/ward, which has a public health facility, may often see the posters hanging at the entrance of the health care center, and it may discourage betel-quid consumption.

We use equation (3.4) to conduct the robustness check with two instruments - numbers of school children (up to a lower secondary level) in a household and dummy for the existence of a public health facility in the same village/ward in which a household lives.

Figure 3-1: Poster of Anti-betel Campaign

Table 3.5 presents the first set of robustness checks. 2SLS estimates in Columns (1)-(8) indicate that, even using additional instrument, the estimated effects of betel-quid are consistent with the baseline estimates. The P-values of Sargan test reassures the exogeneity of the instruments, though in some models the P values are slightly smaller than 0.1

An extensive set of empirical research commonly used instruments such as religiosity and state level characteristic as instruments to examine the causal impact of using an addictive substance on different outcomes such as income, crime, use of health facility, and lower education (French & Popovici, 2008). We use household religious affiliation and geo-climatic suitability of betel nut cultivation to construct instruments to conduct an additional robustness check.

Betel nut can only be cultivated under certain geo-climatic conditions. It requires annual rainfall in a range from 750 millimeters to 4500 millimeters and it can only be cultivated below 1000 meters of mean sea level. The ideal temperature is the range between 10°C to 40°C (Staples & Bevacqua, 2006). As betel-nut cultivation depends on specific geo-climatic conditions, we assume that the decision to cultivate betel nut is exogenous and uncorrelated to any regional economic condition. We construct betel-nut suitable regions based on three geo-climate conditions for betel-nut cultivation: annual rainfall and temperature by using the information from Myanmar Climate Report (Zin et al., 2017), and regional average elevation data (NASA's SRTM data). If a region is coincident with the three geo-climate conditions, we define the region as a betel-nut suitable region. We have five betel-nut suitable regions out of fifteen in our sample. Our proposed mechanism of the consumption variations among regions is the difference in price of betel-quid. The price will be higher in a region in which betel-nut cannot be cultivated due to the transportation cost and we assume a higher price may hinder or discourage betel-quid consumption.

Most Buddhists in Myanmar believe that betel-quid is an essential delicacy to religious ceremonies and other social occasions, such as a traditional wedding ceremony (Sein, Swe, Toe, Zaw, & Sein, 2014). The OLS estimates (Reported in appendix table C-2) indicate that Buddhist households consume more betel-quid relative to other religions. Therefore, we exploit the variation in household betel-quid consumption determined by customs of religions to construct instrument variables (Auld, 2018; Kaestner, 1991, 1994; Register & Williams, 2019; Renna, 2007). In this study, we assume that household religious affiliation is uncorrelated with socioeconomic conditions. However, there is a favorable relationship between religion and economic growth in many empirical articles (Barro & McCleary, 2003; Guiso, Sapienza, & Zingales, 2003; Wang & Lin, 2014). On the other hand, some studies found contradicting evidences, which indicate that a particular religious affiliation has no robust effects on economic performance (Durlauf, Kourtellos, & Tan, 2009; Noland, 2005).

In order to avoid the potential endogeneity in household religious affiliation and classification of betel-nut suitable regions, we interact dummy for household religious affiliation and dummy for betel-nut suitable region. We construct three dummy variables: Buddhist household in betel-nut suitable regions;

non-Buddhist household in betel-nut suitable regions; and other household in betel-nut non-suitable regions (Omitted category).

Table 3.6 presents results from the robustness checks by using different instrumental variables. The 2SLS estimates in this setting are smaller than the baseline results, but they are also economically and statistically significant and still consistent with the baseline estimates.

With reasonable assumptions, IV estimates provide the average treatment effect for "compliers", however, people whose participation may change with different instruments. With two different instruments; therefore, the two sets of compliers are going to be somewhat different. In other words, instrumental variables provide an estimate for a specific group—namely, people whose behavior can be manipulated by instruments (Angrist & Krueger, 2001). As the IV estimates are Local Average Treatment Effects (LATE), if the compliers are different due to the using of different IVs, the size of coefficients may be somewhat different.

Table 3-5: Robustness Check I

	(1) Food poverty	(2) Relative poverty	(3) Absolute poverty	(4) Log of food Exp	(5) Log of total Exp	(6) Log of health Exp	(7) Log of working days	(8) # of HH members who have chronic illness
Panel A: Two-stage least squares								
Log of quantity of household betel-quid consumption	0.576***	0.412***	0.140**	-0.628***	-0.646***	1.052*	-1.558***	0.242**
	(0.162)	(0.126)	(0.054)	(0.235)	(0.185)	(0.631)	(0.363)	(0.102)
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: First-stage for log of quantity of household betel-quid consumption								
# of school children (up to a lower secondary level) in a household	-0.049***	-0.049***	-0.049***	-0.049***	-0.049***	-0.062***	-0.045***	-0.049***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.013)
Dummy for existence of public health facility in the Village/ward (Yes=1)	-0.110**	-0.110**	-0.110**	-0.110**	-0.110**	-0.099**	-0.121**	-0.110**
	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.047)	(0.048)	(0.049)
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test	10.010	10.010	10.010	10.010	10.215	10.010	10.450	10.010
Sargan test (P-value)	0.129	0.113	0.062	0.723	0.189	0.067	0.088	0.0954
Observations	15098	15098	15098	15098	15095	15098	14903	15098

Notes: Notes: 2SLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. The dependent variable in columns (1)–(3) are dummies for poverty incidence, which equals to one if a household is below the poverty line, zero takes otherwise, in columns (4)–(5) are the natural log of household food consumption expenditure and total consumption expenditures, which are adjusted for household composition and household size (economies of scales), in column (6) is the natural log of household health expenditure, in column (7) is the natural log of household's working days, in column (8) is # of household members who have chronic illness. We use # of school children (up to a lower secondary level) in a household and dummy for the existence of public health facility in the same village/ward in which a household lives as instruments for the log of quantity of household betel-quid consumption.

"Household controls" include # of household members, # of children aged<=5, # of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.

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

Table 3-6: Robustness Check II

	(1) Food poverty	(2) Relative poverty	(3) Absolute poverty	(4) Log of Food Exp	(5) Log of total Exp	(6) Log of health Exp	(7) Log of working days	(8) # of HH members who have chronic illness
Panel A: Two-stage least squares								
Log of quantity of household betel-quid consumption	0.252**	0.290**	0.107*	-0.348**	-0.411**	0.940***	-0.256*	0.100*
	(0.127)	(0.121)	(0.063)	(0.170)	(0.179)	(0.199)	(0.142)	(0.054)
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agro-ecological region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: First-stage for log of quantity of household betel-quid consumption								
Dummy for Buddhist household in betel-nut suitable regions (Yes=1)	0.787***	0.856***	0.856***	0.856***	0.857***	0.980***	0.838***	0.809***
	(0.180)	(0.173)	(0.173)	(0.173)	(0.173)	(0.220)	(0.157)	(0.161)
Dummy for Non-Buddhist household in betel-nut suitable regions (Yes=1)	0.416**	0.471***	0.471***	0.471***	0.471***	0.491***	0.457***	0.454***
	(0.169)	(0.167)	(0.167)	(0.167)	(0.167)	(0.169)	(0.158)	(0.156)
Household Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agro-ecological zones FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test	67.976	88.473	88.473	88.519	88.512	201.307	77.144	73.529
Sargan test (P-value)	0.874	0.457	0.228	0.871	0.826	0.348	0.211	0.526
Observations	12328	12328	12328	12312	12325	24342	12328	12328

Notes: 2SLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. The dependent variable in columns (1)–(3) are dummies for poverty incidence, which equals to one if a household is below the poverty line, zero takes otherwise, in columns (4)–(5) are the natural log of household food consumption expenditure and total expenditure, which are adjusted for household composition and household size (economies of scales), in column (6) is the natural log of household health expenditure, in column (7) is the natural log of household's working days, in column (8) is # of household members who have chronic illness. We use three categorical variables: Buddhism household in betel-nut suitable regions, Non-Buddhism households in betel-nut suitable regions, and households in betel-nut non-suitable region (Omitted category) as instruments for the log of quantity of household betel-quid consumption. Betel-suitable regions are classified on fifteen administrative regions.

"Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.

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

3.7 Conclusion

This paper studies the impacts of chewing betel-quid on poverty in Myanmar. We use household consumption information to determine whether a household is below the poverty line. We use three different poverty lines to discover the effects of chewing betel-quid on poverty: the food poverty line, the monetary value of the minimum caloric requirement; the relative poverty line, the basic requirement of food and non-food items; and the absolute poverty line, the international poverty line calculated at US$ 1.9 a day. In addition, we explore the underlying causes of chewing betel-quid on poverty through the direct channel - crowding-out effects of betel-quid consumption and associated health expenditure - and the indirect channel - loss of participation in the household workforce due to illness. To address the potential endogeneity in a household's decisions on chewing betel-quid, we exploit household and community characteristics as instruments.

The results indicate that the substance addiction, chewing betel-quid, indeed pushes households into poverty. One percent increase in quantity of household betel-quid consumption in thirty days is associated with the increase in probability of being below the food poverty line, relative poverty line and absolute poverty line 0.697, 0.581 and 0.175 percentage points respectively. The findings also show that spending on betel-quid crowds out household expenditures on food and non-food items. In addition, the higher health expenditure and lower working days in a household is associated with higher betel-quid consumption. As chewing betel-quid push households into poverty; reducing betel-quid consumption would not only be a public health policy, it would also be a policy to reduce poverty.

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Appendix C

Table C- 1: Analyzing the Validity of Instrument

	(1) Log of household expenditure on alcohol consumption	(2) Log of household expenditure on smoking
# of HH members currently attending school (up to a lower secondary level)	0.030 (0.027)	0.003 (0.028)
Household Controls	Yes	Yes
Region FE	Yes	Yes
Observations	15098	15098

Notes: OLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. We use household's spending on alcohol beverages instead of quantity in order to account for different types of alcoholic beverages such as beer, toddy alcohol, local alcoholic beverages, imported alcoholic beverages, and rice wine consumed by households in a month. "Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.
*p<0.10, **p<0.05, ***p<0.01

Table C- 2: Religious Affiliation and Betel-quid Consumption

	(1) Log of quantity of household betel-quid consumption
Dummy for household religious affiliation (Buddhist-HH=1)	0.170*** (0.047)
Household Controls	Yes
Observations	14646

Notes: OLS estimates are reported with cluster standard error in parentheses. "Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. *p<0.10, **p<0.05, ***p<0.01

Table C- 3: The Validity of Instrument (OLS)

	(1) Dummy for food poverty incidence	(2) Dummy for relative poverty incidence	(3) Dummy for absolute poverty incidence
Log of quantity of household betel-quid consumption	-0.034*** (0.005)	-0.018*** (0.004)	-0.003* (0.002)
# of HH members currently attending school (up to a lower secondary level)	-0.008 (0.005)	0.004 (0.004)	0.004 (0.003)
Household Controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Observations	14270	14270	14270

Notes: OLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. "Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions. *p<0.10, **p<0.05, ***p<0.01

Table C- 4: The Validity of Instrument (2SLS)

Dependent Variable= Dummy for Poverty Incidence (Below poverty line=1)	(1) Food poverty incidence	(2) Relative poverty incidence	(3) Absolute poverty incidence
Panel A: Two-stage least squares			
Log of quantity of household betel-quid consumption	0.249**	0.372*	0.108*
	(0.126)	(0.201)	(0.062)
# of school children (up to a lower secondary level) in a HH	0.012	-0.010	-0.005
	(0.008)	(0.009)	(0.004)
Household controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
Panel B: First-stage for the log of quantity of household betel-quid consumption			
Dummy for Buddhist household in betel-nut suitable regions (Yes=1)	0.797***	0.766***	0.866***
	(0.181)	(0.258)	(0.175)
Dummy for Non-Buddhist household in betel-nut suitable regions (Yes=1)	0.418**	0.364**	0.473***
	(0.169)	(0.146)	(0.167)
Household controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
F-test	69.024	64.070	89.677
Sargan test (P-value)	0.893	0.831	0.237
Observations	12328	13488	12328

Notes: 2SLS estimates are reported with standard error in parentheses, which is clustered at district level (there are 62 districts). The unit of observations is a household. The dependent variables in columns (1)–(3) are dummies for poverty incidence, which is equal to one if a household is below the poverty line, zero takes otherwise. We use # of school children (up to a lower secondary level) in a household as an instrument for the log of quantity of household betel-quid consumption.

"Household controls" include # of household members, number of children aged<=5, number of seniors aged 65+, dummy for rural household, household head's education and gender. In all regressions, we control for dummies for fifteen regions.

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