

# The Impact of Mobile Signal Strength on Daily Wage Earnings in Myanmar

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# **RELEVANCE OF THE STUDY**

## Labor Force Issues in Myanmar

- Labor force statistics in Myanmar are recent: 2015 first national level appraisal in 30 years
- Focuses on three aspects:
  - Labor force characteristics (women's participation)
  - Child labor
  - School to work transition and youth unemployment
- Daily wage workers minimally addressed
- Minimum wages currently important on the policy agenda: worker protests etc.

## Focus: Wage workers in Myanmar

- As per the Myanmar Labor Force Survey 2015, 54% of the population at the national level identified themselves as waged workers
  - 18% in our sample are wage workers (1451 workers)
  - Wage workers are present across regions: Urban (15%); Rural (21%)
  - And in the non-agricultural sector also: Only 26% of the wage workers in the sample are from the agricultural sector. Note: Wage work spikes in the lean agricultural seasons and the survey was conducted during the non-lean season for wheat, potato and maize; lean season for rice (FAO).
- Average daily wages
  - Urban: 5950 Kyat (6498 Kyat); rural: 3870 Kyat (4425 Kyat)
  - Male: 4900 (5859.5); female: 3340 (3526.6 Kyat)
- Wage work provides off-farm employment in the lean seasons: 70% of Myanmar's population works in agriculture (contributes to 37.8% of GDP, accounts for 25-30 % of export earnings)
- Volatility of agricultural income increasing due to climate change; wage work will become more relevant as a safety net

# **DEMAND/SUPPLY OF WAGE WORK**

## Demand for wage work

- Shortfall: Median poor has an annual poverty gap of 50,000 Kyat; 25-30 days of paid work (UNDP, 2010).
- Average wage worker in the sample wanted to work an **additional 2.5 days in rural areas (over 24.5 days worked); urban 0.5 days (over 26 days worked)**
- Median income is just 25% above the poverty line (UNDP, 2010), so vulnerability to income shocks – safety nets needed (via earning opportunities)
- Consumption poverty and inequality are low in Myanmar due to high indebtedness – supplementary income can reduce further borrowing. The median poor has debts of 60,000 Kyat. Just eliminating debt can move them out of poverty.

## Supply of wage work

- Work is not equally distributed and paid for: people work 60 million hours too much weekly in aggregate beyond the 44 hour week. Redistribution could provide jobs for 1.34 million more people; make wages more equitable (UNDP, 2010).
- Major labor market issues: (i) low skills and capital usage causing low labour productivity (ii) underdeveloped market structures increase cost and hamper productivity (iii) unbalanced market powers causing capping of wages.
- Information access would make the market more efficient – lower search cost, match skills with jobs better and faster.
- Impact: more people employed; more equitable incomes

## **Assumptions underlying the Theory of Change**

- There is an existing pool of unfilled jobs (or excess work hours) on the supply side; or the number of jobs (or work hours) will grow along with demand from candidates; or both
- If there are inadequate jobs (or work hours) or if the supply of jobs doesn't grow along with demand, wages could start falling in some sectors/regions



# **EMPIRICAL METHOD**

## Empirical Strategy: Heckman and 2sls

- The question of interest: impact of mobile signal strength on daily earnings of wage workers
- We consider the wages of only a section of the labor force: wage workers; wage income data is therefore truncated.
- There are likely to be unobservable characteristics (example: motivation, abilities) that affect the decision to take up daily wage work which also affect earnings – selection problem; use Heckman method.
- Also, the impact of signals on daily earnings has a potential endogeneity problem: people earning more might live in areas that are better served in terms of infrastructure, including mobile signals (reverse causality). Use an instrumental variable approach.

## Empirical Strategy: Heckman and 2sls (contd.)

- We first run a probit regression to estimate the likelihood of selection into wage-work and calculate the Inverse Mills Ratio. This is the ‘non-selection hazard’: by how much are conditional wages shifted up (or down) due to selection?
- The second stage is a two-stage least squares (2sls) regression to address the endogeneity of signals with respect to earnings. ‘Lightning frequency’ in the 2 months prior to the survey is used as an instrument (a source of exogenous variation in signal strength).

## Empirical Strategy: Heckman and 2sls (contd.)

- In the signal strength equation (first equation of 2sls), we include the Inverse Mills Ratio, besides the geo-climatic regressors that affect mobile signal strength (prior work). We then calculate the estimated signal strength, which is introduced in the second equation of the 2sls. This estimated variable is not endogenous to earnings.
- The second equation models daily wage earnings as a function of a diverse set of variables: socio-economic, demographic, regional, geo-climatic, etc. and includes the estimated signal strength from the first stage of the 2sls.

# MODEL VARIABLES

# Discussion of control variables

## **A. Level of existing wealth affecting need for supplementary wage income**

- Asset ownership (a wealth index is constructed using Principle Components Analysis, from a range of asset variables, and the sample is stratified into 5 quintiles based on level of asset wealth).
- Housing quality (categories based on building materials)

## **B. Physical ability to travel to work**

- Remoteness (distance to post office)
- Vehicle ownership – type, if any (besides asset ownership)
- Access to public transport (distance to source of public transport)

## **C. Ability to take up employment**

- Health variable (distance to medical facilities)
- Family size – affects wage requirements and labour supply
- Gender – cultural factors might limit the ability to work; women might absorb a much higher share of household chores

## Discussion of control variables (contd.)

### **D. Regional variation in job availability (economic and political factors)**

- Rural/urban
- Region dummy (coastal, northern hills, eastern hills etc.)
- “Cluster” by village/ward in the regressions

### **E. Conditions of work;**

- Average climate annual (rainfall; temperature) could affect working conditions for outdoor manual labor

**F. Extent of mobile ownership:** no handset or sim; at least 1 handset; at least 1 SIM; at least one handset and sim

**G. General level of curiosity/awareness:** Has read the newspaper in the past 30 days

## Discussion of control variables (contd.)

**H. Exclusion restriction for Heckman:** Hours of electricity available in the home (affects selection into wage work as it likely indicates levels of poverty but the number of hours has no correlation with daily wage earnings).

**I. Lightning frequency in two months preceding the survey**

Used as an instrument for exogenous variation in signal strength in the signals equation; used to indicate seasonality in agriculture in the selection equation

**J. Cost of living** (average price for a set of standard grocery items): data to be added in additional iteration of regression



# FINDINGS

## Discussion of Results

- Those likely to take up wage work are younger, male, less educated, in the lower quintiles of asset ownership, rural, and are in service occupations (unskilled and semi skilled) and are small business owners (relative to agriculture)
- The selection effect is not very strong (coefft of IMR is significant at 20% level) and positive (unobservables associated with selection are positively correlated with unobservables associated with daily wage earnings).
- In our main equation of interest, signal strength has a significant, negative impact on the average daily earnings of wage workers. This suggests that greater accessibility of jobs increases the candidate pool more than the job availability and brings down wages.

## Discussion of Results

- Improvements in signal strength have a demonstrable impact on the daily wage earnings of wage workers, who are particularly vulnerable to income shocks. Can be a tool that lifts people out of poverty.
- This can be particularly useful in Myanmar, where a large share of the population is close to the poverty line, and can be lifted out with relatively small increases in work days and income.
- Given indebtedness is high, would prevent further borrowing.
- However, crucially: improvements in the quality of mobile coverage will need to go hand in hand with economic transformation that increases job supply

## Areas for future attention

- How can mobile coverage and quality be used to stimulate economic growth, particularly in rural areas? IT along with electrification have been identified as two important constraints, particularly in agriculture. How can these be more effectively used by employers to generate more jobs?
- In areas of high economic growth (where the availability of unfilled jobs is known to be high or growing), improving signal strength in mobile networks would be an important tool to create greater efficiencies in the labor market.
- In less developed areas, improving the quality of mobile networks alone, without simultaneous job growth, could have potentially contrary impacts.

Thank you.

# **APPENDIX 1: REGRESSION RESULTS**

# SELECTION EQN: WAGE WORK

VARIABLES	(1) wageworker coef	(2) tstat
assetquintile2	-0.201	-1.619
assetquintile3	-0.267	-2.808***
assetquintile4	-0.437	-4.342***
assetquintile5	-0.680	-5.556***
housematerial_cat2	-0.039	-0.247
housematerial_cat3	0.104	0.668
housematerial_cat4	0.090	0.464
postoffice_dist	0.000	1.730*
dist_nearesttransport	-0.000	-0.981
truck	-0.025	-0.092
bicycle	0.174	2.640***
motorbike	-0.251	-3.702***
motorboat	-0.622	-1.378
cart	-0.471	-2.546**
fourwheeltrolley	-0.513	-1.495
dist_nearestmedical	-0.000	-0.426
age	-0.006	-2.165**
male	0.562	9.005***
married	0.038	0.566

## SELECTION EQN: WAGE WORK (contd.)

hhead_primeduc	-0.089	-0.937
hhead_seceduc	-0.145	-1.512
hhead_higheduc	-0.246	-2.268**
hhead_univeduc	-0.687	-4.145***
occ_services	1.763	21.069***
occ_smallbiz	0.809	6.909***
occ_pvtsector	-0.036	-0.115
occ_gov	-0.339	-0.901
hh_size	0.005	0.258
ehills	-0.177	-0.889
middry	0.248	1.647*
lowervalley	0.077	0.362
delta	-0.074	-0.268
coast	-0.191	-0.659
rural	0.137	1.747*
simonly	0.137	0.778
handsetonly	-0.172	-0.831
handsetandsim	-0.228	-2.758***
Distance to top up	0.000	0.477
Read newspaper past 30 days	0.124	1.847*
Lightning frequency in the past 3 months	-0.053	-1.274
Precipitation (annual avg)	0.040	0.255
Temperature (annual avg)	-0.083	-2.702***
Altitude (log) of HH	0.126	1.953*
electricityhours	0.009	1.661*
Constant	-0.873	-0.511
Observations	4,603	

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## 2SLS: STRENGTH OF SIGNAL EQUATION - 1

VARIABLES	(1)	(2)
	Marginal Effects at means	t - stat
Lightning freq (prev 3 mos)	-2.365	-1.255
Precipitation (annual avg)	-21.859	-3.626***
Temperature (annual avg)	0.681	0.516
Altitude (log) of HH	-11.333	-7.054***
Rural	-16.490	-4.045***
Inverse Mills Ratio (IMR)	1.075	1.269
Constant	261.198	4.173***
	-2.365	-1.255
Observations	4,488	

*Source: Equation adapted from Evaluation Document (includes IMR)*

# 2SLS: WAGE INCOME EQUATION - 2

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VARIABLES	(1) Marginal Effects at means	(2) t - stat
assetquintile2	13,370.031	0.387
assetquintile3	5,481.387	0.205
assetquintile4	113,188.897	1.280
assetquintile5	12,969.648	0.266
housematerial_cat2	-23,864.148	-0.234
housematerial_cat3	339.504	0.003
housematerial_cat4	-56,427.153	-0.602
postoffice_dist	-0.852	-0.381
dist_nearesttransport	-6.005	-1.111
truck	209,602.393	0.969
bicycle	49,005.441	1.020
motorbike	61,161.699	1.468
motorboat	19,248.452	0.255
cart	83,988.524	1.095
fourwheeltrolley	147,265.577	0.890
dist_nearestmedical	-3.040	-0.752
age	-23.878	-0.019
male	32,987.335	1.147
married	42,991.402	1.243

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# 2SLS: WAGE INCOME EQUATION – 2 (CONTD.)

VARIABLES	Marginal effects at means	t - stat
hhead_primeduc	-47,990.777	-1.131
hhead_seceduc	22,654.724	0.485
hhead_higheduc	-123,824.726	-1.266
hhead_univeduc	29,649.198	0.443
occ_services	-122,893.654	-1.153
occ_smallbiz	333,408.341	1.422
occ_pvtsector	171,689.571	1.254
occ_gov	301,978.500	0.977
hh_size	2,286.753	0.279
ehills	11,889.959	0.104
middy	-95,299.937	-1.296
lowervalley	-46,227.998	-0.585
delta	4,497.418	0.050
coast	4,569.872	0.053
rural	-1855676.231	-1.679*
simonly	11,554.118	0.236
handsetonly	238,928.921	1.066
handsetandsim	61,214.447	1.660*
Distance to top up	-1.924	-0.651
Read newspaper in 30 days	46,528.467	0.645
Precipitation (annual avg)	-2217977.532	-1.669*
Temperature (annual avg)	109,646.312	1.492
Altitude (log) of HH	-1253568.102	-1.679*
Predicted strength	-111,483.348	-1.675*
Constant	26750948.398	1.708* <sup>27</sup>

# **APPENDIX 2: BACKGROUND INFO**

# Stratified four stage PPS cluster sampling design used

Stage	Number selected	Sampling frame	Method of selection
Stage 1	74 townships (units)	List of townships in order of # of HH [as per 2014 National Census]	PPS with replacement
Stage 2	2 wards + 3 VT per township	List of Wards/VTs in sample townships in order of # of HH [as per 2014 National Census]	PPS with replacement
Stage 3	2 streets per ward + 2 villages per VT	List of segments in sample wards/VTs in order of # of HH [obtained on the field from local administrator]	PPS Systematic sampling
Stage 4	10 HH per Segment	none; HHs within sample segment listed on the field	Circular systematic sampling
After Household data collected from HH head			
	1 individual per HH	List of HH members aged 15-69 in order of age	Kish grid (random number chart)

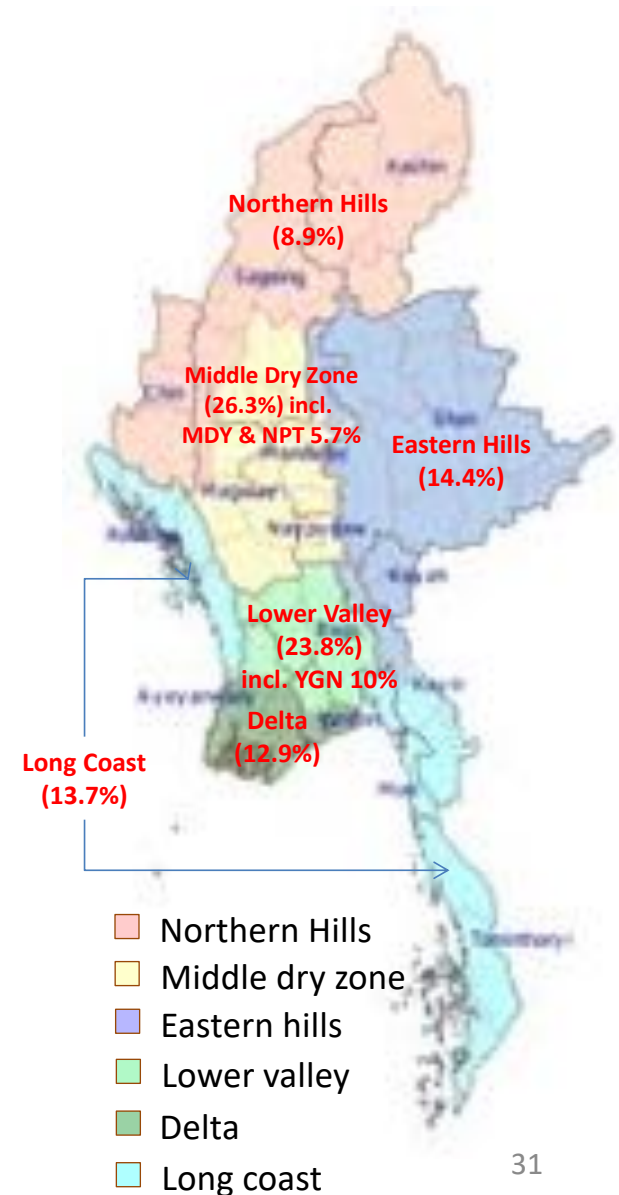
# Townships excluded from sampling frame due to inaccessibility/security concerns (approx. 3% of population)

## Townships Survey Not Carried Out

Northern Hills	Eastern Hills	Delta	Long Coast
Chipwi	Bawlakhe	Cocokyun	Buthidaung
Hpakan	Hopang		Maungdaw
Injyangyang	Hpapun		Rathedaung
Khaunglanhpu	Konkyan		
Lahe	Kunlong		
Lay Shi	Laukkaing		
Machanbaw	Matman		
Nanyun	Mese		
Nawngmun	Mongmao		
Paletwa	Mongyawng		
Putta-O	Narphan		
Sumprabum	Pangsang		
Tanai	Pangwaun		
Tsawlaw	Shadaw		

# Geographic stratification

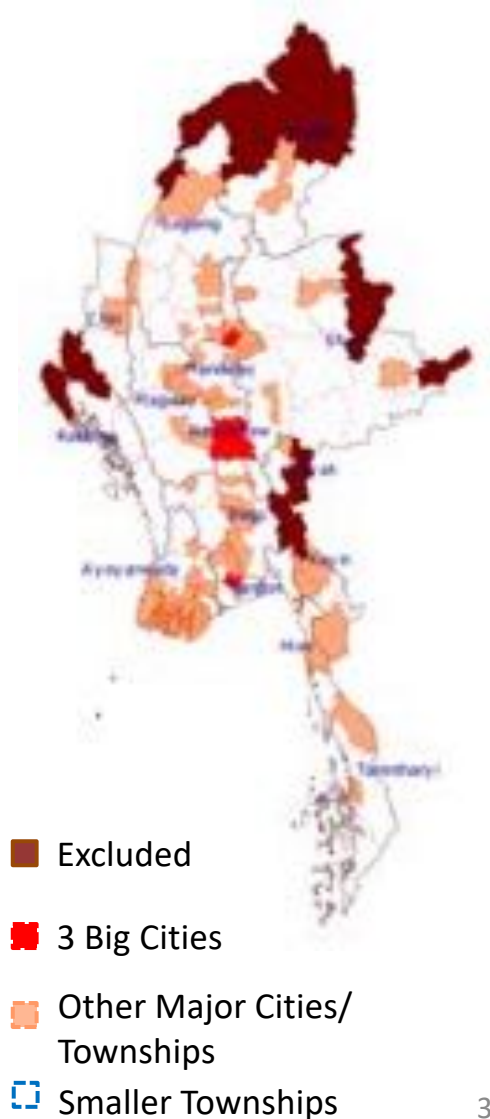
	Population (%)
Northern hills	8.9
Middle dry zone (incl. Mandalay and Nay Pyi Taw)	26.3
Eastern hills	14.4
Lower valley (incl. Yangon)	23.8
Delta	12.9
Long coast	13.7



# Population size stratification (main strata)

	Criteria	Townships	Population (%)
Big cities (Yangon, Mandalay, Nay Pyi Taw)	Population >1m	46	15.7
Other major cities/townships*	Population 0.25-1m	51	28.4
Smaller townships	Population <0.25m	201	52.3
Excluded townships	Inaccessible	32	3.6

Based on Provisional Results of 2014 Population & Housing Census of Myanmar  
 \*Township consists of urban towns and wards as well as rural village tracts and villages



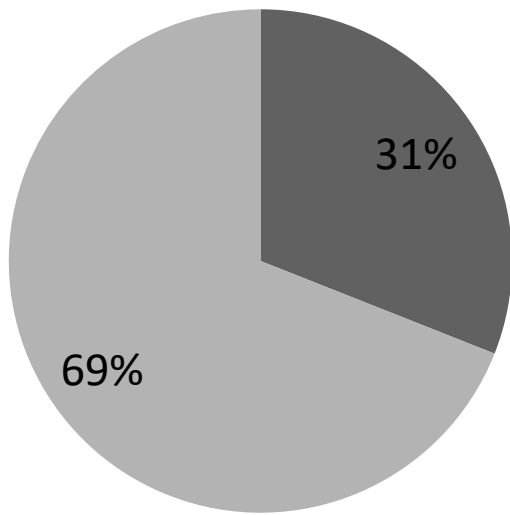


# Myanmar population and survey sample

State/ Region	Total (millions)	Urban (millions)	Rural (millions)	Urban (% of total)	Rural (% of total)	Urban-Sample	Rural-Sample	Total sample
Kachin	1.6	0.6	1.1	36%	64%	120	180	300
Kayah	0.3	0.1	0.2	25%	75%	80	120	200
Kayin	1.5	0.3	1.2	22%	78%	80	120	200
Chin	0.5	0.1	0.4	21%	79%	80	120	200
Sagaing	5.3	0.9	4.4	17%	83%	240	360	600
Tanintharyi	1.4	0.3	1.1	24%	76%	120	180	300
Bago	4.9	1.1	3.8	22%	78%	200	300	500
Magway	3.9	0.6	3.3	15%	85%	200	300	500
Mandalay	6.1	2.1	4	35%	65%	560	440	1000
Mon	2.1	0.6	1.5	28%	72%	120	180	300
Rakhine	2.1	0.4	1.7	17%	83%	120	180	300
Yangon	7.4	5.2	2.2	70%	30%	980	320	1300
Shan	5.8	1.4	4.4	24%	76%	240	360	600
Ayeyawady	6.2	0.9	5.3	14%	86%	320	480	800
Nay Pyi Taw	1.2	0.4	0.8	33%	68%	160	240	400
<b>Total</b>	<b>50.2</b>	<b>14.9</b>	<b>35.3</b>	<b>30%</b>	<b>70%</b>	<b>3620</b>	<b>3880</b>	<b>7500</b>

# Sample demographics consistent with 2014 Census

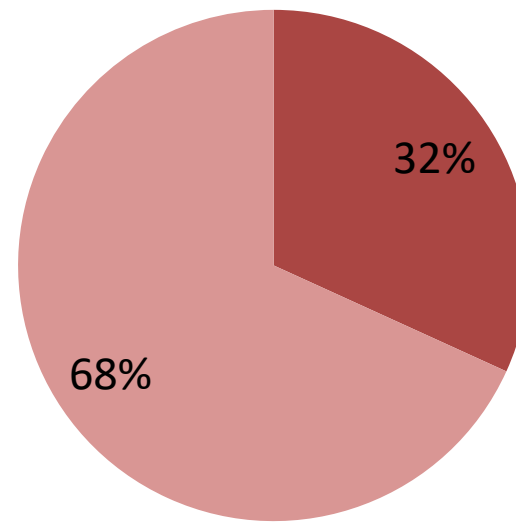
Urban/rural split: 2015



■ Urban  
■ Rural

Base: All Households surveyed (8,138)

Urban/rural split: 2016



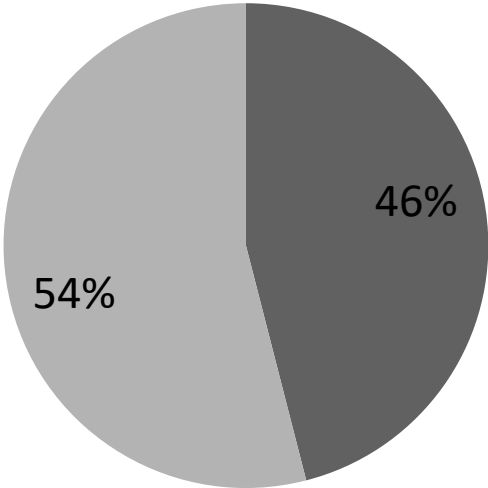
■ Urban  
■ Rural

Base: All Households surveyed (7,204)

Union Census 2014 Population	%
Urban	70
Rural	30

# Sample demographics consistent with 2014 Census

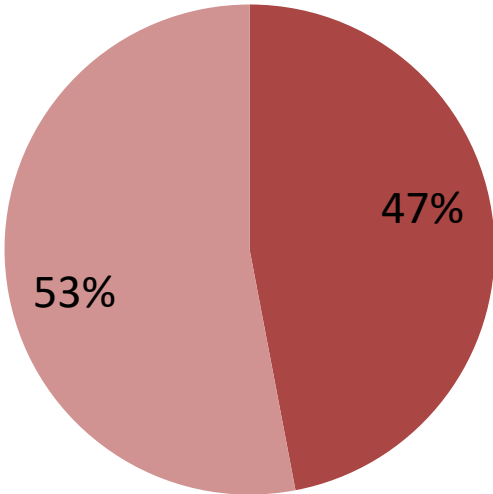
Gender split: 2015



Base: All respondents aged 15-65

■ Male  
■ Female

Gender split: 2016

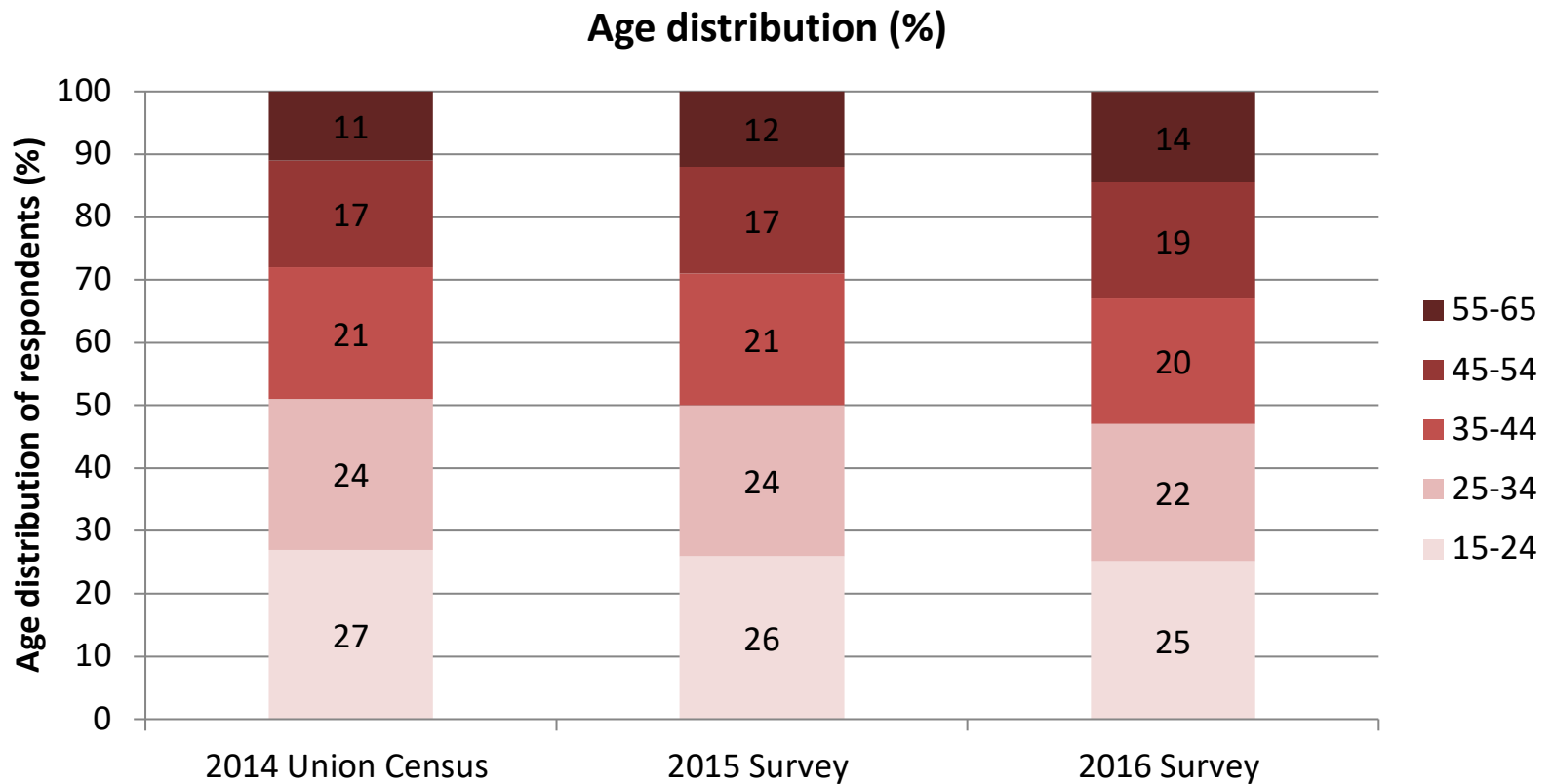


Base: All respondents aged 15-65

■ Male  
■ Female

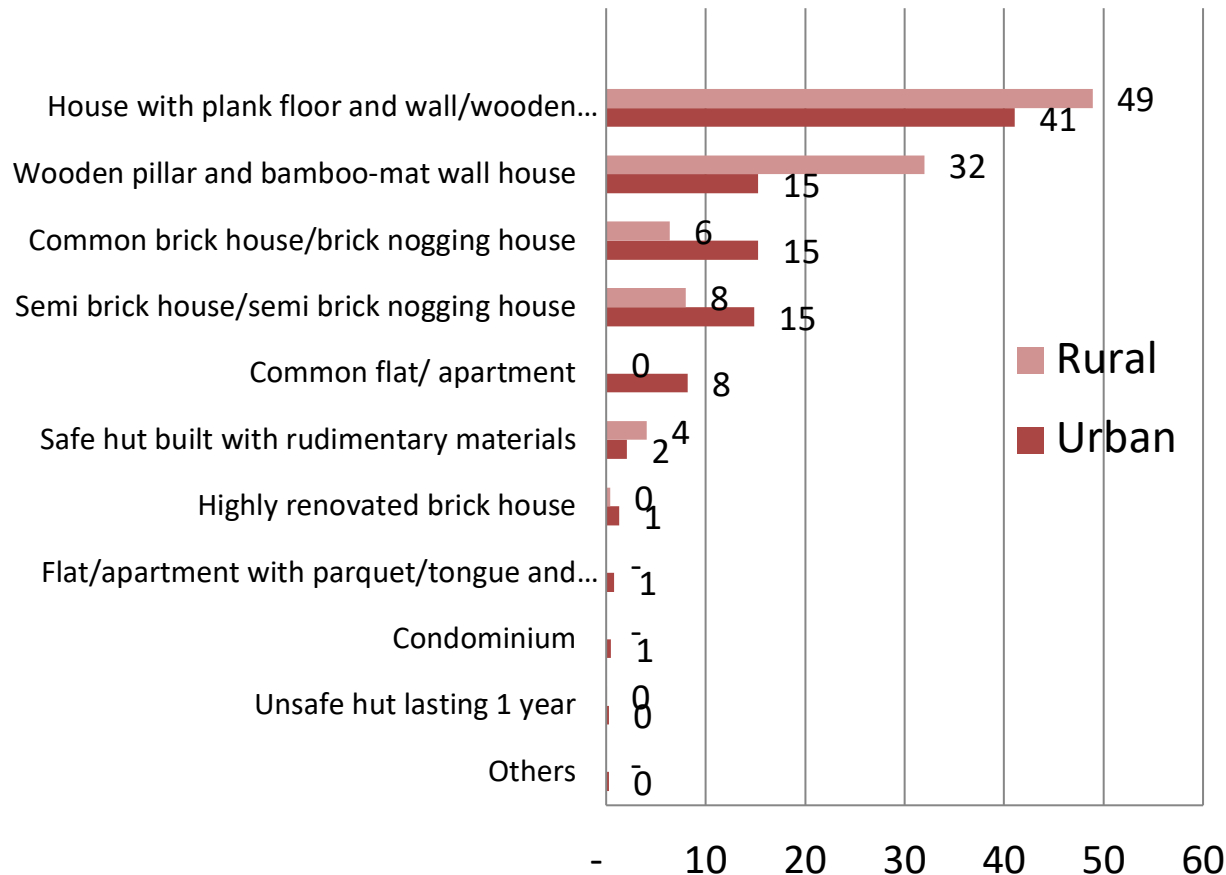
Union Census 2014 Population	%
Male	47
Female	53

# Sample Profile: Age Distribution in Myanmar



# Wooden houses widely prevalent across urban and rural areas

## Type of house (% of households)



Wooden house



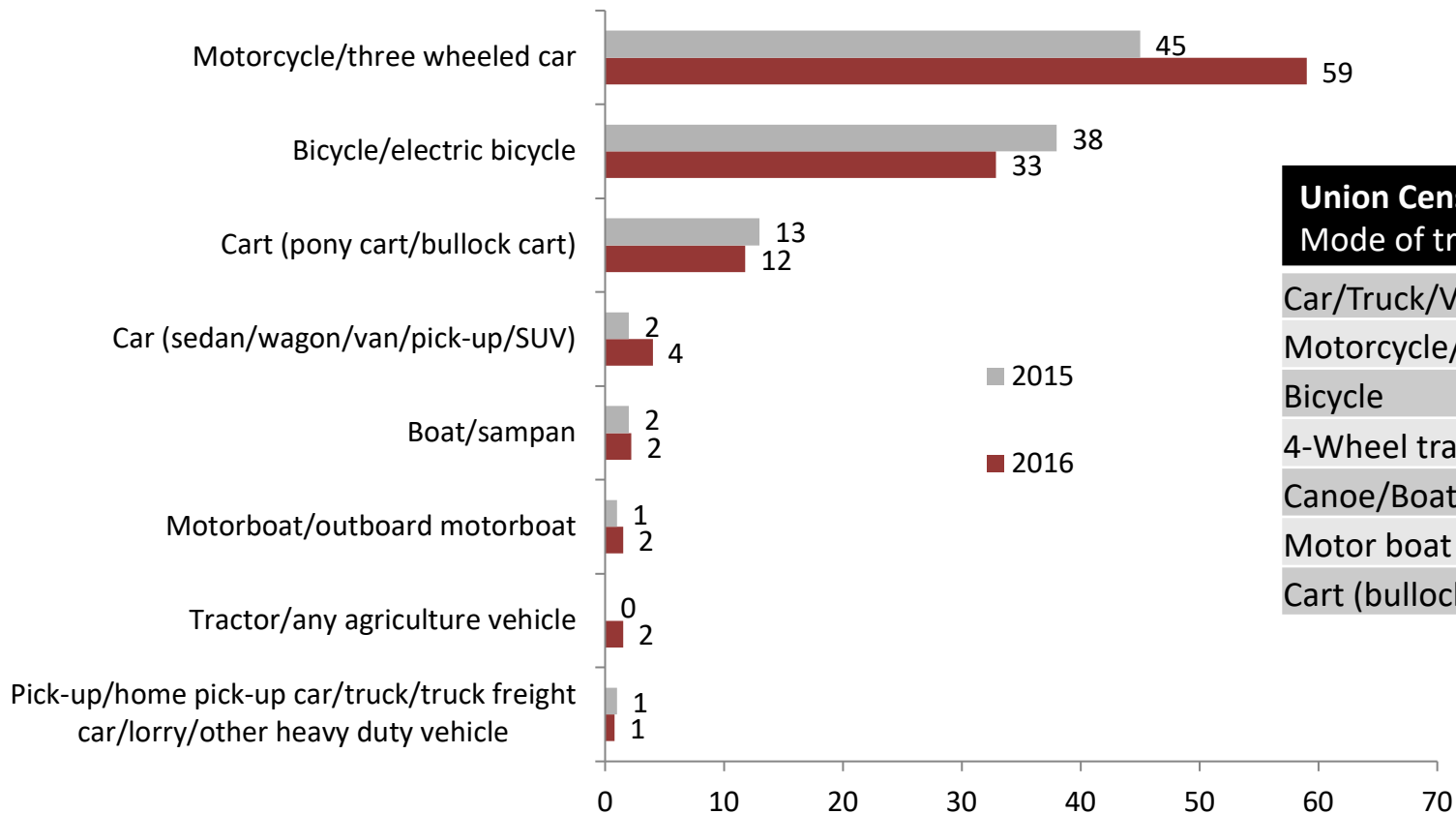
Bamboo house

Proportion of wooden houses have increased in both urban and rural areas, while the proportion of wooden pillar and bamboo mat wall houses have fallen.

Proportion of safe huts with rudimentary materials have halved in both areas.

# Motorcycles/three wheeled car are still dominant but car ownership doubled.

Ownership of modes of transportation (% of households)



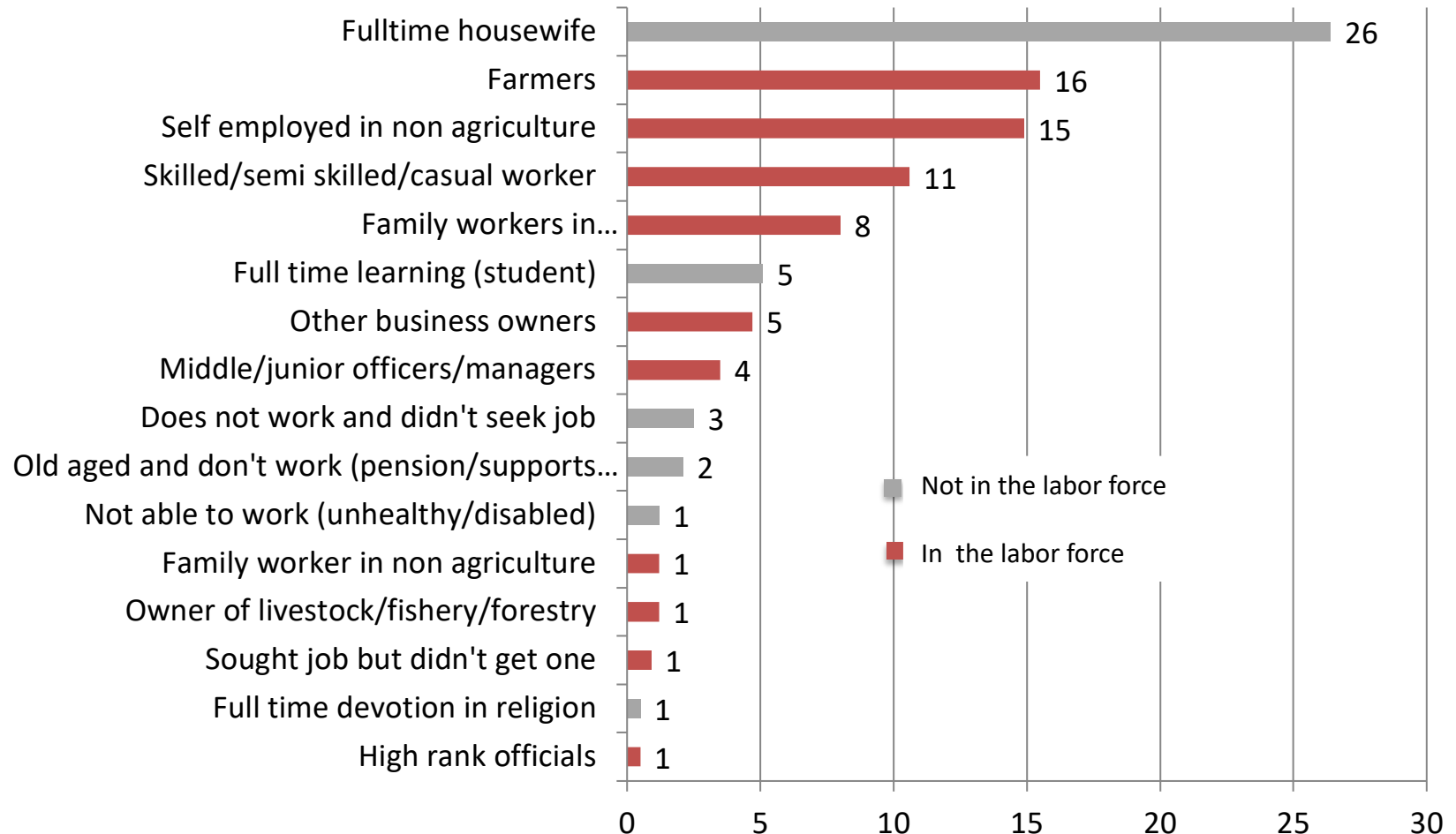
Union Census 2014	
Mode of transportation	%
Car/Truck/Van	3
Motorcycle/Moped	39
Bicycle	36
4-Wheel tractor	3
Canoe/Boat	4
Motor boat	2
Cart (bullock)	22

Q: Does your house own a working/functioning \_\_\_\_\_?

Base: all households surveyed

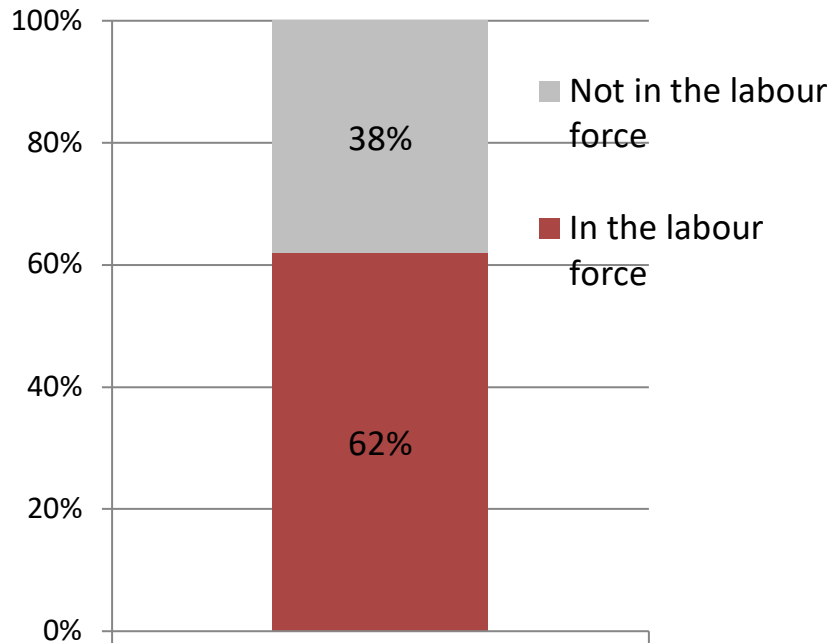
# 62% in the labor force; others not working in formal labor force or looking for employment

Main occupational group (% 15-65 population)

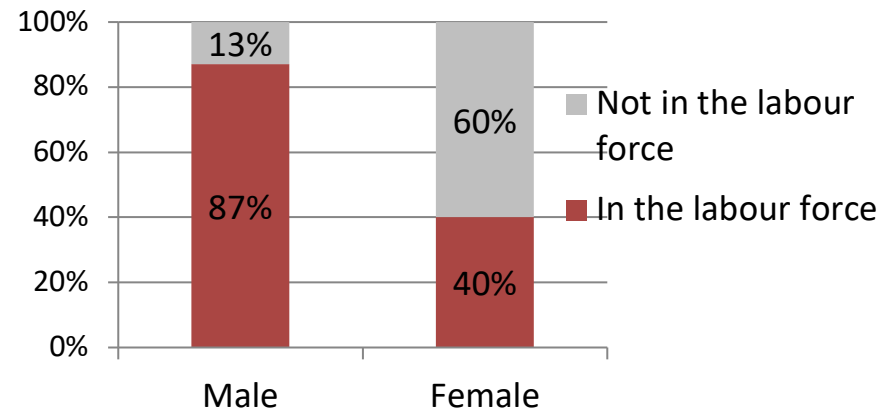
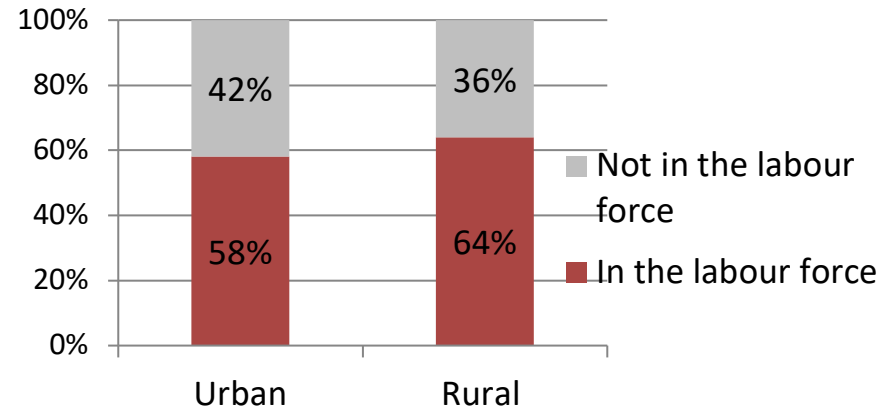


# Labor force participation significantly higher among men (compared to women)

## Labor force participation over the previous six months (% 15-65 population)



## Labor force participation over the previous six months (% 15-65 population)



Q: What is main activity of [name] during the last 6 months?



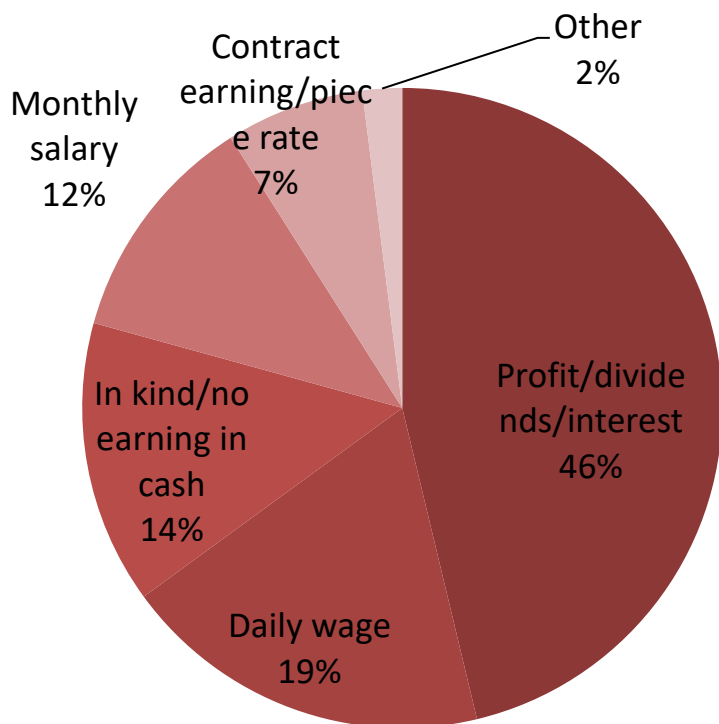
# Economic status: LIRNEasia surveys (2015, 2016) vs. Myanmar Govt. Census (2014)

Economic status in the previous six months		2015 LIRNEasia survey: % of 15-65 population	2016 LIRNEasia survey: % of 15-65 population	2014 Union Census: % of 15-64 population
In the labor force	Employed	59%	61%	64%
	Unemployed (Sought job, got no job)	3%	1%	3%
Not in the labor force	Fulltime housewife	25%	26%	21%
	Full-time student	7%	5%	5%
	Old aged and don't work	2%	2%	2%
	Not able to work (Unhealthy/ Disabled)	1%	1%	1%
	Did not work and didn't seek job	3%	3%	0%
	Not working for other reasons	1%	0.4%	4%
	<i>Total</i>	100%	100%	100%

- Census data 2 years outdated, but best publicly available
- Age bands differ by 1 year (65 vs. 64)
- Household surveys → higher proportion of housewives

# The majority of those working earn via profit/dividend/interest basis

Type of earning (% of those engaged in economic activity in the pervious six months)



- Profit dividend interest earned by
  - 85% of farmers
  - 80% of owners of livestock/fishery and forestry
  - 58% other business owners
  - 55% self employed in non-agriculture
- Daily wage earned by
  - 70% of skilled/semi-skilled & casual workers
- Monthly salary earned by
  - 80% of high rank officials (govt/pvt sector), law makers, professionals, technicians
  - 90% of middle/junior officers/managers (govt & private)
- In-kind/no earning cash reported by
  - 68% of family workers in agri/livestock/fishery/forestry
  - 72% of family workers in non agricultures

Q: How do you earn mainly? Is it by profit/ daily wages/ contract earning/ salary?

# Median household income MMK 200,000; Median household expenditure MMK 150,000

## Household income and expenditure (MMK)

	Income	Expenditure
Mean	267,620	178,669
Median	200,000	150,000

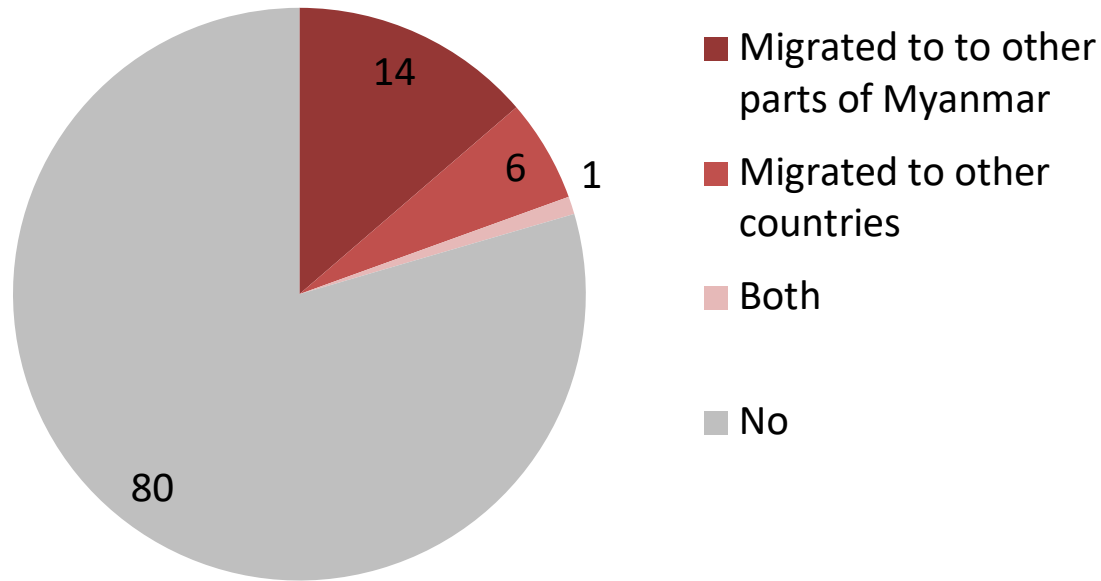
## Mean household income and expenditure (MMK): urban vs. rural

	Income	Expenditure
Myanmar total	265,620	178,669
Urban	352,941	235,002
Rural	228,017	152,511

In the past 12 months, what is your household's regular monthly income (in cash)/expenditure per month?

# 21% had a family members living in other parts of Myanmar or overseas

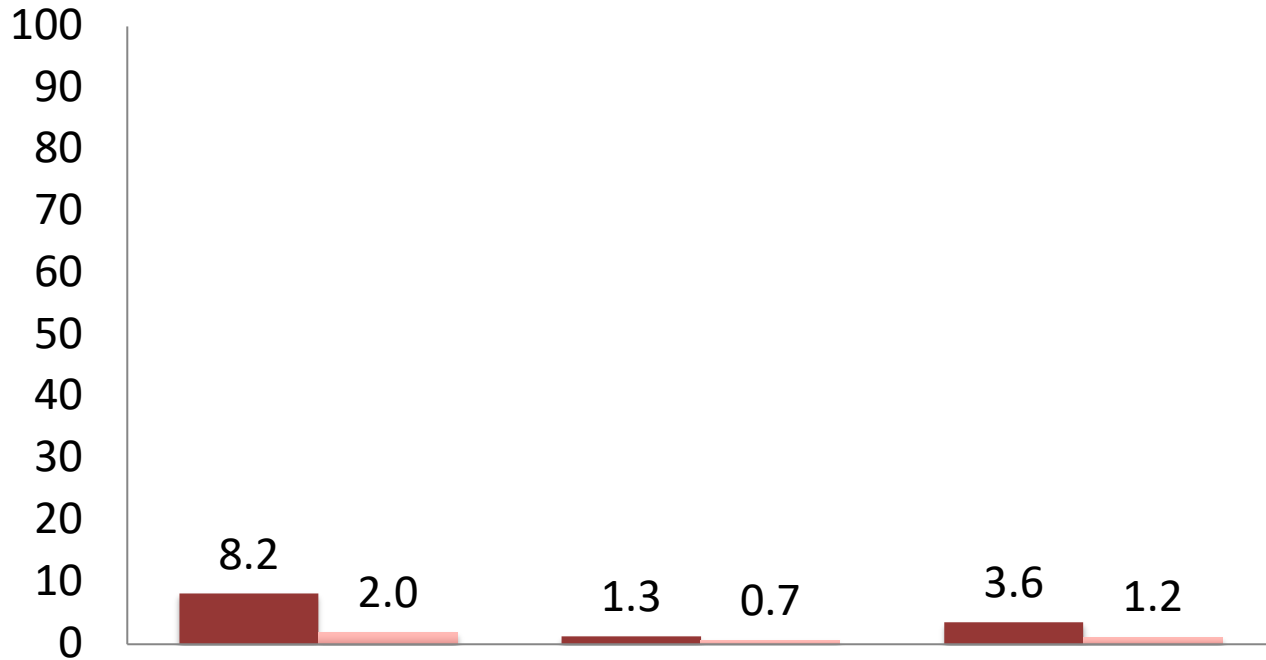
Households with migrant family members (% of Myanmar households)



Q: Are there any immediate family members who have migrated to either other parts of Myanmar (outside of this town or village) or migrated abroad?

# Only 3.6% of respondents had personal bank accounts; a third of those with bank accounts had debit/credit cards

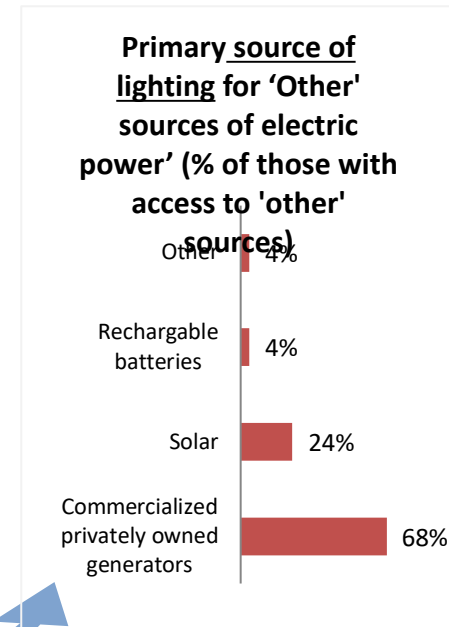
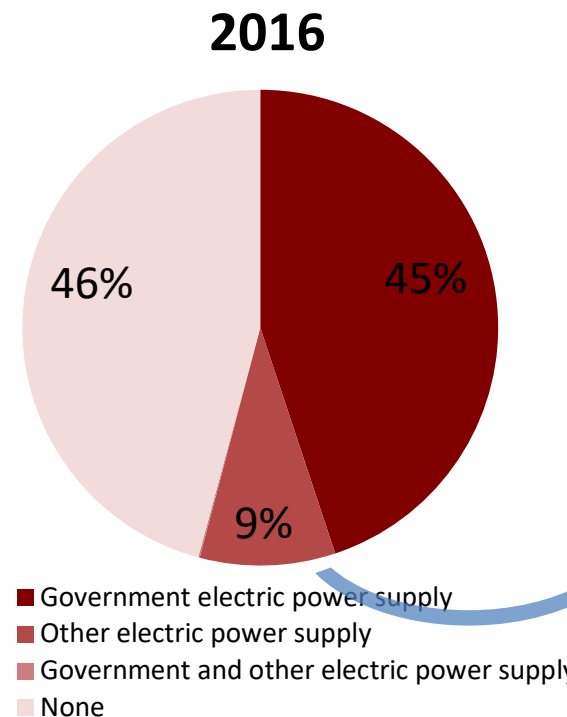
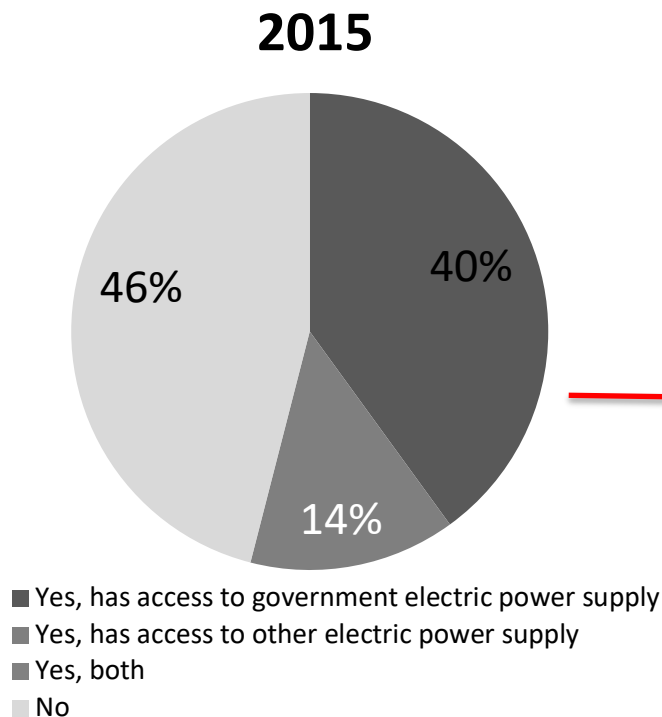
Population with their own bank account/s and debit/credit card/s  
(% 15-65 population)



	Urban	Rural	Total
% houses with bank account, 2015	6.5%	0.9%	2.5%

# 54% of households had some form of electricity

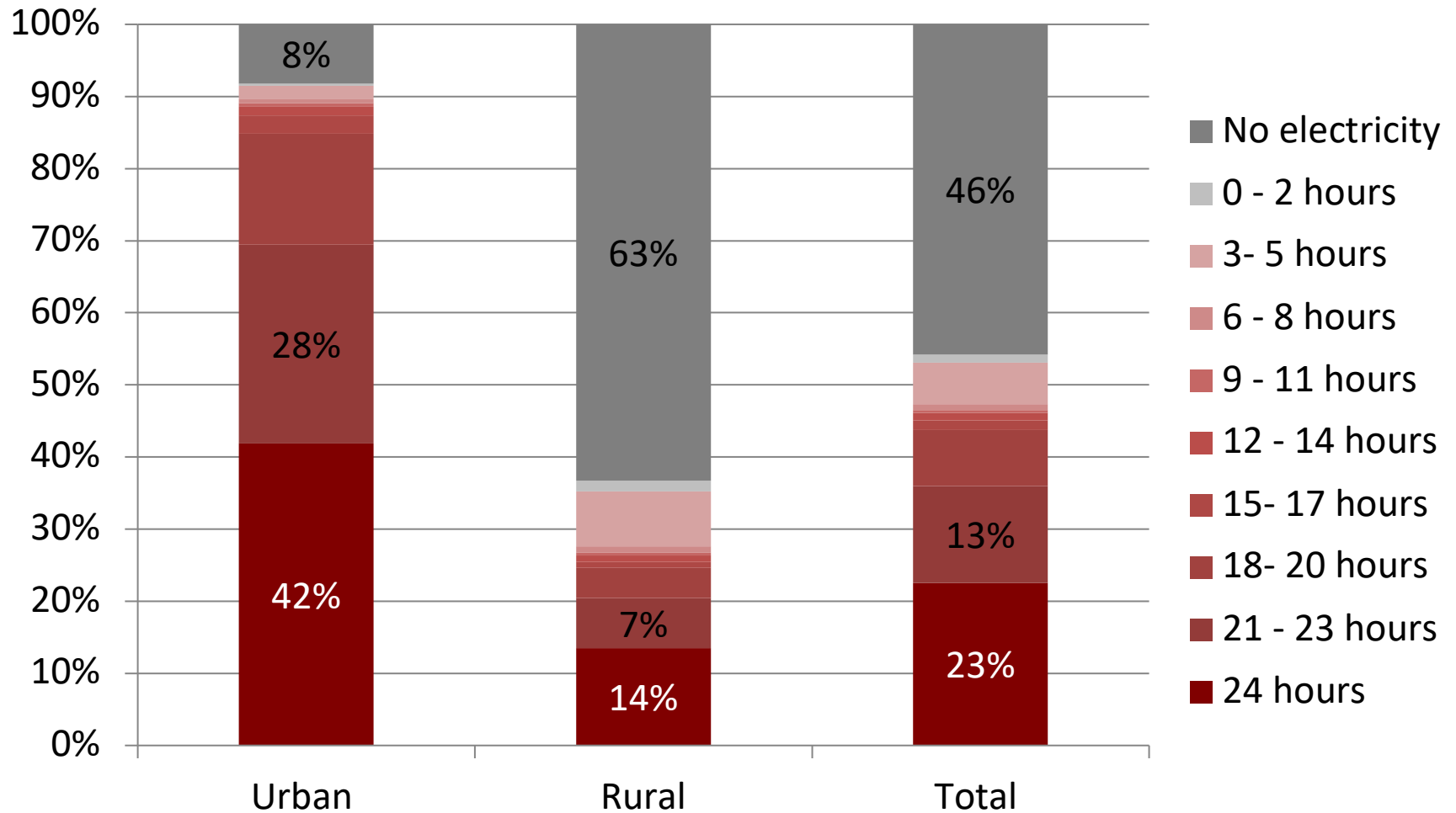
Access to electric power supply (% of households)



1. WB data for 2012 says that 52.4% of **population** have access to electricity (data source is not specified)
2. Myanmar Census refers “Main Source of Lighting” (where electricity is one of the options) therefore cannot compare with our data.

Q: Does your household have access to government electric power supply or other electric power supply?

# Among all households, only 23% of households had 24 hours of electricity on previous day



Q: How many hours did this household have electricity in the past 24 hours?

Base: Households with access to electricity