Monetary Policy and Household Income Distribution:
An Empirical Analysis from Cambodia
Online Appendix

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Contents

A   Data Appendix

In this section, I deliver additional tables of summary statistics for macro data and microdata used as monetary policy shocks, macroeconomic and financial aggregates, and household wealth through three monetary policy channels. First, I present macro data, and then I give detailed statistics on the level of households. Finally, I show the histogram of the distribution of household wealth across the country and the region.

A.1   Macro Data

This section offers the descriptive statistics of macroeconomic aggregates used as monetary policy shocks in section 5. There are five main variables: inflation, output, unemployment rate, interest rate, exchange rate, and broad money.

Table A1: Summary statistics for macroeconomic variables

	Obs.	Mean	S.D.	Min.	Max.	Unit	Source
Inflation	46	3.01	1.51	0.70	7.06	Percent	NIS
Output	46	4.83	1.39	2.78	7.45	Billion dollars	NIS
Unemployment rates	46	0.43	0.23	0.13	0.77	Percent	ILO
Interest rates	46	5.26	0.77	4.19	6.91	Weighted average rate	NBC
Exchange rates	46	4071.58	52.64	3985.60	4257.36	Khmer riels/US dollars	NBC
M2	46	15.66	9.84	4.13	36.29	Billion dollars	NBC

Note: This table displays the descriptive statistics of macroeconomic variables that using for the investigation of monetary policy shocks. The second column reports the number of observations, the third presents the mean, and the fourth column is standard deviation errors. Many variables are observed quarterly, and some variables, such as the unemployment rate and output, are recorded annually. I suppose the real input growth and the employment rate have the same proposition every quarter in a whole year, and then I multiply it with 4 to get the quarter data. The dataset comes from the National Institute of Statistics, the International Labor Organization, and the National Bank of Cambodia.

A.2   Summary Statistics of Micro Data

This part presents the descriptive statistics of household data from the 2014–2019/2020. I classified four main wealth channels: income, consumption, assets and liabilities. According to the questionnaire, I get the wealth data and household demographics as follow:

Income. Household income = wages + non agricultural income + crops income + other crops income + rice income + seed income + livestock income + fishery income + pond rent income + forestary income + land sold income + building rend income + other incomes.

Consumption. Household consumption expenditure = food and non food expenditure + durable goods expenditure = food consumption + housing consumption + dwelling repair spending + building spending + house rent consumption + livestock consumption + forestry consumption + illness consumption, taxes expenditure + durable goods + land buying + land rent spending + education expenditure.

Assets. Household assets = non agricultural investment + rice stock + livestock stock + crops investment + livestock investment + fishery investment + forestry investment.

Liabilities. Household liabilities = borrowing for agriculture activities + non agricultural activities + consumption needs + illness, injury, accident + emergency expenditure + rituals + dwelling improvement + durable goods + serving, existing debt + others.

The value of household wealth is calculated in the annual by using the annual exchange rate of each year between Khmer riels and US dollars. There are about 4,038 riels per $1 unit in 2014, 4,045 riels per $1 unit in 2017 and 4,052 riels per $1 in 2019. More wealth data are reported in monthly, therefore I multiply it with 12 to get the annually data.

Table A2: Descriptive statistics of the 2014 CSES

	Sample	Mean	P10	P25	Median	P75	P90
CSES 2014 (US dollars)							
Panel A: Demographics							
Age of head	12090	47.81	30.00	36.00	47.00	58.00	67.00
Gender of head	12090	0.77	0.00	1.00	1.00	1.00	1.00
Year of education	9536	6.77	3.00	4.00	6.00	9.00	12.00
Married status	12055	0.83	0.00	1.00	1.00	1.00	1.00
Number of household member	12091	4.46	2.00	3.00	4.00	5.00	7.00
Number of earner	12091	2.40	1.00	2.00	2.00	3.00	4.00
Annual hours of work	12090	6349.93	2340.00	3640.00	5824.00	8320.00	11336.00
Retired and children	12091	0.21	0.00	0.00	0.00	0.00	1.00
Unemployment	12091	0.14	0.00	0.00	0.00	0.00	1.00
Panel B: Household Income							
Wages	11974	1978.16	0.00	0.00	1367.01	3090.64	5170.88
Business income	11975	3466.84	0.00	0.00	0.00	1778.11	10523.77
Agricultural income	11974	1242.42	0.00	0.00	386.33	1511.27	3531.45
Other incomes	12014	518.13	0.00	0.00	17.34	148.59	920.01
Net income	11855	8367.77	1137.94	2262.26	4301.02	8499.26	17989.10
Panel C: Household Consumption							
Food consumption	11859	1874.27	759.78	1081.72	1596.83	2375.93	3379.10
Non food consumption	11854	1613.15	368.75	643.88	1115.65	2032.94	3429.79
Housing consumption	11867	270.92	100.74	132.84	196.14	320.95	537.89
Durable good consumption	11974	235.38	0.00	0.00	2.97	74.29	859.34
Other consumption	11974	427.40	30.83	121.59	247.15	474.99	986.26
Total consumption	11854	4592.93	1663.69	2374.69	3605.15	5735.71	8722.68
Panel D: Household Asset							
Maturing assets	11739	-512.53	-5188.61	-2495.29	-698.37	1037.64	3621.17
Nominal assets	11974	3326.48	0.00	93.73	952.76	3030.58	8327.51
Durable good assets	11854	1542.48	42.10	138.81	639.92	1686.48	3440.81
Home asset	12039	637.99	118.87	178.31	297.18	594.35	1485.88
Land asset	11983	3368.17	0.00	0.00	990.59	4061.42	9658.25
Building asset	11974	12379.22	495.29	1981.18	4952.95	11391.78	29717.68
Panel E: Household Liability							
Nominal liabilities	11981	340.31	0.00	0.00	0.00	198.12	1114.41
Panel F: Model Data							
URE	11644	-2171.64	-16442.20	-8174.37	-2531.88	2710.48	10109.58
Net nominal position	11867	2872.08	-150.96	0.98	675.38	2718.80	7542.03
Gross incomes	11854	8966.26	1159.48	2397.65	4583.21	9116.02	19406.14
APC	11739	0.85	0.45	0.74	1.00	1.00	1.00

Table A3: Descriptive statistics of the 2017 CSES

	Sample	Mean	P10	P25	Median	P75	P90
CSES 2017 (US dollars)							
Panel A: Demographics							
Age of head	3839	49.26	31.00	38.00	49.00	59.00	68.00
Gender of head	3839	0.77	0.00	1.00	1.00	1.00	1.00
Years of education	3269	6.79	3.00	4.00	6.00	9.00	12.00
Married status	3823	0.83	0.00	1.00	1.00	1.00	1.00
Number of household member	3839	4.42	2.00	3.00	4.00	5.00	7.00
Number of earner	3839	2.47	1.00	2.00	2.00	3.00	4.00
Annual hours of work	3839	6597.65	2496.00	4108.00	5928.00	8632.00	11492.00
Retired and chidren	3839	0.17	0.00	0.00	0.00	0.00	1.00
Unemployment	3839	0.13	0.00	0.00	0.00	0.00	1.00
Panel B: Household Income							
Wages	3801	2781.69	0.00	0.00	2135.97	4390.61	6882.57
Business income	3801	1092.55	0.00	0.00	0.00	197.78	2255.87
Agricultural income	3801	886.98	0.00	0.00	79.11	933.50	2667.00
Other incomes	3801	322.87	0.00	0.00	42.03	222.50	1023.49
Net income	3763	5707.73	786.16	2128.06	4096.42	7119.90	11753.40
Panel C: Household Consumption							
Food consumption	3763	2419.25	1022.00	1439.80	2095.43	3087.86	4255.13
Non food consumption	3763	1860.20	512.86	809.64	1353.94	2332.76	3639.06
Housing consumption	3774	318.67	100.87	148.33	226.95	385.66	661.56
Durable good consumption	3801	258.32	0.00	0.00	0.00	81.09	1072.93
Other consumption	3763	464.06	3.34	129.79	284.80	567.37	1116.19
Total consumption	3762	5626.88	2171.97	3039.75	4603.36	6945.19	9878.12
Panel D: Household Asset							
Maturing assets	3692	127.25	-4772.31	-2450.01	-418.10	1850.11	5410.14
Nominal assets	3801	1344.27	0.00	42.52	400.15	1708.58	3634.12
Durable good assets	3762	2097.39	86.53	327.56	1128.06	2315.20	4438.32
Home asset	3815	807.33	148.33	237.33	474.66	1038.32	1779.98
Land asset	3806	3291.89	0.00	0.00	0.00	3955.50	9888.75
Building asset	3804	15994.99	825.71	2966.63	7663.78	18603.21	44499.38
Panel E: Household Liability							
Nominal liabilities	3817	873.99	0.00	0.00	0.00	494.44	2966.63
Panel F: Model Data							
URE	3676	-1365.11	-17126.08	-8704.80	-2188.88	4341.53	14485.29
Net nominal position	3782	489.49	-1428.78	-0.39	155.47	1101.75	3012.81
Gross incomes	3764	6133.54	824.47	2235.91	4381.52	7675.90	12669.77
APC	3692	0.83	0.43	0.67	1.00	1.00	1.00

## Table A4: Descriptive statistics of the 2019–2020 CSES

	Sample	Mean	P10	P25	Median	P75	P90
CSES 2019–2020 (US dollars)							
Panel A: Demographics							
Age of head	10074	48.32	31.00	37.00	48.00	58.00	67.00
Gender of head	10074	0.80	0.00	1.00	1.00	1.00	1.00
Years of education	8256	6.45	3.00	4.00	6.00	9.00	12.00
Married status	10007	0.86	0.00	1.00	1.00	1.00	1.00
Number of household member	10075	4.42	2.00	3.00	4.00	5.00	7.00
Number of earner	10075	2.19	1.00	1.00	2.00	3.00	4.00
Annual hours of work	10075	6510.63	2496.00	4108.00	5824.00	8372.00	11336.00
Retired and chidren	10075	0.17	0.00	0.00	0.00	0.00	1.00
Unemployment	10075	0.08	0.00	0.00	0.00	0.00	0.00
Panel B: Household Income							
Wages	9976	3249.48	0.00	0.00	2398.82	5093.78	8292.20
Business income	9975	116.28	0.00	0.00	0.00	0.00	0.00
Agricultural income	9975	1323.12	0.00	0.00	309.23	1382.03	3911.65
Other incomes	9975	496.61	0.00	0.00	61.70	298.12	1480.75
Net income	9975	5857.12	407.21	1979.27	4338.60	7699.90	12438.30
Panel C: Household Consumption							
Food consumption	9875	2520.97	968.65	1448.86	2200.89	3210.86	4517.28
Non food consumption	9875	1817.65	449.18	717.20	1211.27	2227.38	3851.45
Housing consumption	9917	304.15	100.69	142.15	213.23	340.57	607.11
Durable good consumption	9975	470.16	0.00	0.00	7.40	199.90	1678.18
Other consumption	9876	660.45	57.26	171.40	375.12	760.61	1501.23
Total consumption	9875	6262.85	2167.39	3203.18	4856.66	7584.62	11586.79
Panel D: Household Asset							
Maturing assets	9786	-362.02	-6696.51	-3075.19	-397.18	2269.63	5827.52
Nominal assets	9975	1109.71	0.00	2.71	256.66	1357.60	3167.57
Durable good assets	9880	2951.64	148.08	520.85	1403.26	2892.09	6250.00
Home asset	9975	823.38	148.08	296.15	473.84	888.45	1776.90
Land asset	9975	9643.27	0.00	0.00	2961.50	9871.67	25666.34
Building asset	9981	17530.89	493.58	2961.50	7897.33	19743.34	41115.50
Panel E: Household Liability							
Nominal liabilities	10000	2074.17	0.00	0.00	0.00	1653.50	6416.58
Panel F: Model Data							
URE	9732	-4984.39	-28742.75	-12527.94	-2843.32	5317.91	15322.01
Net nominal position	9904	-944.90	-5318.34	-727.62	12.81	784.70	2512.73
Gross incomes	9975	6240.76	432.13	2058.24	4635.24	8242.65	13272.95
APC	9786	0.82	0.41	0.64	1.00	1.00	1.00

A.3 Micro Data

This section reports the histogram of household wealth through disposable income, consumption, assets and liabilities. In terms of household income, it is the sum of multiple income sources of a household member such as wage, business income, agricultural income, cash transfer from the government and NGOs, remittance, scholarships, bank interest rate, and sold durable assets (land, cars, motorcycle, house, and jewelry). At the same time, I sum all household expenditure as a part of consumption: foods, non-foods, housing expenditure, durable goods, education, health and sporting activities. Additionally, investment expenditure and actual value of durable assets counted as household assets. Latter, all household loans in difference proposed are a subset of household liabilities. I dropped low-wealth and high-wealth households 1% of three surveys to remove outliers.
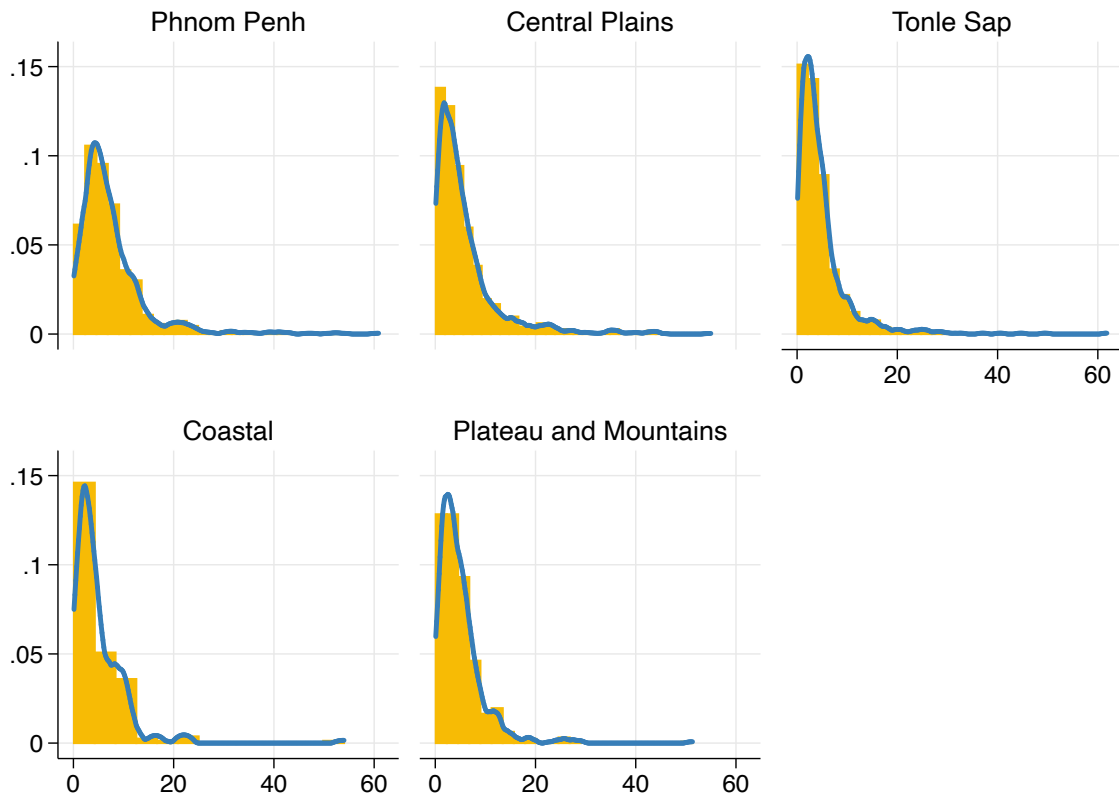
A.3.1 Disposable Household Income

Figure A1: Distribution of annual disposable household income by region in 2014
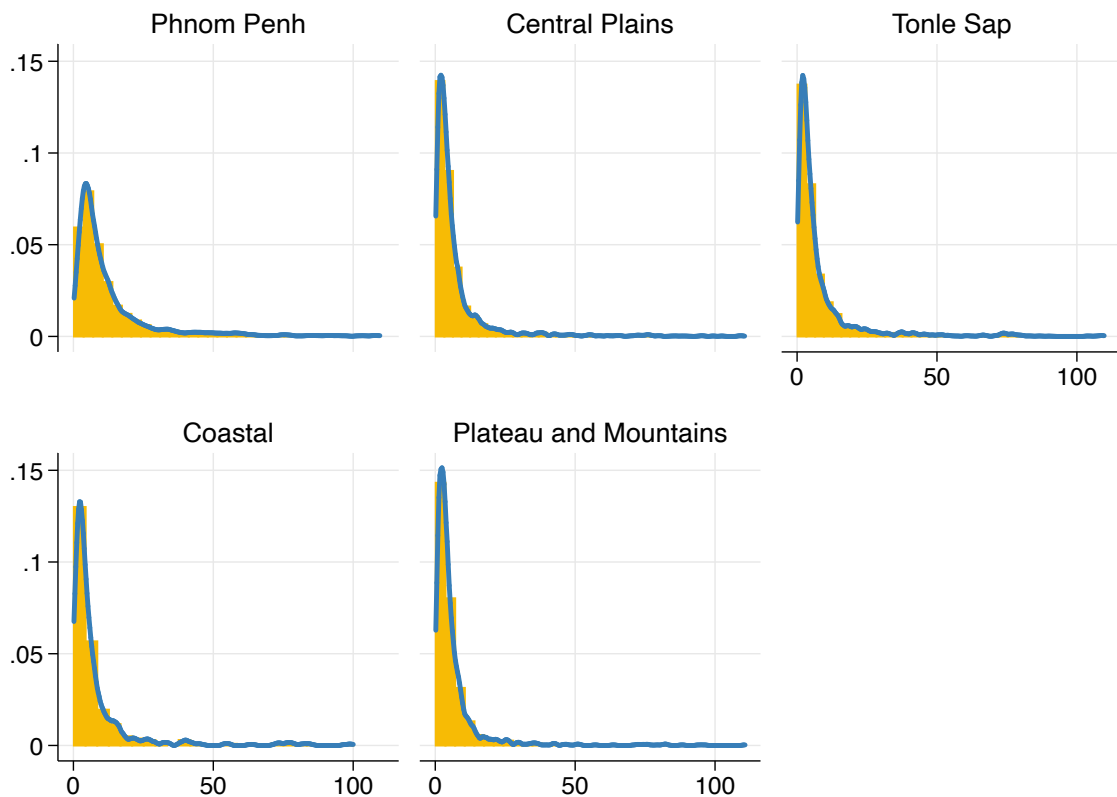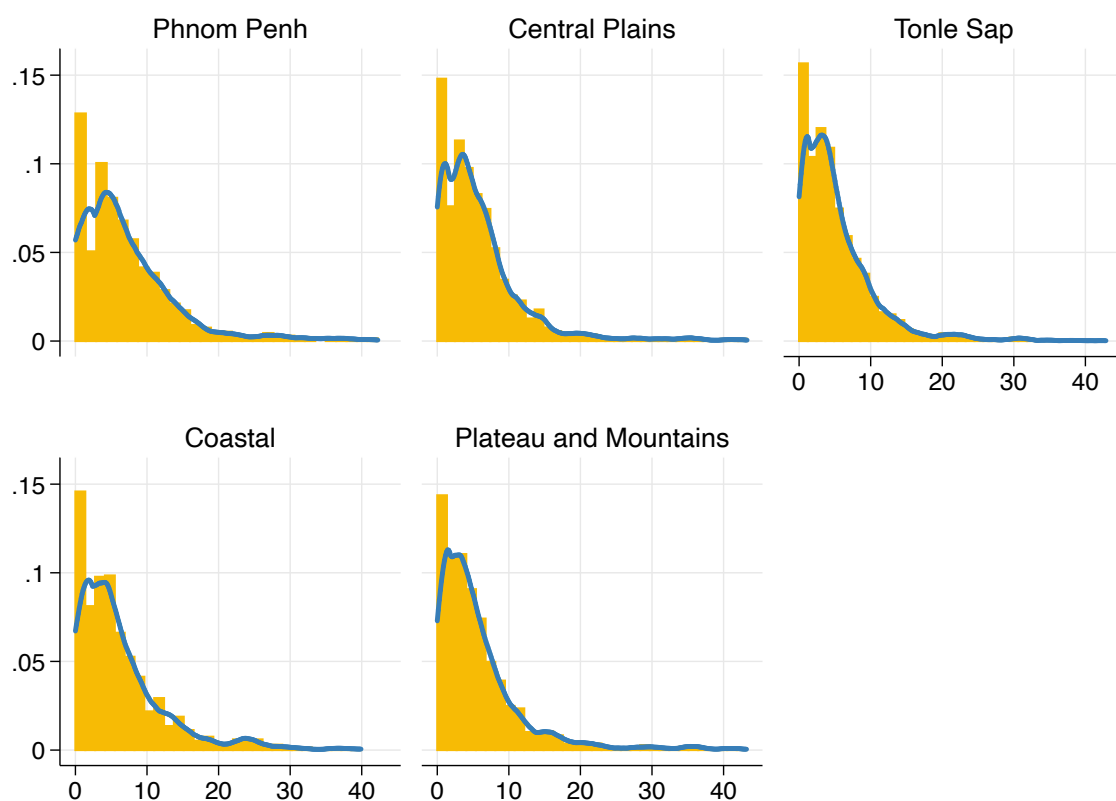

Note: The figure illustrates the histogram of Cambodia's annual disposable household income. All *x*-axis is the income share in US dollar in 1,000 and the *y*-axis is the income density. At the same time, low- and high-household income at 1% is removed from these graphs.

Figure A2: Distribution of annual disposable household income by region in 2017

Note: The figure displays the histogram of the distribution of the annual disposable household income in Cambodia. All *x*-axis is the income share in US dollar in 1,000 and the *y*-axis is the income density. At the same time, low- and high-household income at 1% is removed from these graphs.

Figure A3: Distribution of annual disposable household income by region in 2019-20

Note: The figure shows the histogram of the annual disposable income of Cambodian households. All *x*-axis is the share of income in US dollars in 1000 and the *y*-axis is the density of income. At the same time, low- and high-household income 1% is removed from these charts.
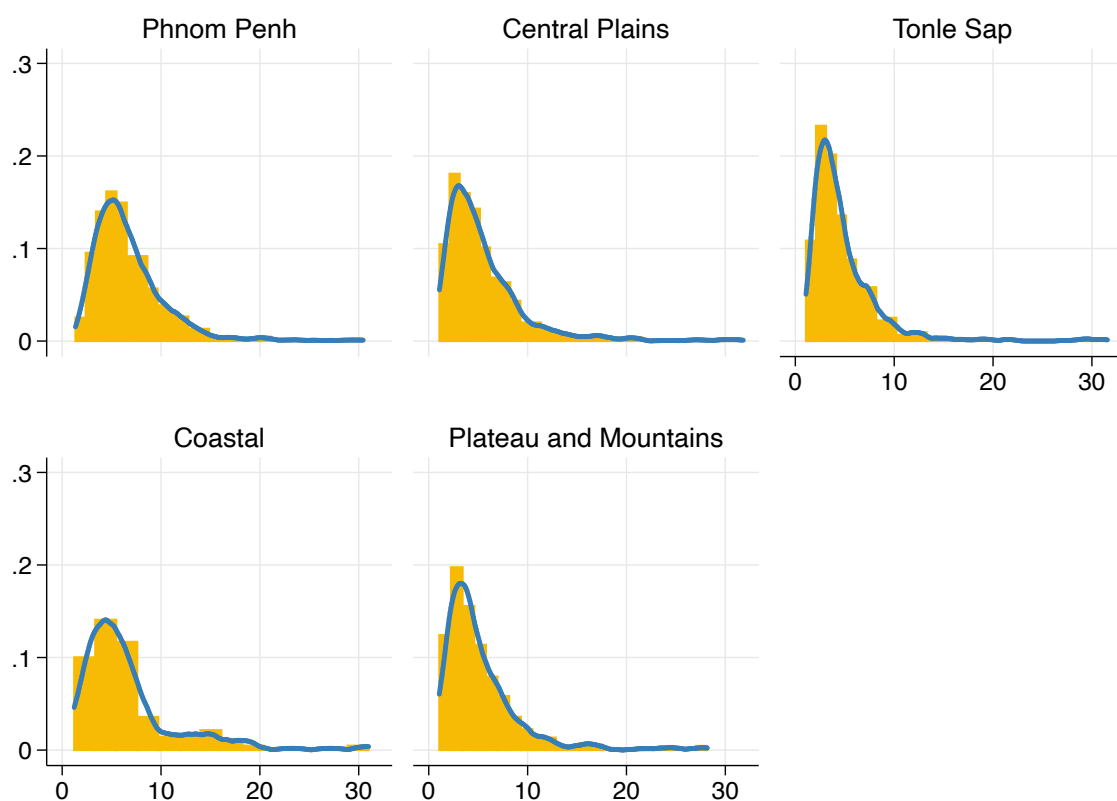
A.3.2 Household Consumption

Figure A4: Distribution of annual household consumption by region in 2014
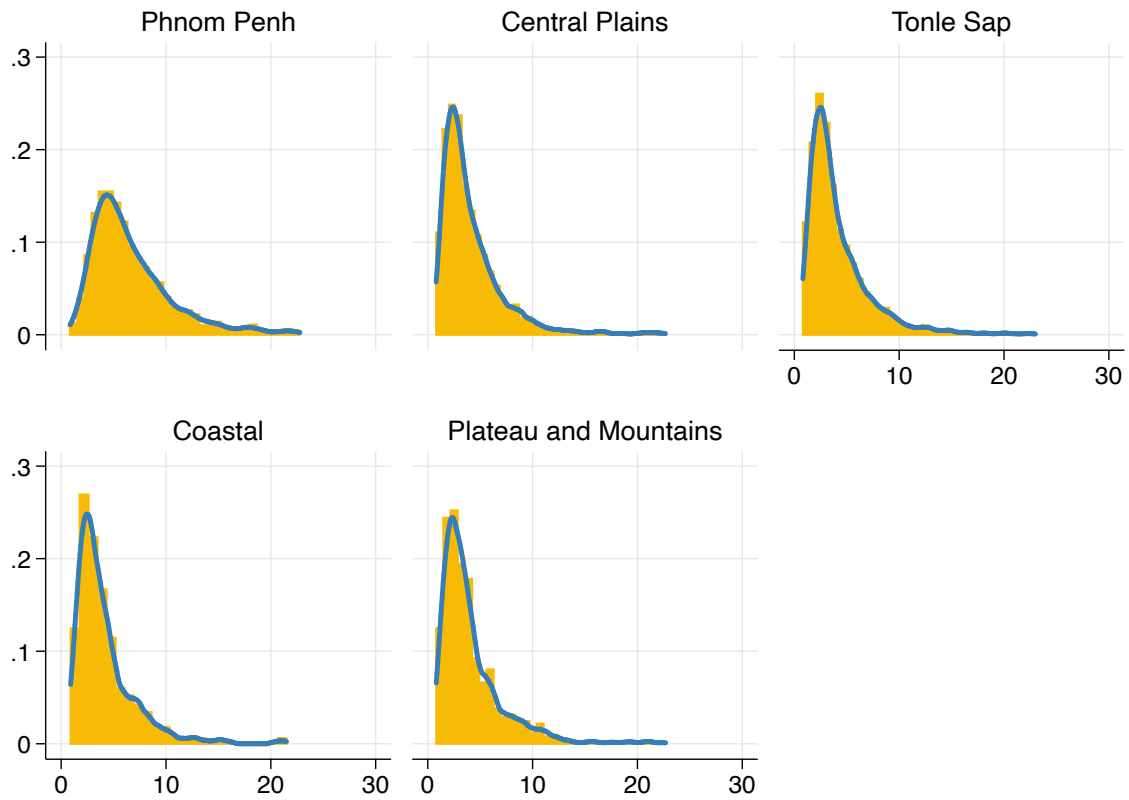
Note: The figure reports the histogram of the distribution of the annual Cambodian household consumption. All *x*-axis is the expenditure share in US dollars in 1,000 and the *y*-axis is the expenditure density. Simultaneously, low- and high-household income at 1% is removed from these graphs.

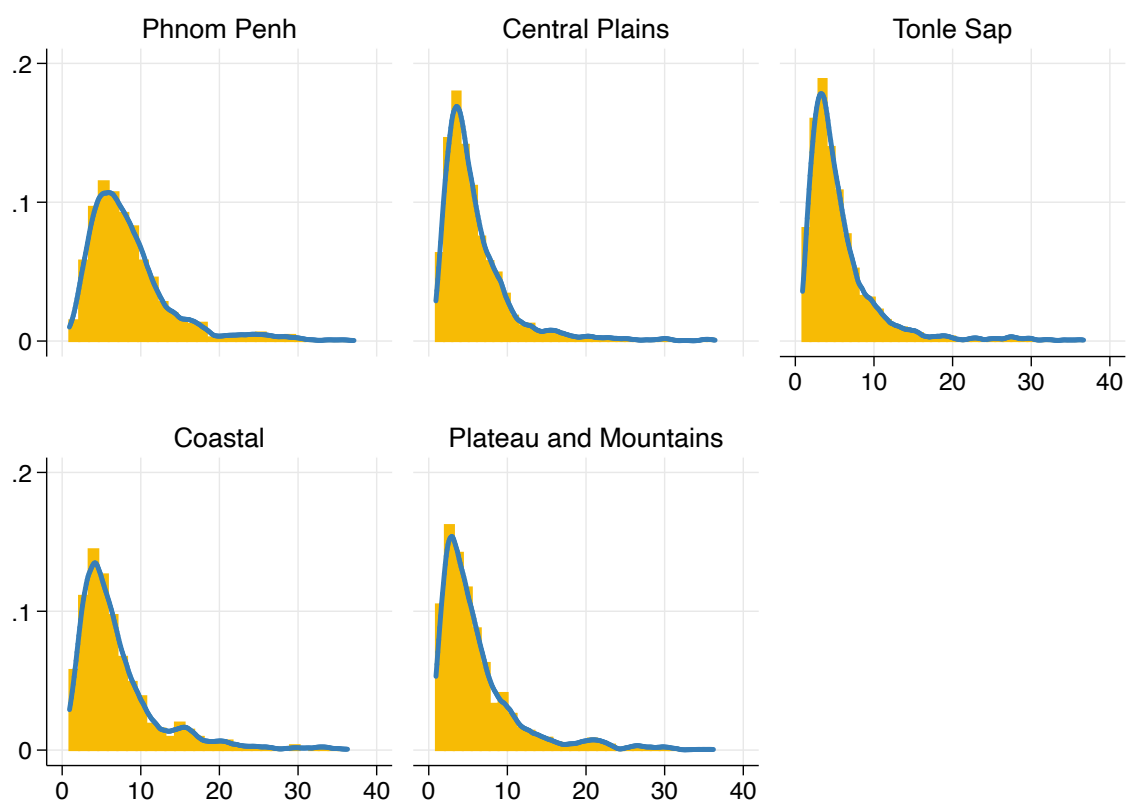Figure A5: Distribution of annual household consumption by region in 2017

Note: The figure reports the histogram of the distribution of the annual Cambodian household consumption. All *x*-axis is the expenditure share in US dollars in 1,000 and the *y*-axis is the expenditure density. Simultaneously, low- and high-household income at 1% is removed from these graphs.

Figure A6: Distribution of annual household consumption by region in 2019/2020

Note: The figure reports the histogram of the distribution of the annual Cambodian household consumption. All *x*-axis is the expenditure share in US dollars in 1,000 and the *y*-axis is the expenditure density. Simultaneously, low- and high-household income at 1% is removed from these graphs.
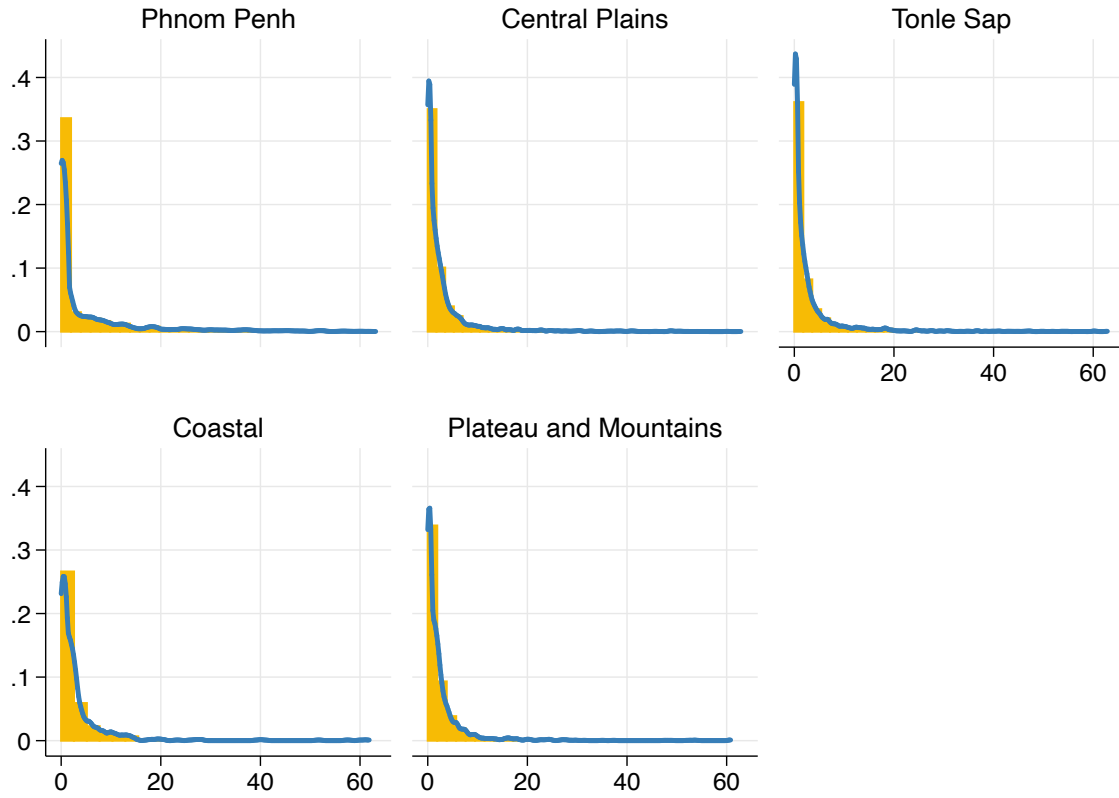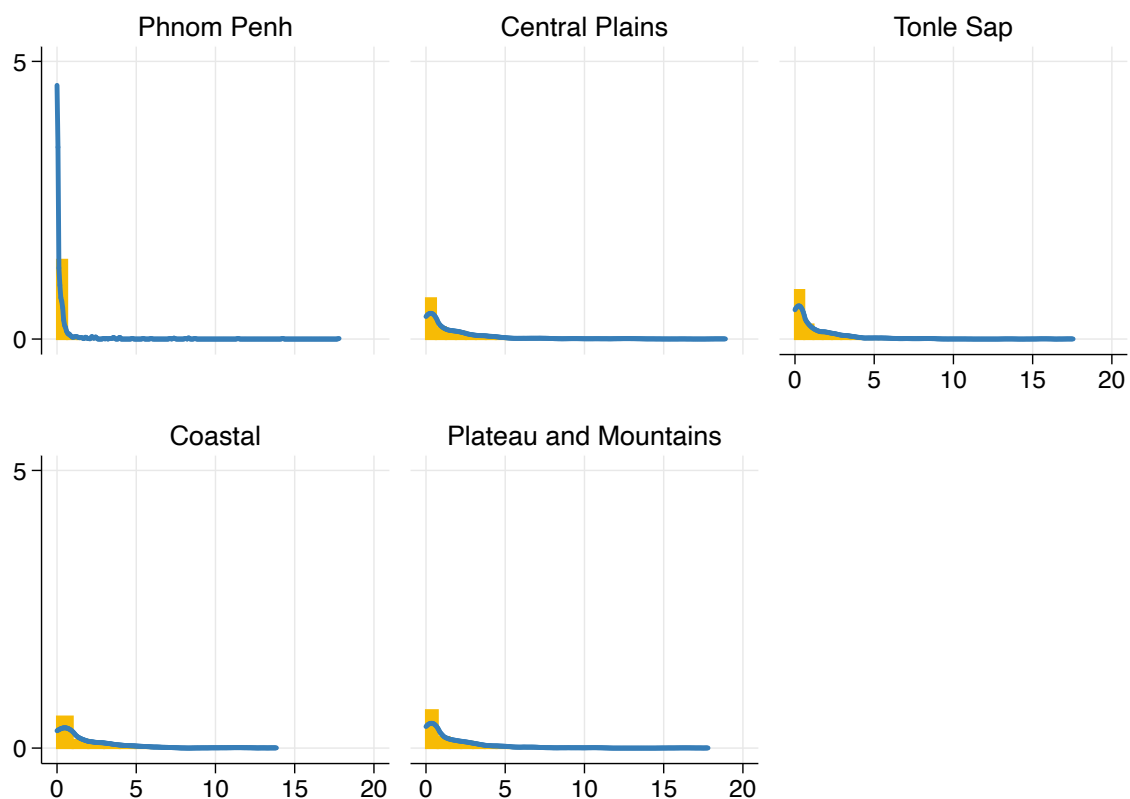
A.3.3 Household Assets

Figure A7: Distribution of annual household assets by region in 2014

Note: The figure reports the histogram of the distribution of annual household assets in Cambodia. All *x*-axis is the asset share in US dollars in 1,000 and the *y*-axis is the asset density. At the same time, low- and high-household income at 1% is removed from these graphs.

Figure A8: Distribution of annual household assets by region in 2017

Note: The figure reports the histogram of the distribution of annual household assets in Cambodia. All *x*-axis is the asset share in US dollars in 1,000 and the *y*-axis is the asset density. At the same time, low- and high-household income at 1% is removed from these graphs.

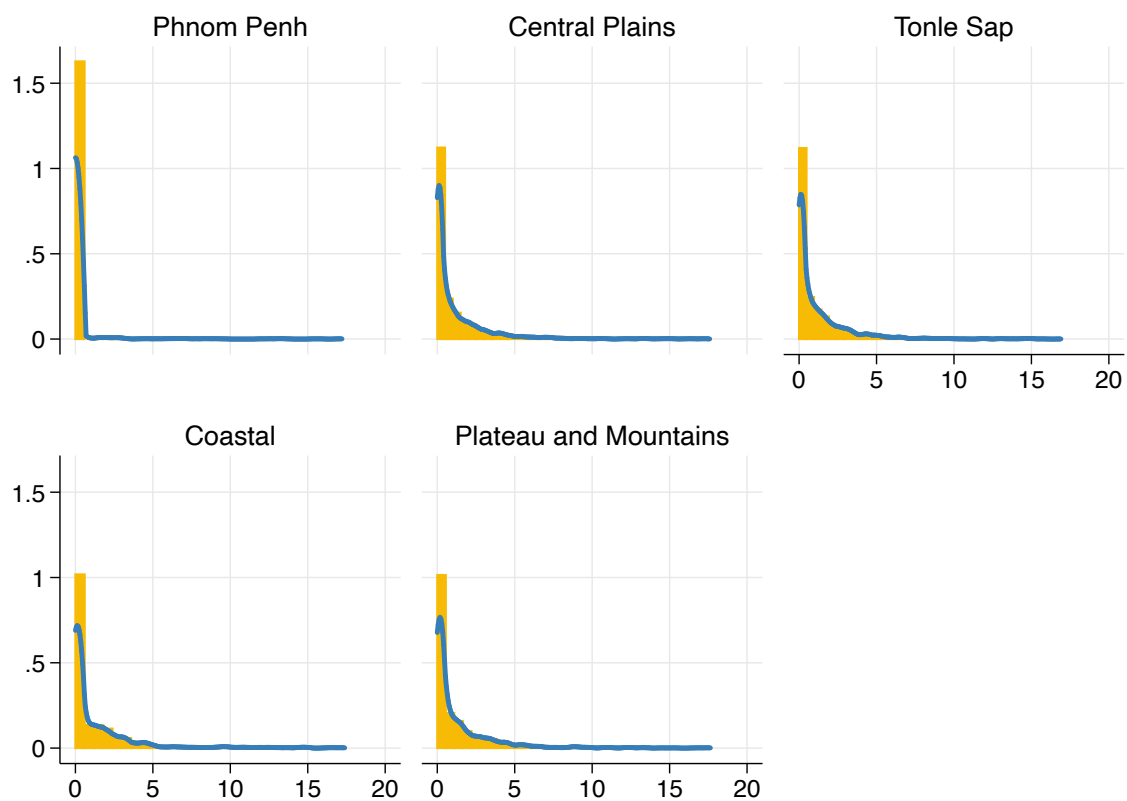Figure A9: Distribution of annual household assets by region in 2019/2020

Note: The figure reports the histogram of the distribution of annual household assets in Cambodia. All x-axis is the asset share in US dollars in 1,000 and the y-axis is the asset density. At the same time, low- and high-household income at 1% is removed from these graphs.

A.3.4   Household Liabilities

Figure A10: Distribution of annual household liabilities by region in 2014

Note: The figure shows the histogram of the distribution of annual household liabilities in Cambodia. All *x*-axis is the asset share in US dollars in 1,000 and the *y*-axis is the liability density. At the same time, low- and high-household income at 1% is removed from these graphs.

Figure A11: Distribution of annual household liabilities by region in 2017
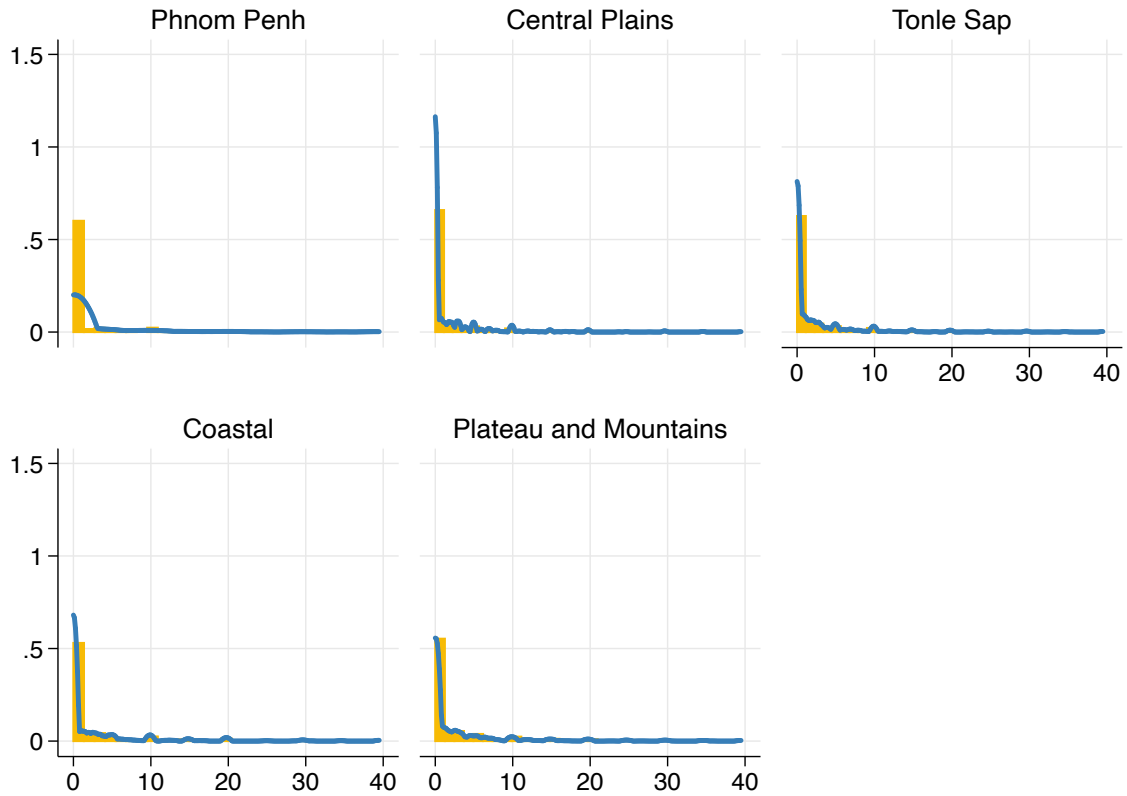
Note: The figure shows the histogram of the distribution of annual household liabilities in Cambodia. All *x*-axis is the asset share in US dollars in 1,000 and the *y*-axis is the liability density. At the same time, low- and high-household income at 1% is removed from these graphs.
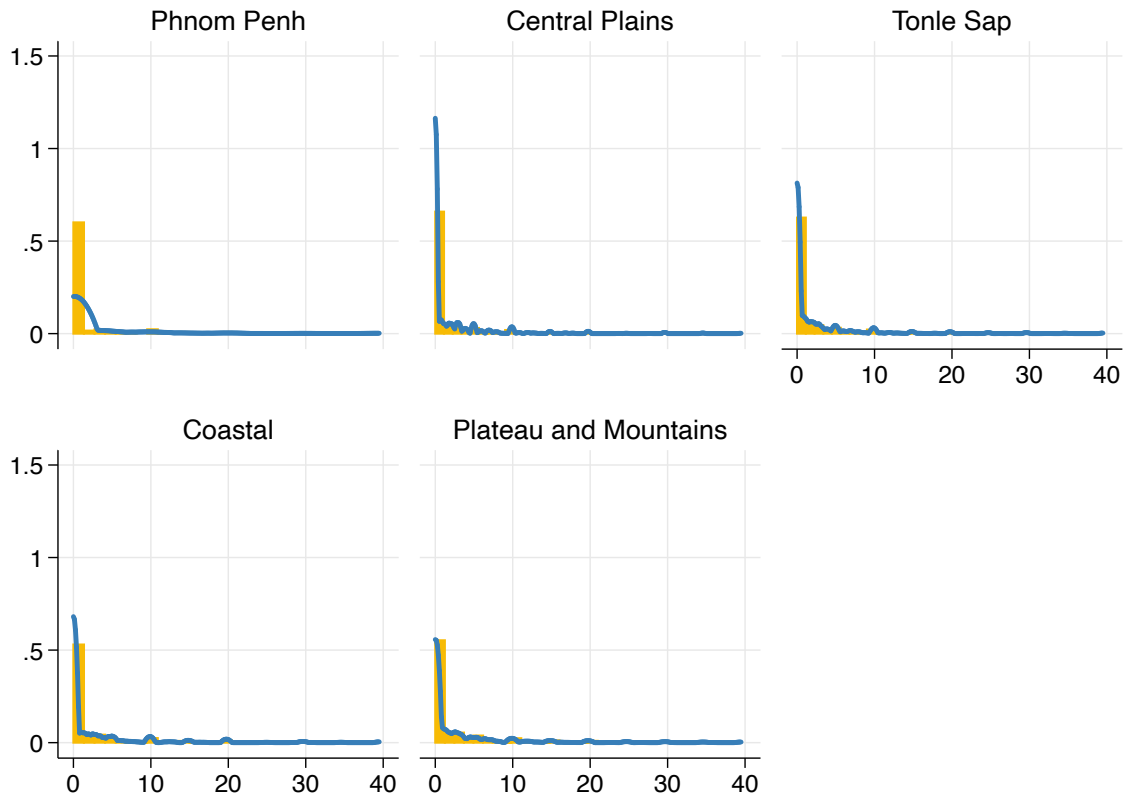
Figure A12: Distribution of annual household liabilities by region in 2019/2020

Note: The figure shows the histogram of the distribution of annual household liabilities in Cambodia. All *x*-axis is the asset share in US dollars in 1,000 and the *y*-axis is the liability density. At the same time, low- and high-household income at 1% is removed from these graphs.
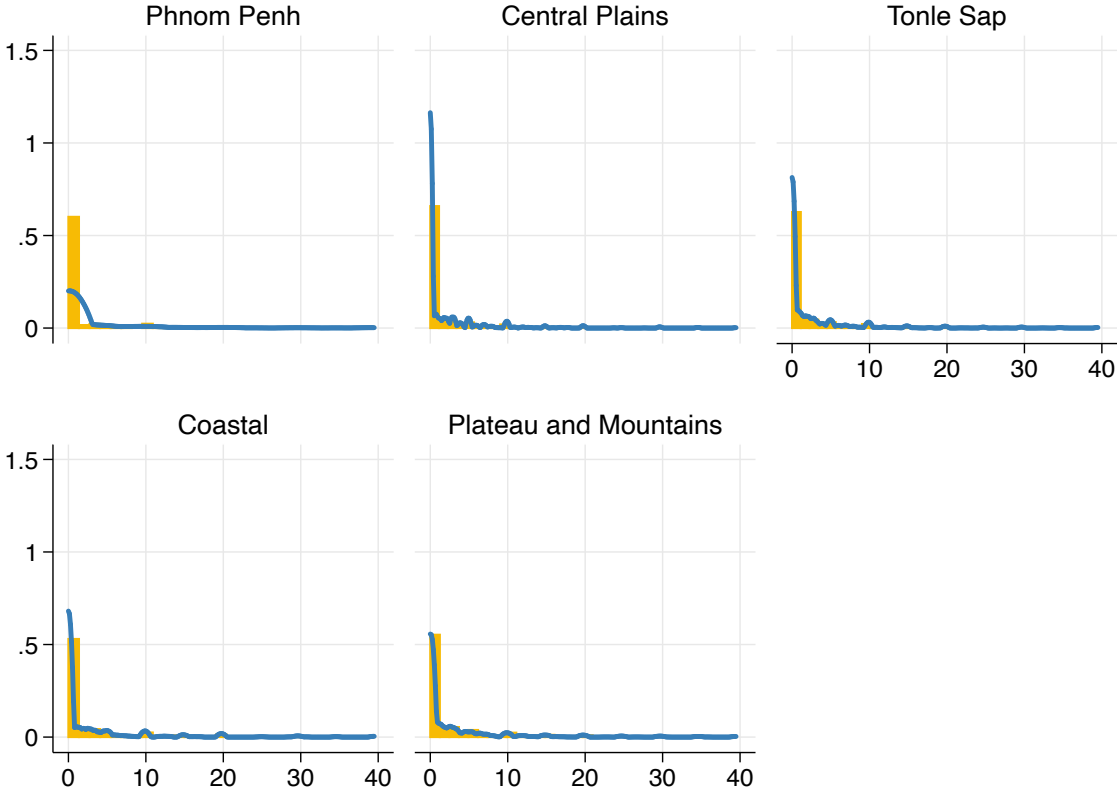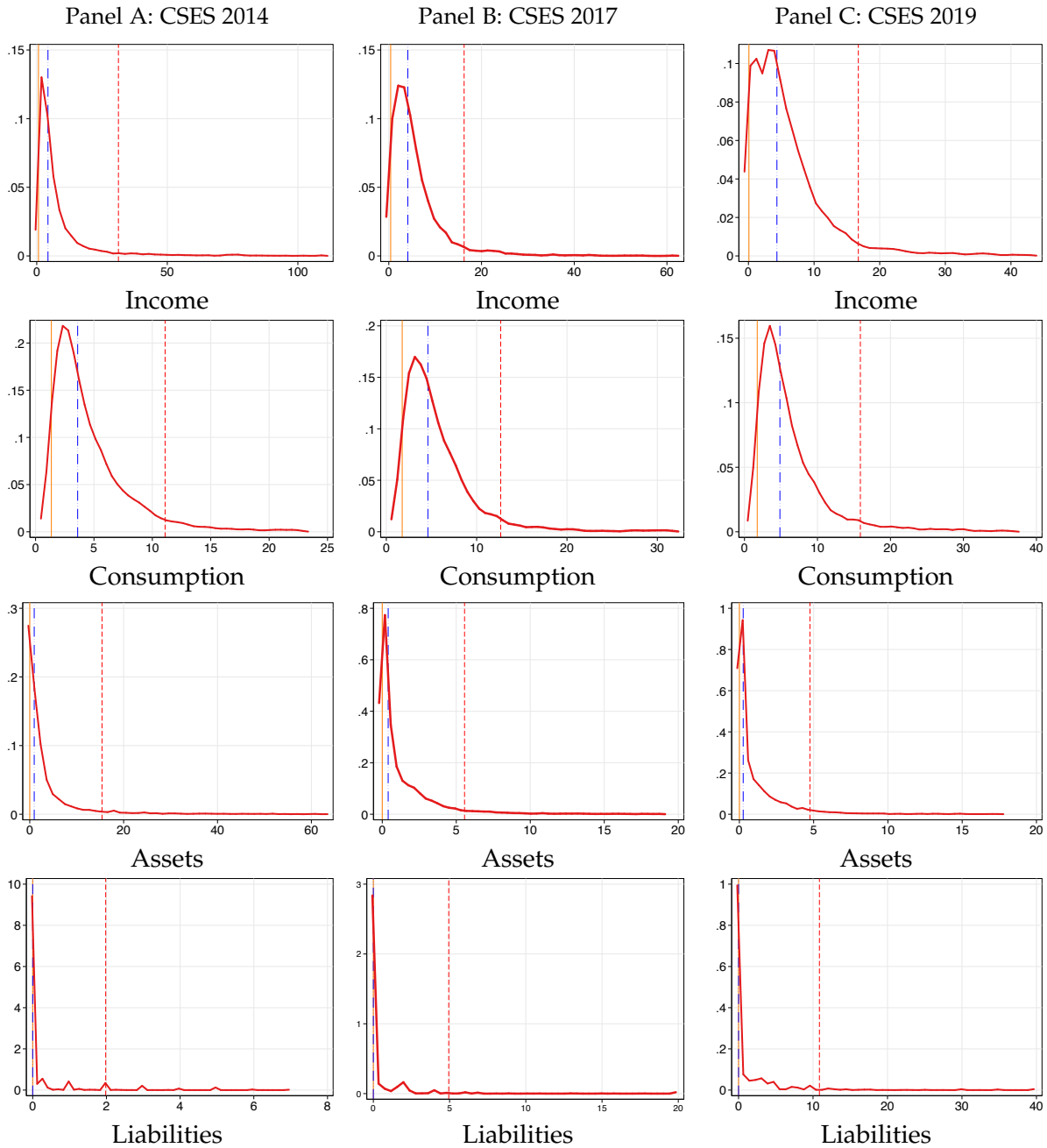
A.4 The Kernel Density of Household Wealth

Figure A13: The Kernel density of household income, consumption, assets and liabilities

Note: The figure illustrates the results of Kernel's estimates on household income, expenditures, assets and total liabilities. The first line is household income, the second line is household spending and the third line is the Kernel curve for household assets. The y-axis is the wealth density of Kernel and the x-axis is the wealth share in US dollars in 1,000. The long dash blue line represents the average household wealth across the country, such as income, consumption, assets and liabilities. The short dash orange line represents the distribution of wealth in the P5 quintile and the red dash line is the high wealth of households in the P95 quintile. It should be remembered that in these plots, I removed lower- and higher-wealth families 1%.

B   Charts, Tables and Additional Sensitivity Checks

This section starts out by providing more details about the data and the *APC* identification strategies for the CSES survey. First, starting with monetary policy shocks in the long run through 42 quarters (2010Q1–2021Q2) and forecasting errors variance decompositions. Next, I show the correlation of *APCs* and their exposures, and then I report the Gini coefficient and percentile radio of three household surveys. Finally, I provide additional graphs of household income and its structure by education, region, age, and loans.

B.1   Monetary Policy Shocks in the Long Run

Figure A14: The impulse response to long-term monetary policy shocks
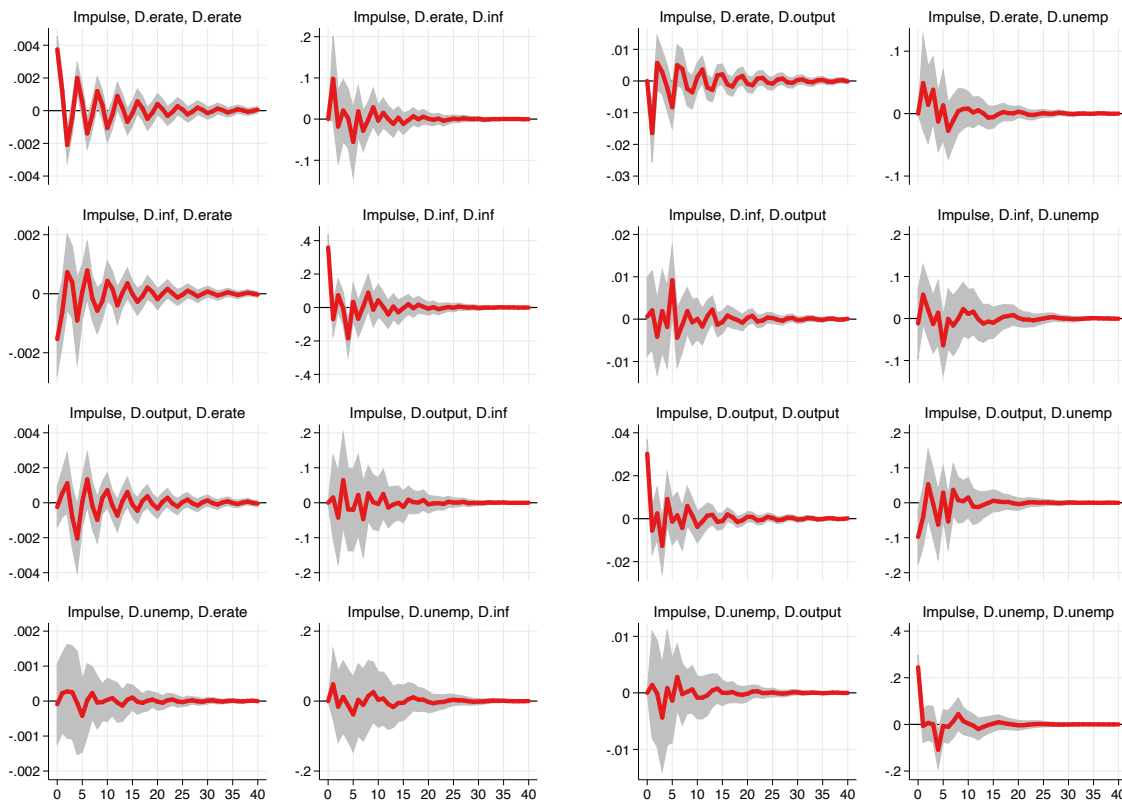
Note: This figure reports the impulse response of monetary policy shocks through the SVAR model on inflation, output, the exchange rate, and the unemployment rate over the horizon 1 to 42 quarters (a constant duration over the sample period 2010Q1–2021Q2) with four lags. All *y*-axis shows the percentage deviation from the pre-shock levels. The grey area shows 95% bootstrapped confidence intervals for each impulse response.

Figure A15: The impulse response to long-term monetary policy shocks
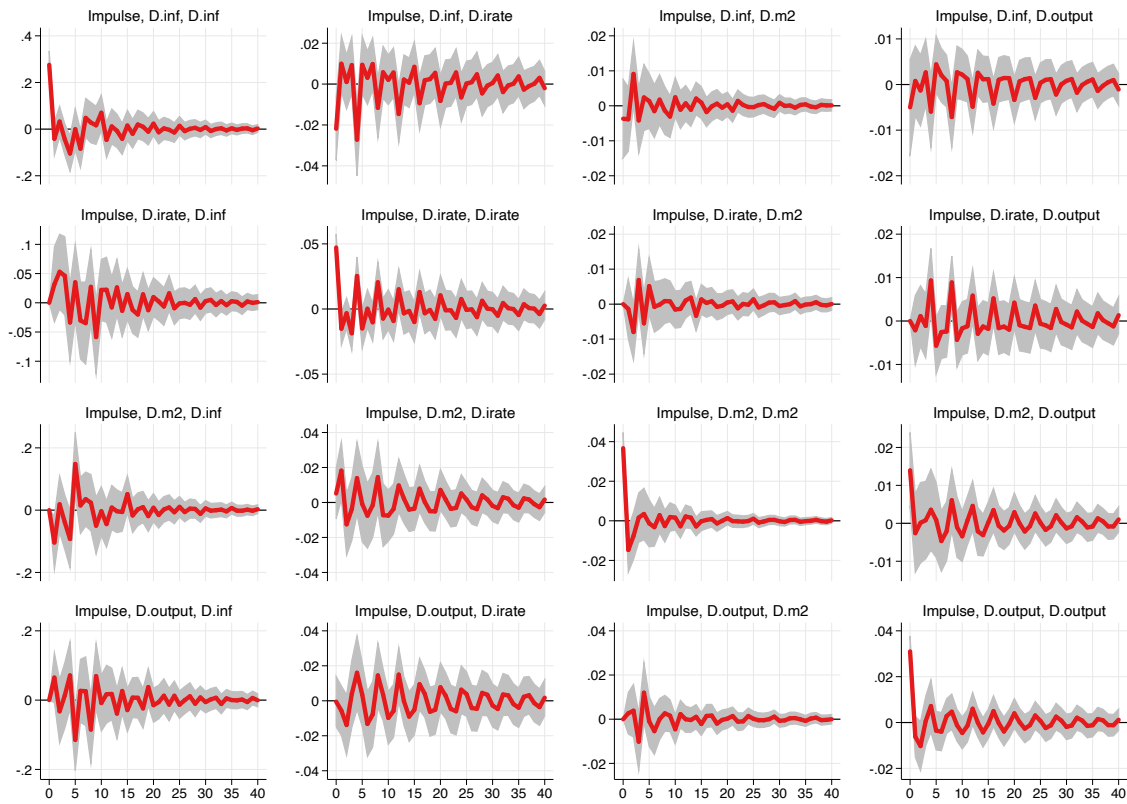
Note: This figure reports the impulse response of monetary policy shocks through the SVAR model on inflation, the interest rate, broad money and output over the horizon 1 to 42 quarters (a constant duration over the sample period 2010Q1–2021Q2) with four lags. All *y*-axis shows the percentage deviation from the pre-shock levels. The grey area shows 95% bootstrapped confidence intervals for each impulse response.

B.2   Forecasting Errors Variance Decompositions

Table A5: Forcasting errors variance decompositions from the SVAR model

Variable	Horizon	Inflation	Output	Exchage rate	Unemployment
Inflation	1	1.0000	0.0004	0.1435	0.0019
	2	0.9173	0.0038	0.1480	0.0435
	3	0.9059	0.0171	0.1324	0.0470
	4	0.8790	0.0173	0.1328	0.0482
	8	0.8622	0.0745	0.1233	0.0779
	12	0.8552	0.0745	0.1234	0.0833
	40	0.8513	0.0776	0.1224	0.0864
Output	1	0.0000	0.9996	0.0037	0.1364
	2	0.0016	0.7741	0.0186	0.1452
	3	0.0132	0.7451	0.0638	0.1736
	4	0.0390	0.7573	0.0872	0.1702
	8	0.0464	0.6742	0.2061	0.2105
	12	0.0498	0.6681	0.2183	0.2074
	40	0.0511	0.6555	0.2309	0.2069
Exchange rate	1	0.0000	0.0000	0.8523	0.0000
	2	0.0655	0.2205	0.8303	0.0309
	3	0.0644	0.2362	0.7983	0.0320
	4	0.0652	0.2110	0.7723	0.0492
	8	0.0700	0.2339	0.6597	0.0482
	12	0.0707	0.2397	0.6483	0.0479
	40	0.0709	0.2491	0.6369	0.0483
Unemployment	1	0.0000	0.0000	0.0005	0.8617
	2	0.0157	0.0016	0.0032	0.7804
	3	0.0165	0.0016	0.0054	0.7473
	4	0.0169	0.0144	0.0076	0.7324
	8	0.0214	0.0175	0.0109	0.6634
	12	0.0243	0.0176	0.0100	0.6614
	40	0.0268	0.0177	0.0099	0.6583

Note: This table reports the forecasting errors variance decomposition of the SVAR model through inflation, output, the exchange rate, and the unemployment rate over the horizon 1 to 40 quarters (a constant term over the 2010Q1–2021Q2 sample period) with 4 lags. Quantities in the table are percentages of the total factor variance. All entries are chi-square test statistics at dregress of freedom with an indicate significant at 1%, 5%, and 10% levels, parentheses are P-values.

Table A6: Forecasting errors variance decompositions from the SVAR model

Variable	Horizon	Inflation	Output	M2	Interest rate
Inflation	1	1.0000	0.0212	0.0100	0.174464
	2	0.8290	0.0208	0.0178	0.168138
	3	0.7955	0.0204	0.0613	0.152381
	4	0.7699	0.0255	0.0648	0.155954
	8	0.5572	0.0562	0.062701	0.231043
	12	0.5146	0.0817	0.068445	0.21545
	40	0.4930	0.1048	0.073112	0.218694
Output	1	0.0000	0.8135	0.0000	0.000091
	2	0.0450	0.8115	0.0045	0.009334
	3	0.0532	0.8245	0.0121	0.059227
	4	0.0520	0.8190	0.0632	0.05634
	8	0.1384	0.7151	0.132182	0.107807
	12	0.1767	0.6419	0.1429	0.131155
	40	0.1923	0.5781	0.1480	0.17266
M2	1	0.0000	0.1653	0.9900	0.009578
	2	0.1154	0.1640	0.9766	0.104275
	3	0.1128	0.1508	0.8906	0.135778
	4	0.1213	0.1502	0.8151	0.124358
	8	0.2468	0.1455	0.7298	0.113263
	12	0.2350	0.1518	0.7136	0.133484
	40	0.2348	0.1582	0.6958	0.138127
Interest rate	1	0.0000	0.0000	0.0000	0.815867
	2	0.0106	0.0037	0.0012	0.718252
	3	0.0385	0.0043	0.0361	0.652615
	4	0.0567	0.0053	0.0569	0.663348
	8	0.0576	0.0832	0.0753	0.547887
	12	0.0737	0.1246	0.0751	0.519912
	40	0.0798	0.1589	0.0831	0.470519

Note: This table reports the forecasting errors variance decomposition of the SVAR model through inflation, output, the broad money, and the interest rate over the horizon 1 to 40 quarters (a constant term over the 2010Q1–2021Q2 sample period) with 4 lags. Quantities in the table are percentages of the total factor variance. All entries are chi-square test statistics at dregress of freedom with an indicate significant at 1%, 5%, and 10% levels, parentheses are P-values.

B.3 Correlates of APCs and Exposures

This section is the supplementation of the correlation of APCs and their exposures that are presented in section 5.3. In other words, its perspectives on the empirical dives of my main error measurements through the monetary policy channels analysis.

B.3.1 The Role of the Head of Household Age

This section examines the distribution of exposures and APC by the head of household in each survey. I divide the population into eight equally-sized age bins. The approach allows me to assess life-cycle dynamics and helps to visualize clearly the relative strengths and weaknesses of the CSES survey.

Exposure Measures. Figure A16 presents the median value of URE, NNP and gross income in each age bin normalized by average consumption in the three surveys. Average URE (the orange line in the first row of graphs) is increasing in age across all three surveys, with a pattern of decline after retirement in the 2014 CSES data. In terms of magnitudes, average URE is always positive in the 2014 CSES data, while in the 2017 and 2019/2020 CSES survey average URE are negative for most working-age households, especially the head of household with age between 37 to 57.
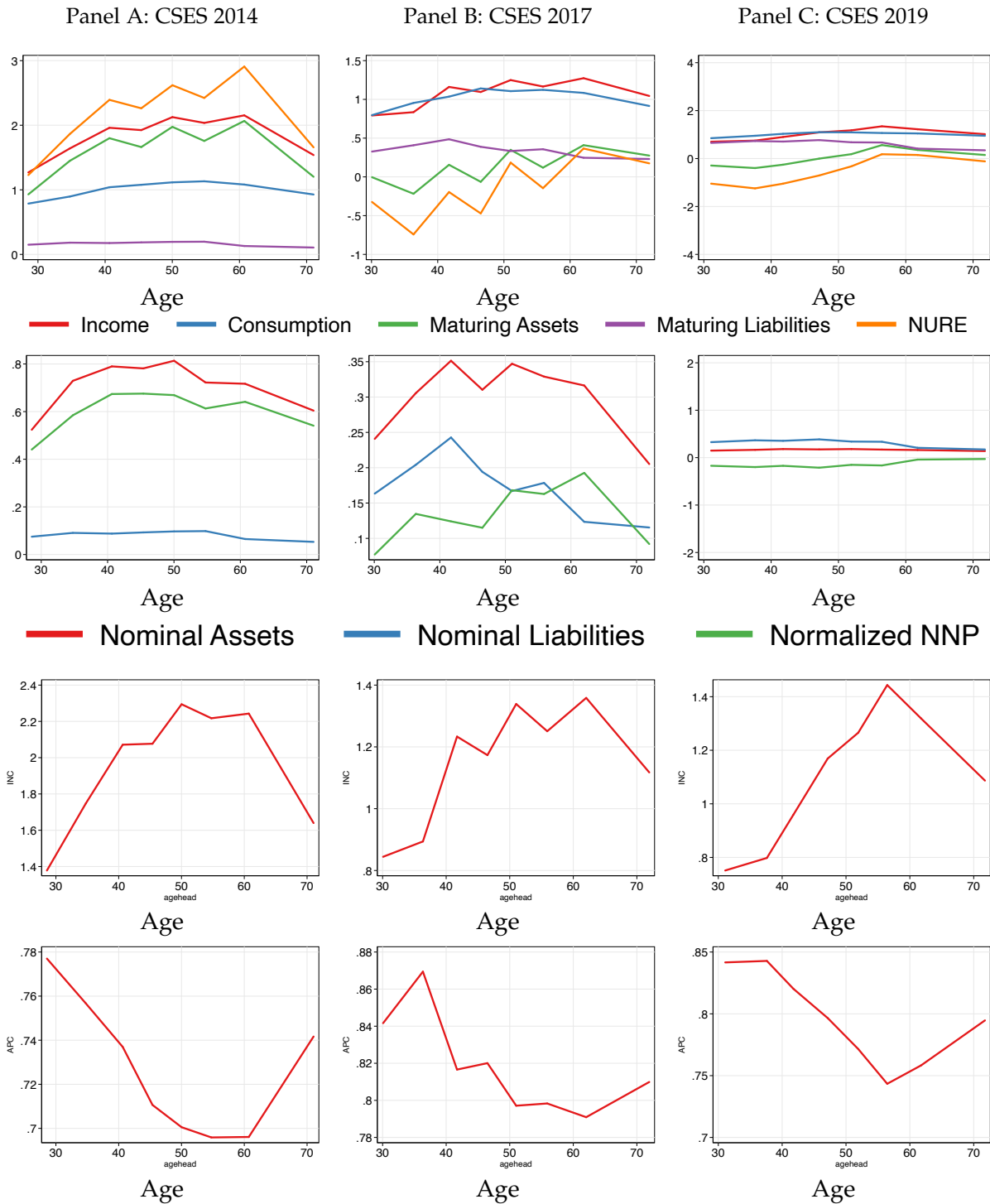
Regrading net nominal positions that show in the second row of graphs report the life-cycle pattern in 2019/2020 is positive increasing in age. By contrast, the 2014 and 2017 datasets report NNP unstable and negative with a minimum around age 45. In particular, in the 2017 CSES data, nominal liabilities are rising in age for young households and then start to decline steadily after age 42, while nominal assets are also declining for households age above 42.

APC. As shown in Figure A16, the fourth row reports the head of household age bins and average propensities to consume in all three surveys. Overall, there is a declining APC in the old household for all three datasets. Interestingly, all three surveys suggest a rise APC around middle age. The results appear that age is indeed a driver of the negative between APC and exposure measures.

B.3.2 The Role of Household Income

Figure A17 examines the distribution of URE and NNP (y-axis) in all three datasets when the population is grouped into eight income bins. Median URE is increasing in income, especially in the 2017 and 2019/2020 data. The increase of URE is seen too much for households with the top income. At the same time, net nominal position patterns are the same tendency in the 2017 and 2019/2020 data. Households tend to raise nominal assets and nominal liabilities.

Figure A16: Exposure measures by the head of household age bins in all three survey

| Panel A: CSES 2014 | Panel B: CSES 2017 | Panel C: CSES 2019 |

Legend (row 1): Income, Consumption, Maturing Assets, Maturing Liabilities, NURE

Legend (row 2): Nominal Assets, Nominal Liabilities, Normalized NNP

Note: The figure plots all three exposure measures and estimated *APCs* by age in all three surveys. Households are grouped by 8 equally-sized bins. The *x*-axis reports the average age in each group and the *y*-axis reports mean exposure as well as estimated *APC* in each bin.

Figure A17: URE and NNP components by income bins in all three surveys

Panel A: CSES 2014   Panel B: CSES 2017   Panel C: CSES 2019

— Income   — Consumption   — Maturing Assets   — Maturing Liabilities   — NURE

— Nominal Assets   — Nominal Liabilities   — Normalized NNP
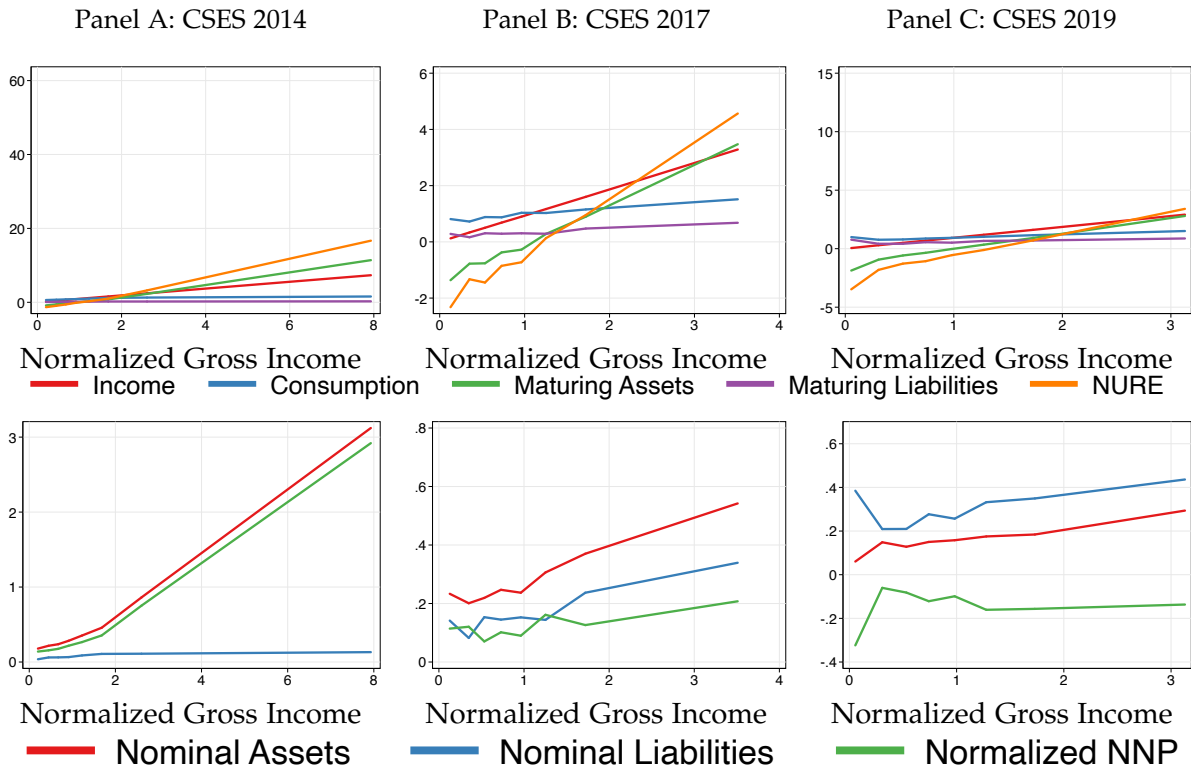
Note: The figure presents normalized *URE* and normalized *NNP*, and estimated *APCs* by income in all three surveys. Households are grouped by 8 equally-sized bins of gross income. The *x*-axis represents the average age in each group and the *y*-axis reports mean exposure as well as estimated *APC* in each bin.

B.3.3 A General Covariance Decomposition

In part, I present a covariance decomposition that projected observables on a single covariate of CSES 2014–2019/2020. This approach can, of course, be generalized to include any number of covariates. Specifically, age groups, gender of head of household, marital status, year of education, household size, unemployed and household demographic. The procedure is in two steps: first, I run an OLS regression:

$$APC_i = (\beta^m)'Z_i + \epsilon_i^m$$
$$URE_i = (\beta^u)'Z_i + \epsilon_i^u$$

where $Z_i = (1, Z_{i1}, \cdots, Z_{iJ})'$ is now a vector of covariates. Then, we recover fitted values

$$\widehat{APC}_i = (\widehat{\beta}_m)'Z_i$$
$$\widehat{URE}_i = (\widehat{\beta}_u)'Z_i$$

and residual $\widehat{\epsilon_i^m}, \widehat{\epsilon_i^u}$. The law of total covariance can now be expressed as

$$\text{Cov}(APC_i, URE_i) = \text{Cov}(\widehat{APC}_i, \widehat{URE}_i) + \text{Cov}(\widehat{\epsilon_i^m}, \widehat{\epsilon_i^u}) \tag{B.1}$$

The first term gives the component of explained covariance and the second the component of unexplained covariance. The explained paart of the covariance can be further decomposed as

$$\text{Cov}(\widehat{APC}_i, \widehat{URE}_i) = \text{Cov}\left(\sum_{j=1}^{J}\widehat{\beta_j^m}Z_{ij}, \sum_{k=1}^{J}\widehat{\beta_k^m}Z_{ik}\right) = \sum_{j=1}^{J}\sum_{k=1}^{J}\widehat{\beta_j^m}\widehat{\beta_k^m}\text{Cov}(Z_{ij}, Z_{ik}) \tag{B.2}$$

Of course, the share of explained covariance is attributed to one particular covariate through this procedure on which other covariates are included in Z_i.

Implementation: Tables A7–A9 report the full matrix described by equation (B.2) for each of my three main covariances $\mathcal{E}_R, \mathcal{E}_P$, and $\mathcal{E}_Y$ in three datasets, when all covariates from table 7 are included simultaneously.

Table A7: Fraction of $\mathcal{E}_R, \mathcal{E}_P$, and $\mathcal{E}_Y$ explained by each pair of CSES 2014 covariates

		Age bins	Gender of head	Married	Years of education	Family size	Unemployed	Region
	Age bins	0.49	0.03	−0.06	−0.18	0.16	−0.06	0.06
	Gender of head	0.05	0.27	−0.38	−0.18	−0.08	0.00	0.04
	Married	−0.02	−0.08	0.29	0.07	0.08	0.00	−0.01
$\mathcal{E}_R$	Years of education	−0.04	−0.03	0.06	1.14	−0.05	−0.01	0.07
	Family size	0.15	−0.06	0.26	−0.17	1.46	0.04	0.00
	Unemployed	−0.04	0.00	0.01	−0.03	0.03	0.10	-0.02
	Region	0.02	0.01	−0.02	0.12	0.00	−0.01	0.24
	Age bins	0.49	0.03	−0.06	−0.18	0.16	−0.06	0.06
	Gender of head	0.05	0.27	−0.38	−0.18	−0.08	0.00	0.04
	Married	−0.02	−0.08	0.29	0.07	0.08	0.00	−0.01
$\mathcal{E}_P$	Years of education	−0.04	−0.03	0.06	1.14	−0.05	−0.01	0.07
	Family size	0.15	−0.06	0.26	−0.17	1.46	0.04	0.00
	Unemployed	−0.04	0.00	0.01	−0.03	0.03	0.10	-0.02
	Region	0.02	0.01	−0.02	0.12	0.00	−0.01	0.24
	Age bins	0.44	0.04	−0.02	−0.17	0.28	0.01	0.06
	Gender of head	0.04	0.35	−0.15	−0.17	−0.14	0.00	0.05
	Married	−0.01	−0.10	0.12	0.06	0.14	0.00	−0.01
$\mathcal{E}_Y$	Years of education	−0.04	−0.04	0.02	1.07	−0.08	0.00	0.07
	Family size	0.14	−0.07	0.11	−0.16	2.51	−0.01	−0.01
	Unemployed	−0.03	0.00	0.00	−0.03	0.04	−0.02	−0.02
	Region	0.02	0.02	−0.01	0.11	0.00	0.00	0.27

Table A8: Fraction of $\mathcal{E}_R, \mathcal{E}_P$, and $\mathcal{E}_Y$ explained by each pair of CSES 2017 covariates

		Age bins	Gender of head	Married	Years of education	Family size	Unemployed	Region
	Age bins	0.22	−0.03	0.02	0.03	0.07	0.01	0.03
	Gender of head	−0.02	0.14	−0.08	−0.02	0.02	0.00	−0.02
	Married	0.01	−0.04	0.06	0.01	−0.02	0.00	0.00
$\mathcal{E}_R$	Years of education	0.02	−0.02	0.01	0.12	0.02	0.00	−0.03
	Family size	0.12	0.06	−0.15	0.06	0.95	−0.02	−0.03
	Unemployed	0.01	0.00	0.00	0.00	−0.01	0.01	0.01
	Region	0.02	−0.02	0.01	−0.04	−0.01	0.01	0.44
	Age bins	2.67	−0.48	−0.05	0.29	0.33	−0.20	0.05
	Gender of head	−0.20	2.07	0.17	−0.16	0.09	0.01	−0.03
	Married	0.08	−0.58	−0.12	0.05	−0.11	−0.01	0.01
$\mathcal{E}_P$	Years of education	0.19	−0.24	−0.02	0.98	0.08	0.02	−0.06
	Family size	1.41	0.93	0.32	0.51	4.65	0.31	−0.05
	Unemployed	0.08	−0.01	−0.00	−0.01	−0.03	−0.16	0.01
	Region	0.20	−0.25	−0.02	−0.32	−0.04	−0.10	0.74
	Age bins	0.43	−0.02	0.00	−0.12	0.30	0.06	0.05
	Gender of head	−0.03	0.10	−0.01	0.07	0.09	−0.00	−0.03
	Married	0.01	−0.03	0.01	−0.02	−0.10	0.00	0.01
$\mathcal{E}_Y$	Years of education	0.03	−0.01	0.00	−0.40	0.07	−0.01	−0.05
	Family size	0.22	0.05	−0.02	−0.21	4.33	−0.10	−0.05
	Unemployed	0.01	−0.00	0.00	0.00	−0.03	0.05	0.01
	Region	0.03	−0.01	0.00	0.13	−0.04	0.03	0.66

Table A9: Fraction of $\mathcal{E}_R, \mathcal{E}_P,$ and $\mathcal{E}_Y$ explained by each pair of CSES 2019/2020 covariates

		Age bins	Gender of head	Married	Years of education	Family size	Unemployed	Region
	Age bins	0.30	−0.00	0.01	0.09	0.15	0.02	0.01
	Gender of head	−0.00	0.00	−0.00	−0.00	0.00	−0.00	−0.00
	Married	−0.00	0.00	−0.01	−0.00	0.01	−0.00	−0.00
$\mathcal{E}_R$	Years of education	0.11	−0.01	0.02	1.22	0.11	−0.03	−0.04
	Family size	0.32	0.00	−0.08	0.19	2.14	−0.07	−0.01
	Unemployed	0.04	−0.00	0.00	−0.03	−0.05	0.14	0.01
	Region	−0.02	0.00	−0.00	0.05	0.01	−0.01	−0.04
	Age bins	1.07	−0.13	0.05	0.44	−0.20	0.02	0.04
	Gender of head	−0.00	0.02	−0.01	−0.01	−0.00	−0.00	−0.00
	Married	−0.01	0.03	−0.03	−0.02	−0.01	−0.00	−0.00
$\mathcal{E}_P$	Years of education	0.40	−0.31	0.08	6.27	−0.16	−0.02	−0.16
	Family size	1.14	0.13	−0.29	0.98	−2.95	−0.05	−0.03
	Unemployed	0.13	−0.01	0.01	−0.17	0.07	0.10	0.04
	Region	−0.06	0.04	−0.01	0.23	−0.01	−0.01	−0.18
	Age bins	0.61	0.03	−0.02	−0.15	0.61	0.05	0.02
	Gender of head	−0.00	−0.01	0.00	0.00	0.00	−0.00	−0.00
	Married	−0.00	−0.01	0.01	0.01	0.03	−0.00	−0.00
$\mathcal{E}_Y$	Years of education	0.22	0.08	−0.03	−2.21	0.47	−0.06	−0.08
	Family size	0.64	−0.03	0.11	−0.34	8.92	−0.15	−0.02
	Unemployed	0.08	0.00	−0.01	0.06	−0.22	0.32	0.02
	Region	−0.03	−0.01	0.00	−0.08	0.02	−0.02	−0.09

B.4 Gini Coefficient and Percentile Ratio

B.4.1 Household Income Inequality

Table A10: Gini index and percentile ratio on household income

	Gini index	P90/P10	P90/P50	P10/P50	P75/P25	Mean
Panel A: CSES 2014						
Phnom Penh	0.52	11.14	3.89	0.35	3.37	12894.50
Central Plains	0.58	15.93	3.95	0.25	3.69	7397.87
Tonle Sap	0.60	17.20	4.53	0.26	3.89	8095.70
Coastal	0.60	15.08	4.03	0.27	3.89	7915.15
Plateau and Mountains	0.54	11.65	3.19	0.27	3.22	6182.62
Total	0.57	14.86	4.01	0.27	3.64	8370.50
Panel B: CSES 2017						
Phnom Penh	0.42	7.51	2.33	0.31	2.53	7397.00
Central Plains	0.51	19.71	3.25	0.17	3.74	5840.37
Tonle Sap	0.49	13.73	3.02	0.22	3.17	4829.05
Coastal	0.47	11.65	2.86	0.25	3.76	4881.58
Plateau and Mountains	0.43	10.21	2.42	0.24	2.89	4962.95
Total	0.47	13.66	2.85	0.23	3.20	5707.81
Panel C: CSES 2019						
Phnom Penh	0.43	12.69	2.59	0.20	2.92	7786.96
Central Plains	0.47	18.78	2.68	0.14	3.30	6129.13
Tonle Sap	0.46	16.78	2.73	0.16	3.53	5478.37
Coastal	0.48	19.97	2.98	0.15	3.52	6553.62
Plateau and Mountains	0.49	18.87	2.93	0.16	3.74	5928.51
Total	0.47	17.69	2.76	0.16	3.43	6074.43

Note: The figure reports the Gini coefficient and percentile ratio of annual household income over 2017–2020 by using the CSES dataset. The value in the mean column report means household income by region in terms of US dollars.

B.4.2 Household Consumption Inequality

Table A11: Gini index and percentile ratio on household consumption

	Gini index	P90/P10	P90/P50	P10/P50	P75/P25	Mean
Panel A: CSES 2014						
Phnom Penh	0.30	4.01	2.09	0.52	2.10	6694.77
Central Plains	0.35	4.87	2.38	0.49	2.31	4172.24
Tonle Sap	0.35	5.08	2.44	0.48	2.34	4209.12
Coastal	0.33	4.49	2.35	0.52	2.19	4116.79
Plateau and Mountains	0.35	5.02	2.45	0.49	2.30	4116.11
Total	0.34	4.80	2.36	0.49	2.28	4590.74
Panel B: CSES 2017						
Phnom Penh	0.28	3.57	1.91	0.54	1.89	6756.90
Central Plains	0.35	4.80	2.19	0.46	2.35	5520.38
Tonle Sap	0.34	4.06	2.11	0.52	2.15	4821.27
Coastal	0.36	5.63	2.66	0.47	2.08	6667.95
Plateau and Mountains	0.35	4.76	2.22	0.47	2.25	5238.44
Total	0.33	4.38	2.14	0.49	2.17	5606.37
Panel C: CSES 2019						
Phnom Penh	0.32	4.31	2.06	0.48	2.05	8526.88
Central Plains	0.36	4.80	2.25	0.47	2.25	5943.27
Tonle Sap	0.37	5.10	2.41	0.47	2.26	5737.90
Coastal	0.37	5.65	2.62	0.46	2.37	7099.85
Plateau and Mountains	0.40	6.28	2.61	0.42	2.65	6178.18
Total	0.37	5.17	2.38	0.46	2.31	6262.90

Note: The figure reports the Gini coefficient and percentile ratio of annual household consumption over 2017–2020 by using the CSES dataset. The value in the mean column report means household expenditure by region in terms of US dollars.

B.4.3 Household Assets Inequality

Table A12: Gini index and percentile ratio on household maturing assets

	Gini index	P90/P10	P90/P50	P10/P50	P75/P25	Mean
Panel A: CSES 2014						
Phnom Penh	0.57	23.65	4.00	0.17	5.87	3541.53
Central Plains	0.63	33.62	4.61	0.14	5.41	3403.52
Tonle Sap	0.60	30.93	4.38	0.14	5.60	3554.84
Coastal	0.67	30.01	6.54	0.22	4.82	4033.18
Plateau and Mountains	0.57	25.53	3.46	0.14	4.85	2577.41
Total	0.60	29.83	4.37	0.15	5.43	3384.54
Panel B: CSES 2017						
Phnom Penh	0.58	22.56	4.12	0.18	5.36	4632.05
Central Plains	0.61	49.41	5.75	0.12	7.39	4929.70
Tonle Sap	0.57	28.37	4.58	0.16	4.73	4052.40
Coastal	0.54	25.99	3.09	0.12	5.10	3766.30
Plateau and Mountains	0.53	23.12	3.22	0.14	4.21	3114.54
Total	0.58	32.84	4.57	0.15	5.64	4292.32
Panel C: CSES 2019						
Phnom Penh	0.54	26.59	3.64	0.14	4.38	4610.31
Central Plains	0.54	21.59	3.33	0.15	4.27	4434.77
Tonle Sap	0.54	22.10	3.82	0.17	4.57	3846.03
Coastal	0.55	29.69	4.16	0.14	4.90	4681.12
Plateau and Mountains	0.56	23.03	4.02	0.17	4.90	4517.49
Total	0.54	23.24	3.71	0.16	4.54	4293.06

Note: The figure reports the Gini coefficient and percentile ratio of annual household assets over 2017–2020 by using the CSES dataset. The value in the mean column report means household assets by region in terms of US dollars.

B.4.4 Household Liabilities Inequality

Table A13: Gini index and percentile ratio on household nominal liabilities

	Gini index	P90/P10	P90/P50	P10/P50	P75/P25	Mean
Panel A: CSES 2014						
Phnom Penh	0.50	25.00	3.45	0.14	6.00	1877.99
Central Plains	0.55	24.00	5.00	0.21	6.40	1158.65
Tonle Sap	0.55	20.80	4.52	0.22	6.00	1068.30
Coastal	0.53	12.50	5.00	0.40	5.00	1073.01
Plateau and Mountains	0.49	15.00	3.75	0.25	6.67	1226.66
Total	0.53	21.36	4.42	0.21	6.18	1256.24
Panel B: CSES 2017						
Phnom Penh	0.63	33.33	6.67	0.20	10.00	3506.75
Central Plains	0.56	20.40	3.40	0.17	6.00	2551.57
Tonle Sap	0.62	24.00	4.80	0.20	6.00	2622.08
Coastal	0.57	20.00	4.08	0.20	6.00	2278.68
Plateau and Mountains	0.50	16.67	2.50	0.15	4.00	2611.95
Total	0.58	23.50	4.36	0.18	6.53	2765.73
Panel C: CSES 2019						
Phnom Penh	0.53	38.33	4.60	0.12	4.80	9370.50
Central Plains	0.54	21.70	4.17	0.19	4.67	5334.45
Tonle Sap	0.57	26.00	4.33	0.17	6.68	5250.24
Coastal	0.54	20.00	5.00	0.25	5.00	6907.65
Plateau and Mountains	0.57	24.00	5.00	0.21	5.33	6133.30
Total	0.55	24.86	4.48	0.19	5.48	5959.36

Note: The figure reports the Gini coefficient and percentile ratio of annual household liabilities over 2017–2020 by using the CSES dataset. The value in the mean column report means household liabilities by region in terms of US dollars.

B.4.5 Income Inequality through Education Group

In this section, I provide additional information on household income distribution through the Gini coefficient of income share by a group of the head family education. I diversified five education groups, primary school, secondary school, high school, junior college and bachelor's degree. Figures A18–A20 show the Gini index of income share by years of schooling groups. It is interesting to note that the index of income inequality among households who received bachelor's degree is very low than others, with around 0.472 in 2014 to 0.331 in 2019/2020.

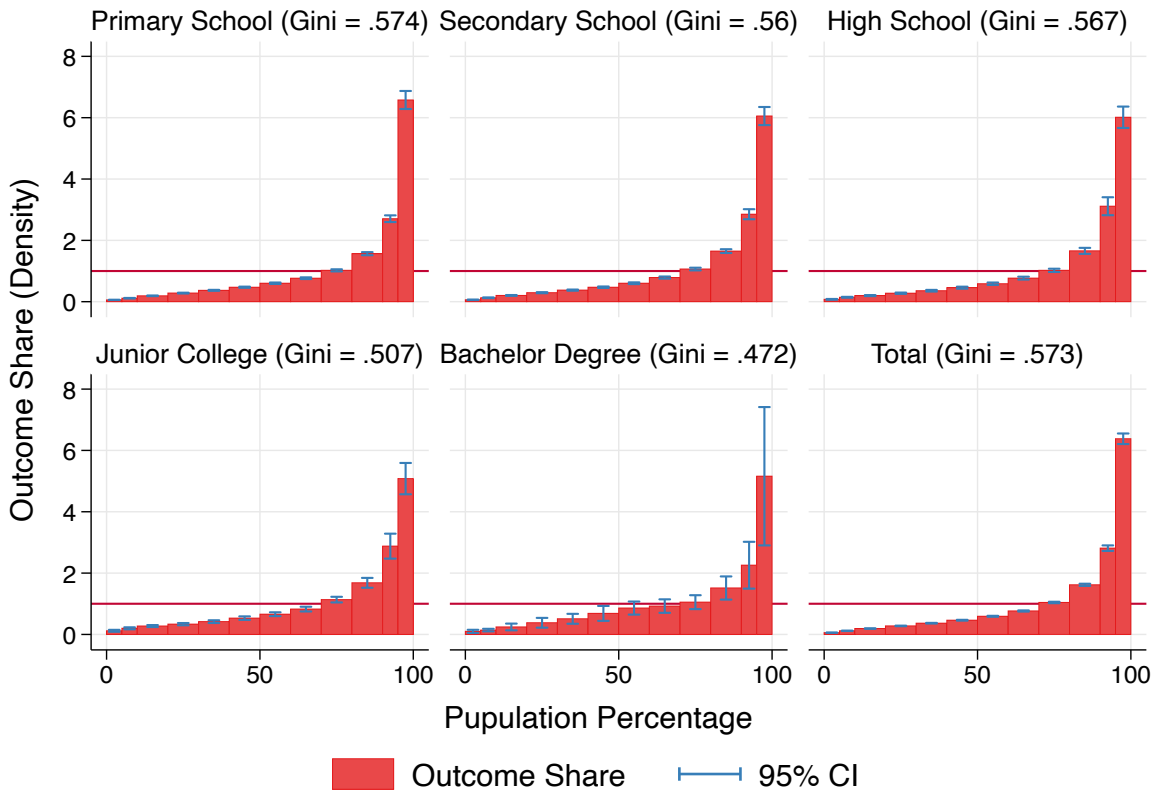Figure A18: Gini index of household income by education group in 2014

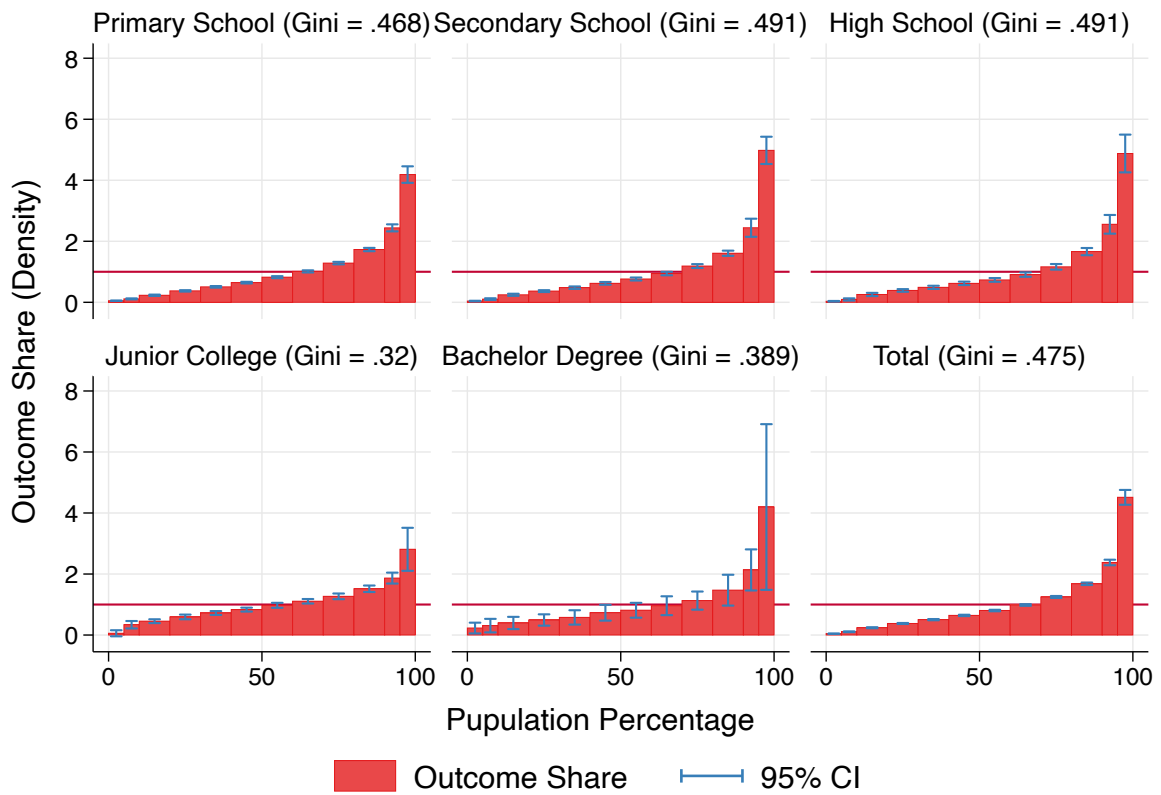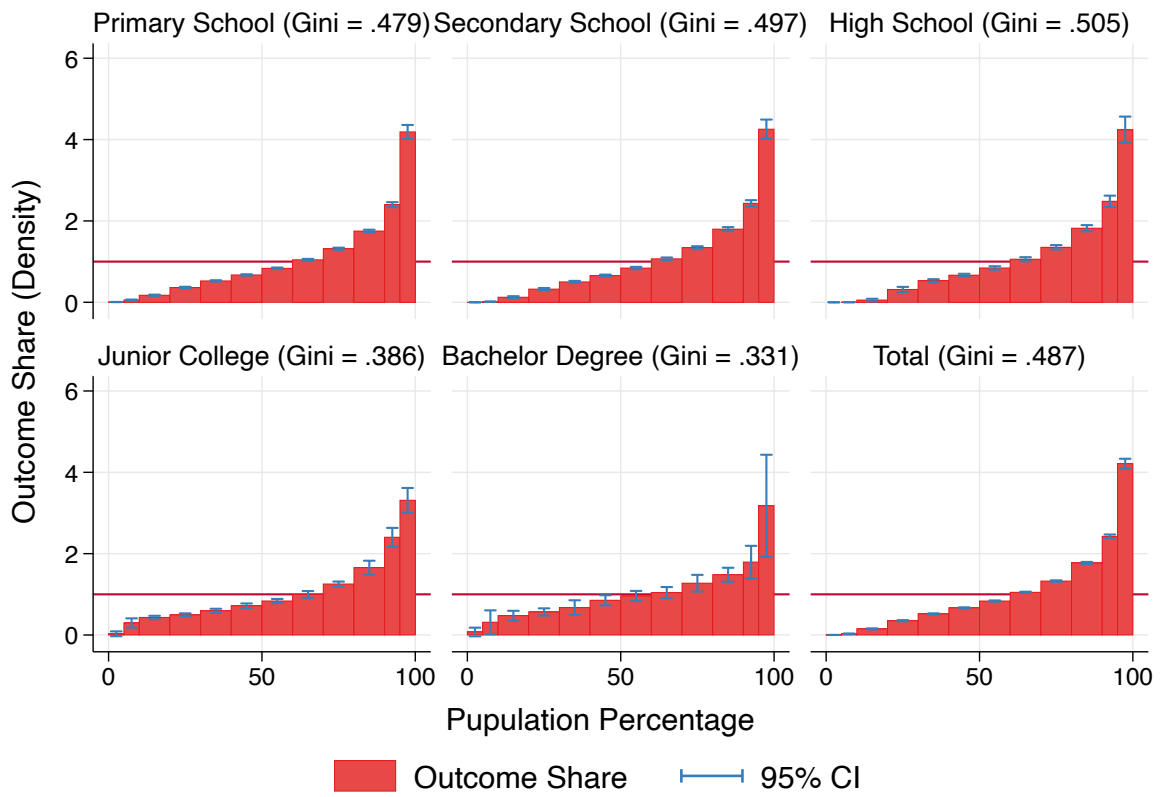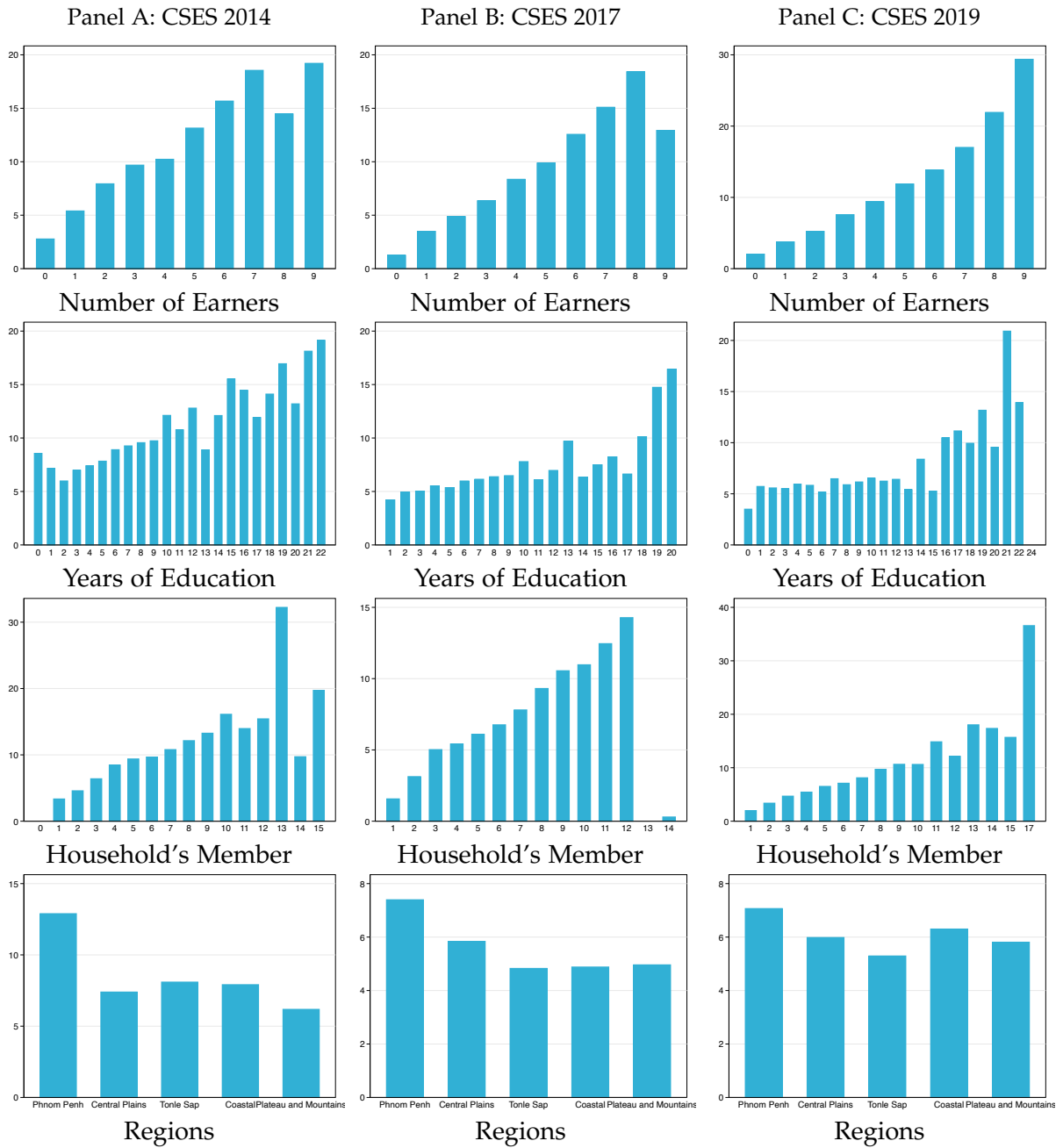Figure A19: Gini index of household income by education group in 2017

Figure A20: Gini index of household income by education group in 2019/2020
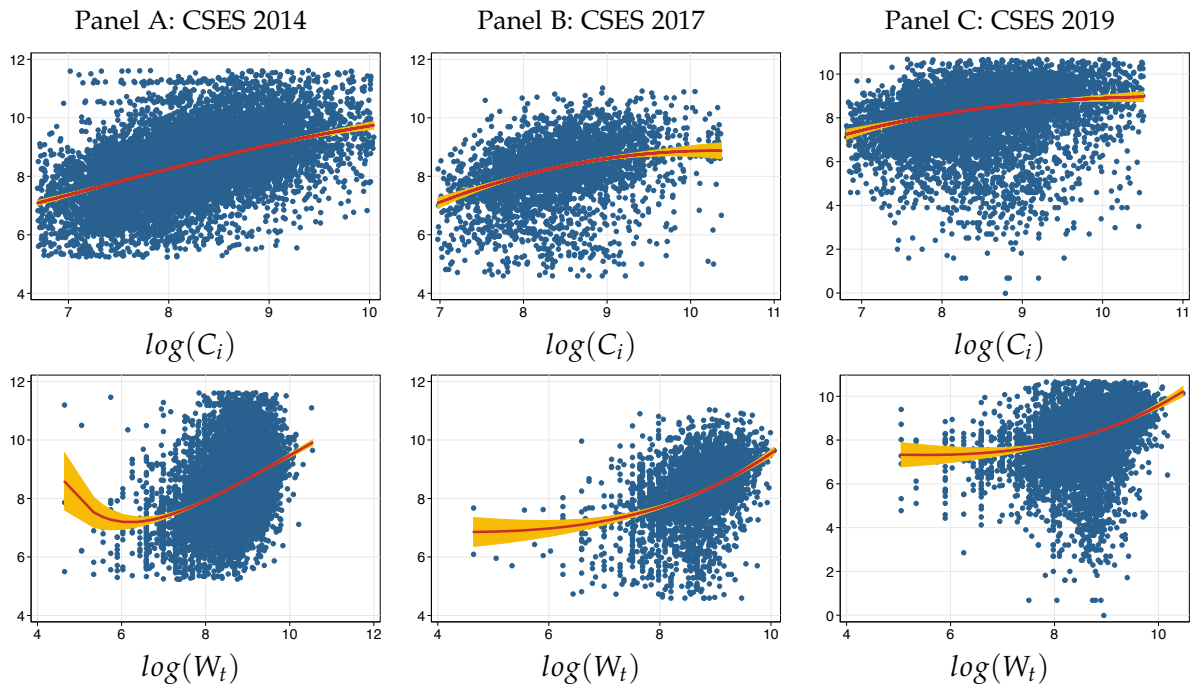
B.5 Median Income by Household Structure

Figure A21: Median household income by type

Note: These figures show the average household income by group: earner numbers, school years, family members, and family regions. The *y* axis is the value of income in US dollars in 1,000.

Figure A22: Scatter plot of the logarithm of household income ($log(Y_i)$)

Panel A: CSES 2014   Panel B: CSES 2017   Panel C: CSES 2019

Note: The figure reports a result of scatter plot of the logarithm of household income with the logarithm of consumption and total hours of worked. The *x*-axis represents the value of log consumption in $1,000 and the value of log total hours of worked. The *y*-axis is the log income in $1,000. Panel A reports the 2014 CSES data, Panel B is the 2017 CSES data and Panel C is the 2019/2020 CSES data.

B.6 Median Consumption by Household Structure

Figure A23: Average household consumption by type

Panel A: CSES 2014	Panel B: CSES 2017	Panel C: CSES 2019
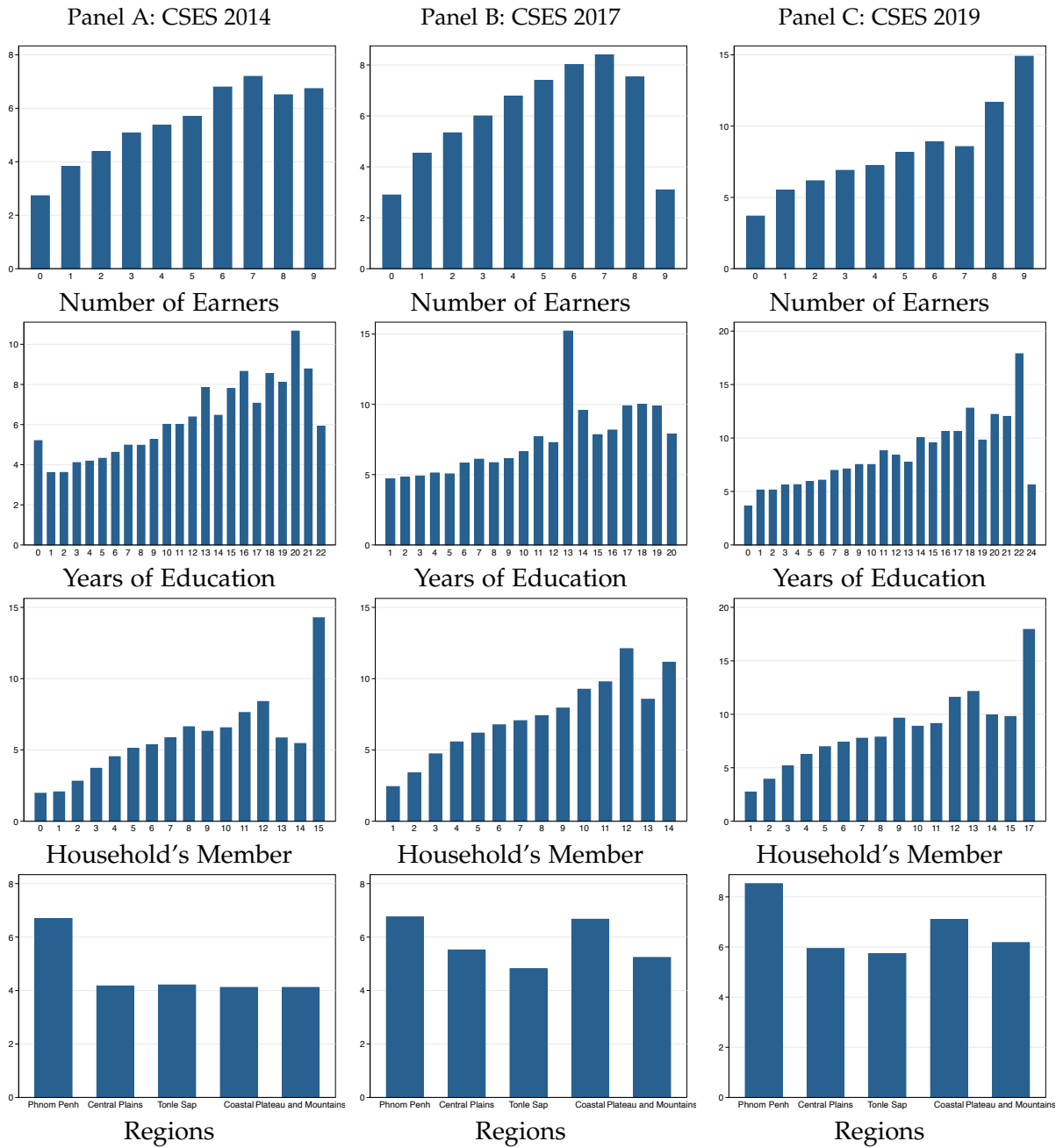
Note: These figures show the average household expenditure by group: earner numbers, school years, family members, and family regions. The y axis is the value of spending in US dollars in 1,000.

B.7 Household Wealth through Education, Age and Region

Figure A24: Sex and education of the head of household
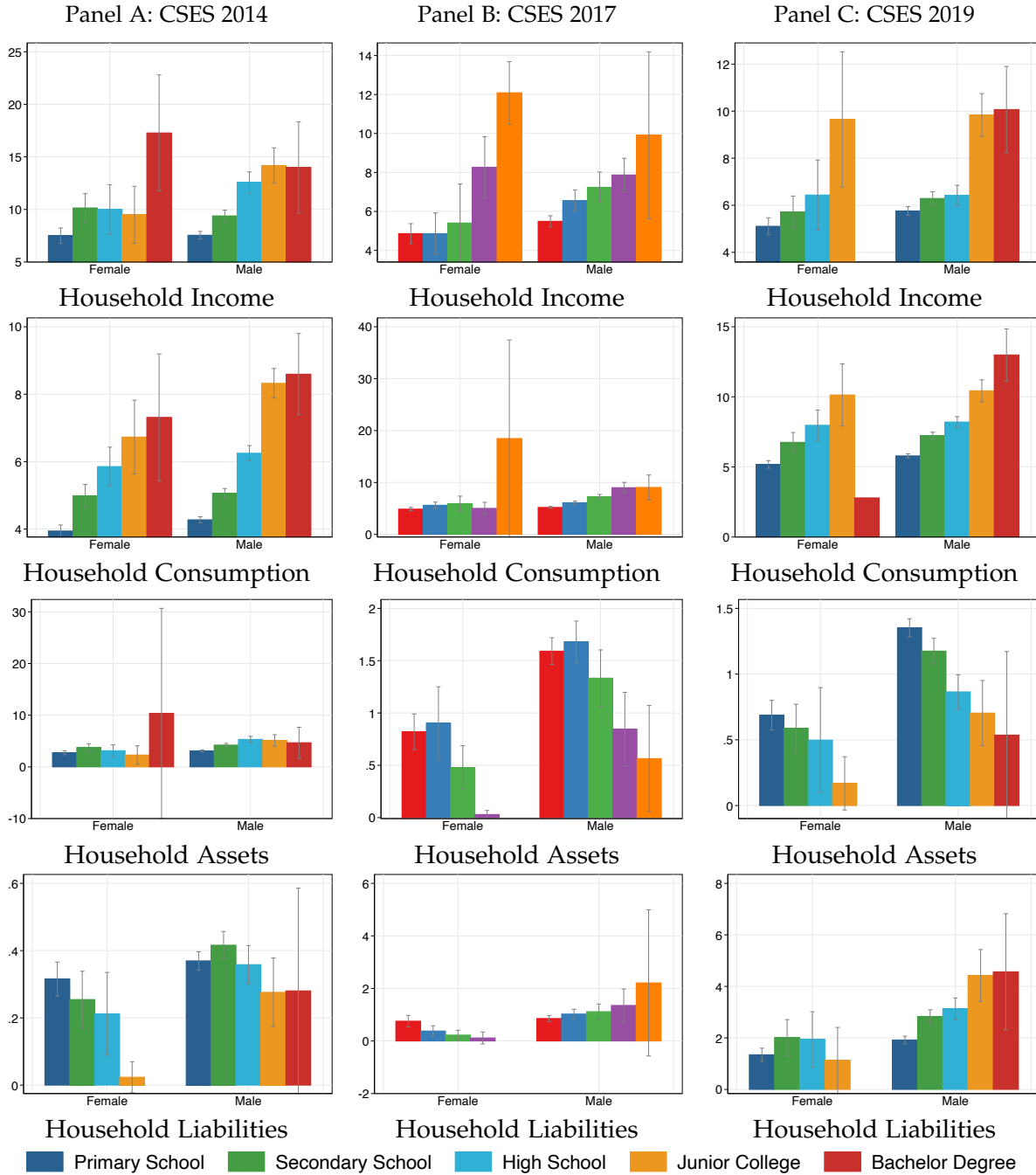
Note: These graphs show the gender of the head of household by years of education groups. The blue line represents years of schooling at the primary school, the green line is the secondary school, the light blue is the high school, the orange line is the junior college, and the red line is the undergraduate degree. Panel A reports the 2014 CSES data, Panel B is the 2017 CSES data and Panel C is the 2019/2020 CSES data. All *y*-axis represent the value of household income, consumption, assets and liabilities in $1,000. It is the sum of all sources of wealth and spending in a family that must neglect the years of schooling of the head family. It is important to remember that all members of a household have different years of schooling.

Figure A25: Mean household assets by five main regions across the nation

Note: The graph plots the average household wealth by types of assets such as housing assets, building assets, land assets and durable goods assets in the different regions. Panel A reports the 2014 CSES data, Panel B is the 2017 CSES data and Panel C is the 2019/2020 CSES data. The red line is Phnom Penh, the blue is the central plains, the green is Tonle Sap, the purple is Coastal and the orange is Plateau and Mountains region. All y-axis represent the value of assets in $1,000.

Figure A26: Lorenz curve of household income, consumption and assets

Panel A: CSES 2014	Panel B: CSES 2017	Panel C: CSES 2019
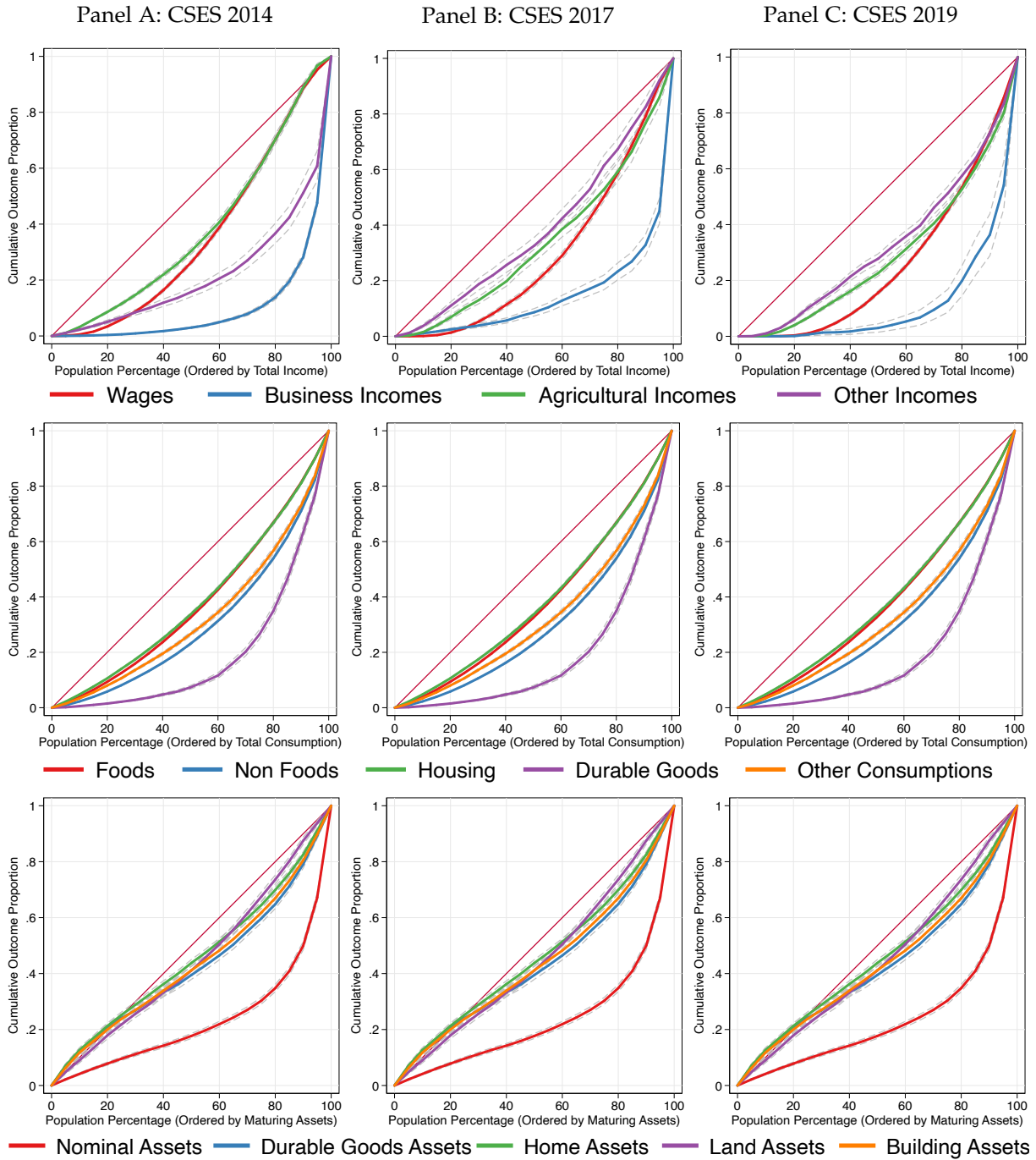
Note: These graphs represent the Lorenz curve of household wealth between 2014–2019/2020 by using the CSES dataset. The first row is the average household income by types of sources, including wages, business income, agricultural incomes, and other incomes. The second row reports the Lorenz curve of the median household expenditure in different factors such as foods, nonfoods, housing spending, and durable goods. The third row is the curve for household assets. The *x*-axis is the population percentage and the *y*-axis is the cumulative outcome proposition.

Figure A27: Average household income and consumption by age group
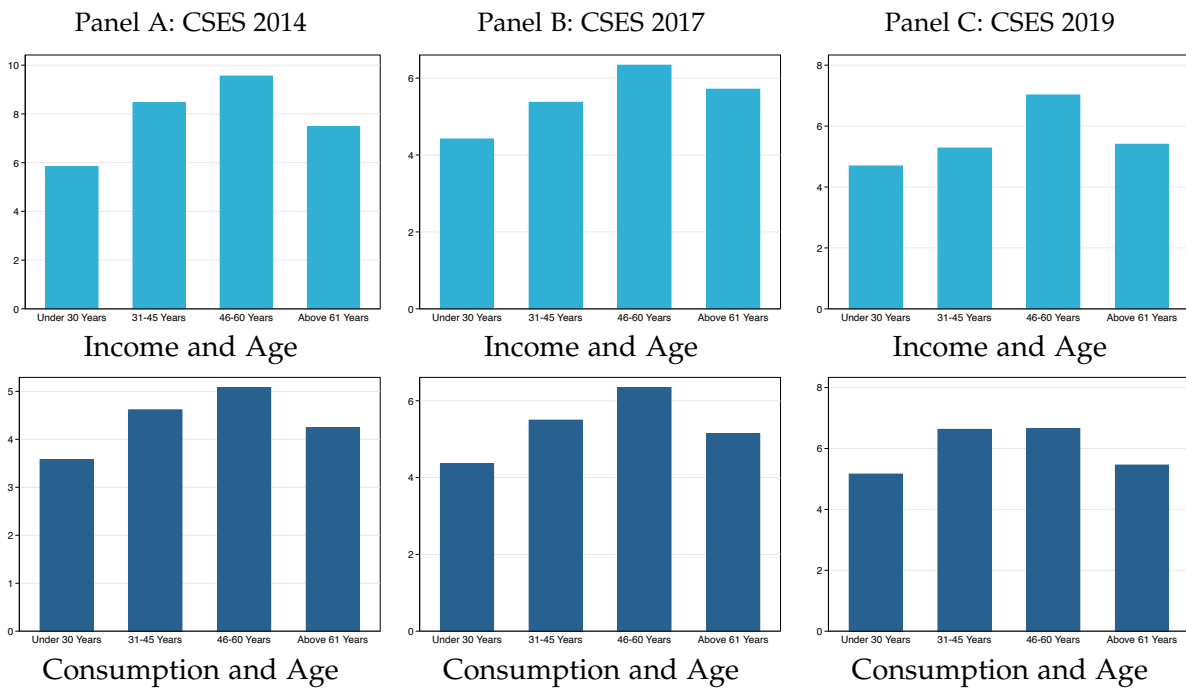
Note: The figure represents the median household income and expenditure between 2014–2019/2020 by using the CSES dataset. The first row is the average household income by group of age. The second row reports the median household expenditure by group of age. All *y*-axis is the value of income and spending in US dollars in 1,000.

B.8 The Interest Rate and Loans

Figure A28: The annual interest rate and monthly interest rate of household liabilities

Panel A: CSES 2014   Panel B: CSES 2017   Panel C: CSES 2019

Annual Interest Rate   Annual Interest Rate   Annual Interest Rate

Monthly Interest Rate   Monthly Interest Rate   Monthly Interest Rate
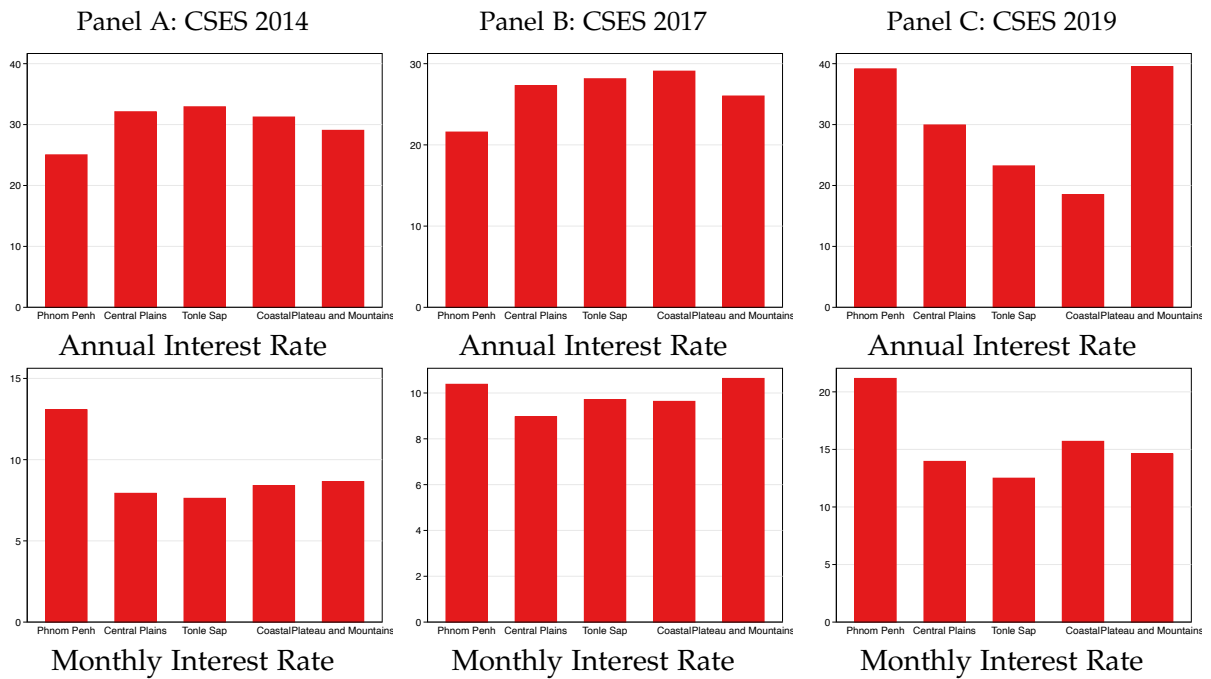
Note: This figure reports the annual interest rate and monthly interest rate of household's loans in different regions. Panel A shows the interest rate of the 2014 CSES data, Panel B is the 2017 CSES data and Panel C presents the 2019/2020 CSES dataset. The first row is the annual rate and the second row is the monthly interest rate. The *y*-axis represents the percentage of interest rates.

Figure A29: The value of loans and their objectives

Panel A: CSES 2014   Panel B: CSES 2017   Panel C: CSES 2019
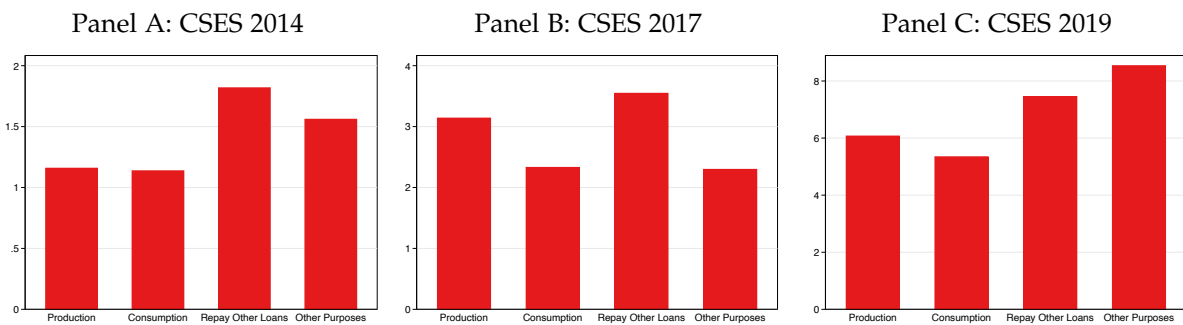
Note: The figure shows the value of household liabilities by objective of loans and amount of values. The *y*-axis is the value of US dollar loans in 1000. All three graphs used sample weight and eliminated the low- and high-loan household at the percentile 1%. I determine the purposes of a loan into four types: for production, consumption, repayment of other debts, and other purposes.