Chapter 4

MONETARY POLICY REDISTRIBUTION CHANNEL: CASE OF MONGOLIA

By
**Munkhchimeg Sukhee[1], Enkhzaya Demid[2],
Tsenddorj Dorjpurev[3] and Batbold Narmandakh[4]**

1. Introduction

Monetary policy is changing around the world, and with it, the tools we employ is evolving in order to address the contemporary issues. Among many things, income inequality has been highlighted as one of the issues that need to be taken in consideration when conducting monetary policy. The great recession and what came afterwards not only showed us the inadequacy of existing models but also called for broader perspectives from central banks.

As recently as 2018, Bank of Mongolia has added macro-prudential measures to its toolbox to cope with its partial responsibility for financial stability. As a support, the Economic Research and Training Institute at the Bank of Mongolia has conducted a nationwide survey that has successfully concluded the first ever attempt of a household balance sheet. This is to complement the already existing household survey conducted by the National Statistics Office every quarter, albeit with a much wider sample. This research paper investigates the monetary policy transmission mechanism for various levels of households, differentiated basically by income and also categorically characterized by their financial position.

The purpose of this study is to contribute to the literature by identifying the role of the redistribution effects of the monetary policy transmission mechanism based on evidence from Mongolian micro level data. For this, we will see how different marginal propensity to consume and the distribution of household income and wealth affects monetary policy. In order to do this, we have used the perfect-foresight general equilibrium model (Auclert, 2019). In determining the effects of monetary policy, this model, in addition to reflecting the effects on aggregate income and substitution channels, which are considered in the traditional model with a representative agent, the indirect redistribution channel that depends on income differences, unexpected price changes and real interest rates changes are included. We have calculated the marginal propensity to consume (MPC) for each income group based on 2016-

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1. Munkhchimeg Sukhee, Research and Statistics Department, Bank of Mongolia, Baga Toiruu 3, Ulaanbaatar, Mongolia. Tel: +976-11-450025, munkhchimeg@mongolbank.mn

2. Enkhzaya Demid, Economic Research and Training Institute, Bank of Mongolia, Baga Toiruu 3, Ulaanbaatar, Mongolia. Tel: +976-11-450025, denkhzaya@mongolbank.mn

3. Tsenddorj Dorjpurev, Economic Research and Training Institute, Bank of Mongolia, Baga Toiruu 3, Ulaanbaatar, Mongolia. Tel: +976-11-450025, d.tsenddorj@mongolbank.mn

4. Batbold Narmandakh, Monetary Policy Department, Bank of Mongolia, Baga Toiruu 3, Ulaanbaatar, Mongolia. Tel: +976-11-323109, batbold.n@mongolbank.mn

2018 survey data from the Mongolian Household Social and Economic Survey (HSES), compiled by the National Statistics Office. The Bank of Mongolia's Household Financial Condition Survey (HFCS) was used to calculate the net nominal position (NNP) and the unhedged interest rate exposures (URE) of the households.

The study consists of the following sections: Section 2 presents the stylized facts on Mongolia while Section 3 summarizes the literature review. Section 4 describes the methodology and the model employed and Section 5 delves into the sources and calculations of quantitative data. Section 6 presents the results of estimation and Section 7 concludes.

2.   Stylized Facts

The Mongolian economy which is highly dependent on mining exports, experienced severe episodes of commodity price boom-bust cycles in the last decade. Naturally, the commodity cycle brought with it fluctuations in the economic growth as well as in the real exchange rate which affected asset prices including housing prices. Monetary policy, in these times, has demonstrated a counter cyclical stance, i.e., tightening during the boom period and loosening when the economy has slowed down.

There is an exception in monetary policy stance between 2012 and 2016 when Bank of Mongolia conducted so-called unconventional monetary policy. It increased the size of the balance sheet by holding mortgage backed securities (MBS) and other corporate-issued bonds both with heavily subsidized rates. This was reflected in the cumulative loss of the banks and acted as quasi-fiscal expenditures. As a result, the decline in growth and household income and expenditure has been smoothened compared with the sharp decline in commodity price.

It also changed the dynamics of the housing market, creating a hump like price increase during the period while the stock market showed a flat figure. Even though the monetary condition index showed a tightening episode in 2015 and 2016, it was actually compensating for the quasi-fiscal activities it conducted. One could say from the figure that the real monetary condition index and the Gini index, except for 2015 and 2016, show that there is a relation between inequality and monetary policy stance.

In recent years, the favorable external condition indicated by the terms of trade has allowed for real increases in economy as well as household income (and expenditure). It is also reflected in the stock market but not in the housing market, which is only calming after the subsidized mortgage credit rush. During this time, Bank of Mongolia under the Extended Fund Facility program which was agreed upon with the IMF in May 2017 has halted, by law, its quasi-fiscal activities. Also within the agreement, international reserves were to be accumulated which, in turn, has kept the real exchange rate at low levels and contributed to the real monetary condition being in the negative territory. However, the slight upward movement in the monetary condition was accompanied with an increase in inequality for 2018.
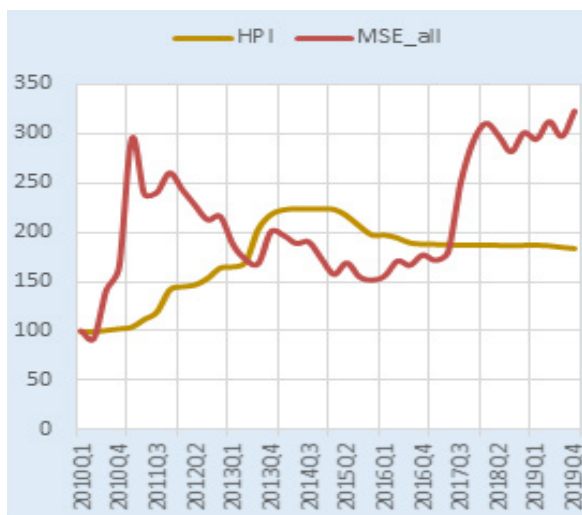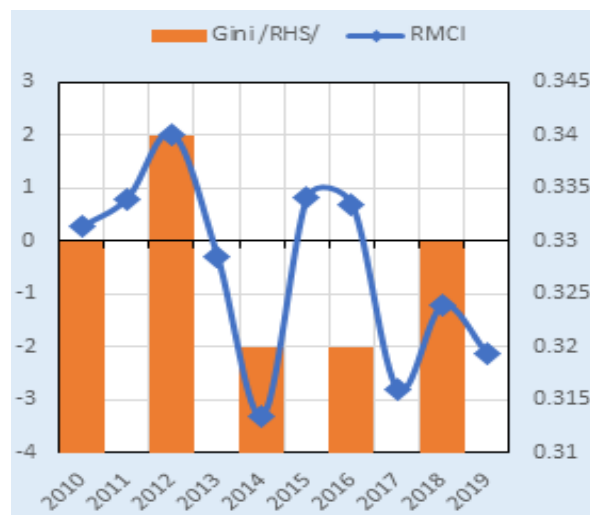
Figure 1
Economic Background
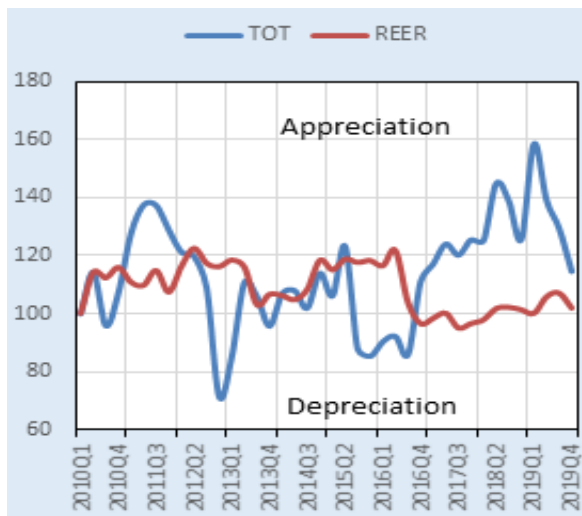
a. ToT vrs REER, 2010Q1=100
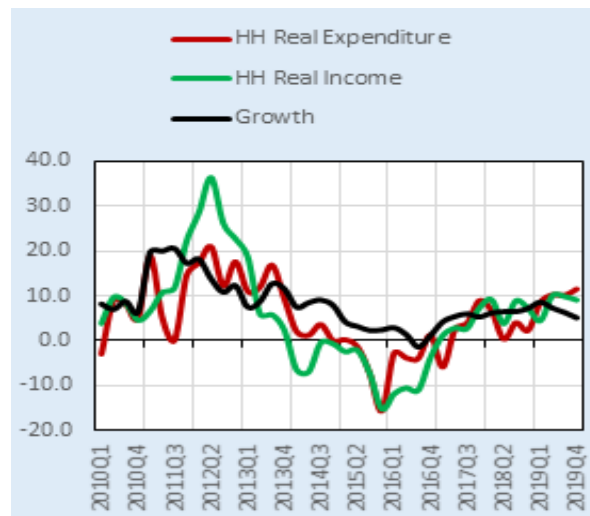
b. Growth vrs HH Income and Expenditure (YoY)

c. Housing Price vrs Stock Market Index (2010Q1=100)

d. Gini Coefficient vs Monetary Condition Index (RMCI)

Source: Bank of Mongolia, National Statistic Office.

This snapshot of the last decade shows how monetary policy is acting together with inequality in response to different economic factors, especially, how the central bank's targeted actions such as MBS purchases affects different asset classes. The overall picture here suggests that inequality has moved downwards and upwards resembling the movements in the stock exchange rate, while the housing price hump is corresponding to the decrease in inequality as well as the period of falling stock prices. These does not clearly tell us how monetary policy affects inequality, but begs the question of the transmission of this effect via household balance structure.

3.   Literature Review

In the standard Representative Agent New Keynesian (RANK) models, response of aggregate consumption to a change in interest rate is described by the Euler equation, which shows strong intertemporal substitution effect and weak income sensitivity of consumption. For instance, a representative household consumes a permanent-income and faces an intertemporal budget constraint. Hence, its consumption is highly sensitive to changes in interest rates but not responsive to temporary changes in income. In detail, the model shows that the direct response to changes in interest rate accounts for more than 95 percent of the consumption response to monetary shocks, while indirect effect due to changes in income makes up less than 5 percent. Thus, the effect of monetary policy on consumption is mainly driven by the intertemporal substitution effect in the RANK models.

In recent years, however, the growing inequality of income and wealth and the rising asset prices have been among key factors in the impact of monetary policy on the economy. Therefore, researchers have developed a Heterogeneous Agents New Keynesian model (HANK) that reflect a more realistic representation of consumption behavior and distributions of household income and wealth. The HANK models explain how monetary policy effects may vary across income and wealth groups with different marginal propensities to consume. For instance, expansionary monetary policy benefits households with high amounts of debt, whereas tight monetary policy tends to favor households with savings. Thus, monetary policy might have redistributive effects on the economy and can cause inequality in the short-run. There are recent papers, including (Kaplan, Violante, & Moll, 2016) and (Auclert, 2019), which explain the importance of the heterogeneous agent model to understand the transmission of monetary policy in the economy.

In particular, (Kaplan, Violante, & Moll, 2016) developed the HANK model, which explains the heterogeneous impact of monetary policy shocks on consumption, taking into account the differences in household wealth and marginal propensity to consume. In this model, monetary policy affects consumption primarily through indirect effects that arise from a general equilibrium increase in labor demand. The study finds a weak intertemporal substitute effect of consumption. They argue that hand-to-mouth households who consume entire current income are highly sensitive to labor income shocks but are not sensitive to interest rate changes. Even wealthy households may not increase consumption in response to an interest rate cut due to the negative income shocks. These are likely to lower the direct impact of monetary policy. The empirical evidence shows that the direct effects of interest rate shock on consumption are relatively small (roughly one-thirds of the total impact), while the indirect effects can be significant (roughly two-thirds of the total impact) based on the U.S. households survey data. Therefore, the HANK model suggests that the indirect effect through changes in income can be the key determinant of the consumption response to monetary shocks.

(Auclert, 2019) identifies the HANK model emphasizing the role of redistribution in the transmission mechanism of monetary policy onto consumption. This model defines the three channels of monetary policy redistribution that affect aggregate spending; (i) an earning heterogeneity channel, (ii) a fisher effect channel, and (iii) an interest rate exposure channel. These channels show that monetary policy shock can have differential effects across the

household's consumption, depending on the differences in the household balance sheet and consumption behavior. According to this model, monetary policy can affect income distribution through changes in interest rates, asset prices, and capital gains. The paper shows analytically that households' heterogeneity may amplify or dampen the effects of monetary shocks on aggregate consumption. Applying micro data including a 2010 Italian Survey, 1999-2013 U.S. Panel Survey of Income Dynamics, and 2001-2002 U.S. Consumer Expenditure Survey, the study concludes that all three channels are likely to amplify the effects of monetary policy in both economies.

Table 1
Review of Empirical Studies

	Papers	Methods	Samples	Main findings
1	(Coibion, Gorodnichenko, Kueng, & Silvia, 2012)	VAR	U.S. 1980-2008	Contractionary monetary policy shocks lead to an increase in income and consumption heterogeneity.
2	(Mumtaz, 2017)	VAR	United Kingdom 1969 - 2012	Contractionary monetary policy raises income inequality. It negatively impacts on low-income households.
3	(De, 2017)	FAVAR, DSGE	India, China 1996- 2013	Monetary policy shocks have a different impact on the consumption of a different group of households. The expansionary monetary policy reduces income inequality.
4	(Cravino, Lan, & Levchenko, 2018)	FAVAR	U.S. 1978-2008	Monetary Policy can have distributional consequences on different income groups by affecting the relative prices of goods.
5	(Davtyan, 2017)	Panel VAR	U.S. 1979-2012	Tight monetary policy raises income inequality.
6	(Furceri, Loungani, & Zdzienicka, 2018)	Panel VAR	32 advanced and emerging market countries 1990-2013	Tight monetary policy raises income inequality. Contractionary monetary policy shocks increase income inequality, on average. The effect varies over time.
7	(O'Farrell, Rawdanowicz, & Inaba, 2016)	Simulations	OECD survey data 2010-2012	Income inequality plays a small role in the monetary policy transmission mechanism. Found mixed results for the euro area countries.
8	(Gornemann, Kuester, & Nakajima, 2012)	DSGE	U.S. 1984-2008	While households in the top 5 percent of the wealth distribution benefit from a contractionary monetary policy shock, the bottom 5 percent lose in the U.S. households.

Another group of studies considers a simple Two Agent New Keynesian (TANK) model (Debortoli, Gali, & others, 2017). The TANK model simplifies the HANK model considering two types of households, Ricardian and Keynesian, but does not consider the effect of wealth distribution. Ricardian consumers are assumed to have no constraint in the financial markets, thus are highly responsive to interest rate changes. On the contrary, Keynesian consumers are assumed as "hand-to-mouth" spenders who do not hold assets and consume their entire income every period so that they do not respond to interest rate changes. The model emphasizes the differences in the average consumption between constrained and unconstrained households in financial markets. A common feature of the HANK and TANK models missing in representative agent models is that a certain part of the households face a borrowing constraint and do not have access to financial markets, thus they do not adjust their consumption in response to changes in interest rates. It implies that the economy's response to monetary policy shocks may differ from the standard New Keynesian model with a representative agent.

In addition to the HANK model, some studies that have investigated how monetary policy shocks affect income inequality using methods such as VAR, FAVAR, Panel VAR, and DSGE. These studies show mixed results on the distributional impact of monetary policy for both cases in single country and cross countries studies. But in most cases, tight monetary policy tend to increase income inequality (Table 1).

For the case of Mongolia, there are some empirical studies related to the transmission mechanism of monetary policy. For instance, Demid (2011) studied the bank lending channel of monetary policy transmission in Mongolia using a structural VECM approach for the period between 2004Q1 and 2011Q1. The findings suggest that the transmission of central bank bill rates to bank credit supply operates through the bank's reserve and equity rather than lending rate and concludes that the bank lending channel is effective in Mongolia. Doojav and Batjartgal (2014) studied the cost channel of monetary policy transmission in Mongolia using a Bayesian Dynamic Dtochastic General Equilibrium approach for 2000.Q1-2013.Q4 data. The paper concludes that incomplete pass-through of the money market rate to the bank lending rate weakens the cost channel of monetary policy transmission. Furthermore, Bayarsaikhan et al. (2015) examined monetary policy transmission mechanisms using VAR and OLS models for the sample period from 2002Q1 to 2015Q2. The study found that the interbank market rate has a 1-2 quarter lagged effect on bank lending rate and concludes that bank lending is the most significant channel of monetary transmission for price and output.

The existing studies on monetary policy transmission are concerned with aggregate macroeconomic data, but its redistribution channel has not yet been investigated in Mongolia. This paper contributes to the literature by highlighting the distributional effects of monetary policy shock on different income groups based on micro-level data of households in Mongolia.

4.   Model Description

4.1   Modeling

We replicate an existing model by Auclert (2019) that incorporates the monetary policy and its redistribution channels. The model is constructed as follows:

Households: There is a closed economy with I types of heterogeneous households. Each agent type i has its own discount factor β_i, utility functions u_i and v_i. We assume that there is a mass 1 of individuals within each type i, each in an idiosyncratic state $s_{i,t} \in S_i$. The cross-sectional average of any variable $z_{i,t}$ is $E_I(z_{i,t})$, taken over individual types I and idiosyncratic state S_i. For example, aggregate consumption per capita C_t is equal to average individual consumption $E_I(c_{i,t})$. Each agent i solves the following discrete time consumer problem with the budget constraint.

$$
\begin{aligned}
&max \sum_t \beta_i^t (u_i(c_{i,t}) - v_i(n_{i,t})) \\
&s.t. P_t c_{i,t} = P_t y_{i,t} + W_t n_{i,t} + B_{i,t}^{t-1} + \sum_{s \geq 1} Q_{t+s}^t (B_{i,t+s}^{t-1} - B_{i,t+s}^t) + \\
&P_t b_{i,t}^{t-1} + \sum_{s \geq 1} (q_{t+s}^t) P_{t+s} (b_{i,t+s}^{t-1} - b_{i,t+s}^t)
\end{aligned}
\tag{1}
$$

Here, each agent i in state $s_{i,t}$ has a stochastic endowment of $e_{i,t}(s_{i,t})$ efficient units of work, and receives a wage of $w_{i,t} = e_i(s_{i,t})w_t$ per hour, where w_t is the real wage per efficient hour. By choosing n_{it} hours of work, the agent earns the earned income $w_t e_{i,t} n_{i,t}$. The agent is also endowed with with real unearned income $y_{i,t}$, here $y_{it} = d_{it} - t_{it}$ is total dividends on the firms he owns $d_{i,t}$ net of taxes from the government $t_{i,t}$. Thus, the agent's overall gross-of-tax income is:

$$
Y_{i,t} = w_t e_{i,t} n_{i,t} + d_{i,t}
\tag{2}
$$

There is a fixed supply of aggregate capital K, and a set of N trees that constitutes claims to those firms' profits and capital stock. Each of those trees distributes dividends which, in the aggregate, add up to the sum of aggregate capital income and profits $E_I d_{i,t} = \rho_t K + \pi_t$. The agents also trade nominal government bonds with supply of B_t, and a set of $J - 1$ additional assets with zero net supply that can be nominal and real. Each agent i also trades a subset N_i of the trees, and a subset J_i of the other assets. If both N_i and J_i are empty, agents of type i live hand-to-mouth. In other cases, it is assumed that trading is subject to a type-specific borrowing constraint D_i. To keep the problem well-defined, we assume that the prices of nominal and real bonds prevent arbitrage profits. This leads to a Fisher equation for the nominal term structure:

$$
Q_{t+s}^t = (q_{t+s}^t) \frac{P_t}{P_{t+s}}, \forall t, s
\tag{3}
$$

Firms: There exists a competitive firm producing the unique final good in this economy, in quantity Y_t and nominal price P_t, by aggregating intermediate goods with constant-returns to scale technology. A unit mass of firms j uses the production functions $X_{j,t} = A_{j,t}F(K_{j,t}, L_{j,t})$. Markets for inputs are perfectly competitive, so firms take the real wage w_t and the real rental rate of capital ρ_t as given. These firms sell their products under monopolistic competition and their prices can be sticky. Firm j, therefore, sets its price $P_{j,t}$ at a markup over the marginal cost and it makes real profits $\pi_{j,t}$. Summing across firms $j \in J$, aggregate production is equal to aggregate income:

$$Y_t = E_J[\frac{P_{j,t}}{P_t}X_{j,t}] = w_t E_J[L_{j,t}] + \rho_t E_J[K_{j,t}] + E_J[\pi_{j,t}] \tag{4}$$

Government: A government has nominal short-term debt B_t, spends G_t, and runs the tax-and-transfer system. Its nominal budget constraint is therefore:

$$Q_t B_{t+1} = P_t G_t + B_t - P_t E_I[t_{i,t}] \tag{5}$$

where $Q_t = \frac{1}{R_t}\frac{P_t}{P_{t+1}}$ is the one-period nominal discount rate. There is a simple rule in which the government targets a constant real level of debt $\frac{B_t}{P_t} = \bar{b} > 0$ and spending $G_t = \bar{G} > 0$. Also, the government balances its budget at the margin by adjusting all transfers in a lump-sum manner.

Market clearing: In equilibrium, the markets for capital, labor, and goods all clear, this implies that at all times t:

$$E_J[K_{j,t}] = KE_I[e_{it}n_{it}] = E_J[L_{jt}]E_I[Y_{it}] = Y_t = C_t + G_t \tag{6}$$

Equilibrium also implies market clearing in all $J + N$ asset markets.

Aggregation result: We focus on the response of the consumption to the a perturbation of this environment in which individual gross incomes ∂Y_i, nominal prices ∂P and the real interest rate ∂R change at t=0 only. Therefore, this is convenient to analyze the effect of no persistent and unexpected shock on the consumption. Here $\partial Y = E_I[\partial Y_i]$. At the market clearing for nominal assets, all nominal positions net out, except for that of the government as follows:

$$E_I[NNP_{i,t}] = \bar{b} = -NNP_{g,t}, \forall t \tag{7}$$

and market clearing for all assets implies that:

$$E_I[URE_{i,t}] = Y_t - E_I[t_{i,t}] + \frac{B_t}{P_t} - C_t = G_t + \frac{B_t}{P_t} - E_I[t_{i,t}] = -URE_{gt} \tag{8}$$

where NNP_{gt} and URE_{gt} are the net nominal position and the unhedged interest rate exposure of the government. Equations (7) and (8) are crucial restrictions from general equilibrium as the agent's asset is another liability and net nominal positions and interest rate exposures must net out in a closed economy.

4.2   Definitions of Re-distributional Channels of Monetary Policy

Using the model defined in the previous part, we consider redistribution channels of monetary policy in the total consumption. It leads to partial impact in response to change in income, interest rate and price on the consumption. Following the theorem defines the response of consumption to overall income, price and interest rate's changes.

Theorem 3. To first order, in response to ∂Y_i, ∂Y, ∂P, and ∂R, aggregate consumption changes by:

$$\partial C = E_I[\frac{Y_i}{Y}\widehat{MPC}_i]\partial Y + Cov_I(\widehat{MPC}_i, \partial Y_i - Y_i\frac{\partial Y}{Y}) - Cov_I(\widehat{MPC}_i, NNP_i)\frac{\partial P}{P}$$
$$+(Cov_I(\widehat{MPC}_i, URE_i)) - E_I[\sigma_i(1 - \widehat{MPC}_i)c_i])\frac{\partial R}{R} \tag{9}$$

Theorem 3 holds no relationship of the underlying model generating MPCs and different types of exposures at the micro-level, as well as the relationship between ∂Y, ∂P, and ∂R at the macro level. The cross-sectional moments are measurable in the household-level data, which are informative about the economy's macroeconomic response to a shock, no matter the source of this shock. The coefficients of Theorem 3 illustrates the following:

- $E_I[\frac{Y_i}{Y}, \widehat{MPC}_i]$, *Aggregate income channel* indicates that in response to an expansionary monetary policy, the aggregate income increases, so do the incomes for each group's income.

- $Cov_I(\widehat{MPC}_i, \partial Y_i - Y_i\frac{\partial Y}{Y})$, *Income re-distributional channel* indicates that lower-income households have higher MPCs, and it is likely that monetary expansions increase aggregate consumption due to their endogenous effect on income distribution. Away from separable preferences, an additional complementary channel of monetary policy can arise, even with a representative agent, when preferences are such that increases in hours worked to increase the MPC.

- $Cov_I(\widehat{MPC}_i, NNP_i)$, *Price channel (Fisher effect)* indicates that net nominal borrowers have higher MPCs than net asset holders. This also has an endogenous outcome that shows monetary policy can increase in aggregate consumption via a Fisher channel.

- $Cov_I(\widehat{MPC}_i, URE_i)$, *Interest rate exposure channel* indicates that households with unhedged borrowing needs have higher MPCs than households with unhedged savings requirements. This has an endogenous outcome that the aggregate consumption responds more to real interest rates than the situation with inter-temporal substitution alone.

- $E_I[\sigma_i(1 - \widehat{MPC}_i)c_i]$, *Substitution channel* indicates the standard interest rate channel. Here σ_i ith household income group's discount and we simplify it by giving a value of 0.5 constantly for all the different income groups as in .

5. Data

The key cross-sectional moments described above are derived from income, consumption, assets and liabilities. Here, the Household Socio-Economic surveys (NSO-HSES, 2016-2018) is used to calculate the marginal propensity to consume for each income group. Due to the lack of data on the household balance sheet, we had to integrate the Household Financial Condition survey (BOM-HFCS 2018) by the Bank of Mongolia, in particular, to compute the net nominal position (NNP) and unhedged interest rate exposure (URE) variables. This information about the households was applied in this work as summarized in the Table 2.

Aggregate income for each group Y is computed as the sum of all income sources including two wage sources, pension, income from sales of livestock and related goods or crop production in net of the costs occurred, income from the social insurance and welfare and government's other transfers, rents, sale of fixed asset, receivables, interests, withdrawals from deposits, dividends, gambling gains, and other incomes. C is a sum of all types of expenditures of households, including food, non-food, energy, rents and interest payments, as well as durable goods. We only include a part with share of ϵ (for the benchmark case $\epsilon = 0.75$) of durable goods expenditure in the total household expenditure calculation.

The URE is measured as the total resource flow that the household needs to invest over the first period of this consumption plan, thus A and L represents, respectively, assets and liabilities that mature over the period, over and above the amounts already included Y and C. Net nominal position (NNP) is computed as the difference between directly held nominal assets (deposits and bonds) and directly held nominal liabilities (mortgages and consumer credit).

Table 2
Mapping Model to Data Objects

Variable	Description	Source
	Unhedged interest rate exposure	$URE_i = Y_i - T_i - C_i + A_i - L_i$
Y_i	Gross income (excluding non-agricultural business)	NSO-HSES
T_i	Taxes net of transfer	Assumed to be zero
C_i	Non-durable + Durable (share ϵ)	NSO-HSES
A_i	time and current deposits	BoM-HFCS 2018
L_i	time liabilities	BoM-HFCS 2018
	Net nominal position (NNP)	
Nominal assets	Deposits+Bonds	BoM-HFCS 2018
Nominal liabilities	Mortgages+Consumer debt	BoM-HFCS 2018

5.1   Household Socio-Economic Surveys

The Household Socio-Economic Survey (HSES) has been conducted by the National Statistical Office of Mongolia since 1989. It covers 14 sets of questions on different attributes of households in Mongolia, in particular general demographic information (education, health and employment), income sources (livestock breeding and crops, non agricultural production, trade, services and social protection), main expenditure sources (food, energy, durable goods, and non-food expenditure) and brief information on savings and loans. The surveys of 2016-2018 are applied to estimate the marginal propensity to consume for different income groups.

Table 3
NSO-HSES: Descriptive Statistics (000's MNTs)

| Year	Statistics	N	Mean	Sd	Min	p5	p25	p50	p75	p95	Max
2018	Income	16,361	11,148	10,128	22	2,570	5,246	8,429	13,823	27,220	253,580
	Consumption	16,361	10847	9,050	81	3,096	5,697	8,800	13,273	24,974	259,922
2017	Income	11,172	10,148	8,999	30	2,456	4,800	7,948	12,708	24,680	228,720
	Consumption	11,172	11,536	9,757	3	2,860	5,696	8,931	14,143	28,396	188,899
2016	Income	16,341	8,959	8,061	31	1,995	4,212	7,140	11,312	21,250	244,570
	Consumption	16,341	8534	6587	175	2,486	4,662	7,164	10,483	18,869	197,957

Source: National Statistical Office.

Table 3 reports basic descriptive statistics on household income and expenditures for 2016-2018. In the latest of these surveys for 2018, the average household income and consumption was MNT 11.4 million and MNT 10.8 million respectively. The household income for the bottom 5 percent was around MNT 2.6 million, significantly lower than that of the top 5 percent (MNT 27.2 million) where consumption is 8 times that of the bottom 5 percent. Overall, the median household income has increased from 2016 to 2018, with an average nominal growth rate of 9.0 percent per annum. Simultaneously, median household consumption increased by about MNT 1.6 million between 2016 and 2018. Interestingly, the average household consumption in 2018 was slightly lower than that in 2017. Nominal cross-sectional variation for household's income tends to increase as economy expands expansion.
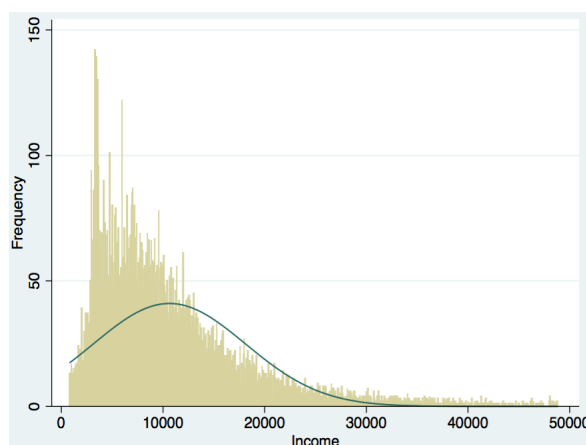
Figure 2
NSO-HSES 2018: Household Income and Expenditure
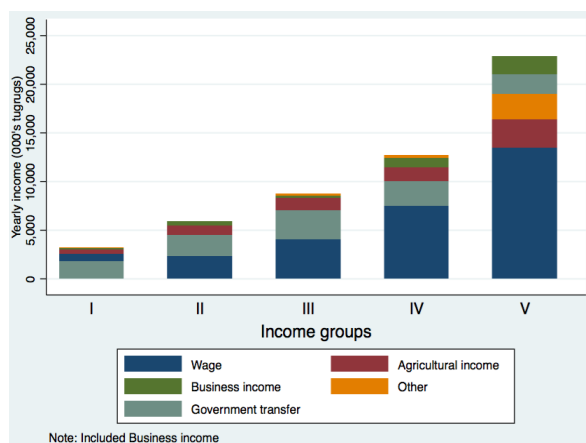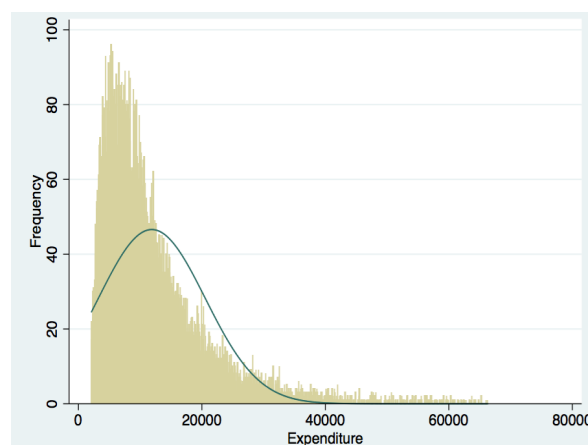

a. **Household Income by Contributions**
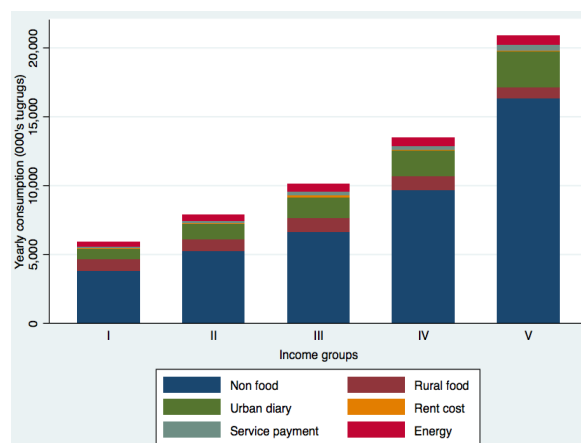
b. **Household Expenditure by Contributions**

a. **Distribution of Household Income**

b. **Distribution of Household Expenditure**

Source: National Statistic Office.

Figure 2 above illustrates the types of income sources and main categories of expenditures for five income groups as of 2018. The average household income for the lowest 20 percent was around MNT 4.0 million and the main source of their income was receipts from government transfer making up 57.2 percent of total household income. Other major sources of income were wages and salaries (23.7 percent), and agricultural income (14.5 percent). The average income for the top 20 percent was about MNT 23.0 million. For this group, wages and salaries is the most important component and accounts for 51.5 percent of household income, followed by agricultural (13.1 percent) and business incomes (13.1percent). Besides, other income such as income from interest, dividends, and others form 11.8 percent of household income for the higher-income groups.

There is a similar pattern for components of household expenditures across the income groups. Among expenditure categories, the share of non-food spending was about 61.0-83.0 percent of the households' total expenditures. Rural-sourced food was also among the major expenditures for the lower two groups of income, making up about 11.0-14.0 percent of their

total expenditures. The households in all groups spend around 10.0-15.0 percent of their expenditures on the urban diary. The remaining consumption comprises of rent and service payments.

The lower panel of the Figure plots the histogram of income and expenditure. The shape of the distribution for both variables is right-skewed indicating that the mass of households is clustered at the bottom half of the median, i.e., a relatively higher proportion of households gets low levels of income, whereas a small part of households earns a higher income in Mongolia.

5.2   Household Financial Condition Survey

The Household Financial Survey (HFCS) has been conducted annually by Bank of Mongolia since 2018. The 2019 data was not made available at the time of this study, hence the decision to merge it with NSO's data was made in order to conduct the necessary analysis for this paper. As mentioned above, this survey was first ever attempt in Mongolia to construct a household balance sheet.

Table 4 summarizes information on the household balance sheet of the survey. It shows evidence of considerable households' heterogeneity in asset and liabilities, despite the income and consumption. Furthermore, URE and NNP are varied widely across households. For example, households in the bottom 25 percentile have noticeably lower levels of assets and net nominal position, compared to those in the top 5 percent of the distribution. In particular, there are negative maturing assets, URE and NNP, as well as no assets and liabilities for the lowest 5 percent of the households. Moreover, the top 5 percent of the distribution holds a considerably higher level of assets and liabilities compared to the median level.

Table 4
BoM-HFCS 2018: Descriptive Statistics (000's MNTs)

Stats	N	Mean	sd	min	p5	p25	p50	p75	p95	max
Net income	2,779	11,925	7,311	480	3,600	7,200	10,200	14,830	25,080	54,000
Consumption	2,779	7,531	4,408	1,095	2,400	4,360	6,520	9,600	16,100	31,100
Maturing assets	2,736	6,038	12,103	-25,100	-5,280	808.5	4,386	8,720	21,320	250,840
Debt repayment	2,736	5,127	32,412	0	0	0	2,568	6,000	12,660	1,206,288
URE	2,736	911	34,154	-1,172,988	-12,060	-2,600	1,201	5,520	17,060	250,840
Asset	2,736	47,360	54,813	0	0	11,000	35,004	70,000	130,000	1,010,000
Liability	2,736	13,549	80,245	0	0	0	3,000	15,000	56,000	4,017,992
Net Nominal Position	2,736	33,811	94,268	3,935,991	-11,700	4,000	24,001	55,000	113,000	999,000

Source: Bank of Mongolia.

6.   Estimation Results

6.1   Marginal Propensity to Consume

The first step in evaluating the distributional impact of monetary policy on consumption is to compute the marginal propensities to consume for different groups. Theoretically, the MPC reflects the change in consumption as household income increases by one unit. For this paper, the marginal propensity to consume for each different income group is calculated by same method used in Auclert (2019).

For each year, households are divided into thousand subgroups indexed as j by their incomes to match the different households in the three different years to each other. At the same time, it is also divided into five main groups, with each representing one type of income group of households indexed as i. We found that the household income and expenditure in Mongolia vary significantly by demographic differences, including house's location and marital status, education and age variations of household head, as shown in Figure 2-3 in the Appendix. These differences must be controlled before calculation of the MPCs to precisely define those changes in the consumption in response to income changes. Therefore, for each subgroup, we run regressions for dependent (y) and independent (c) variables, both in log terms with several dummy variables that represents variations of the location of households, marriage status, and pension status of household heads for each subgroup. The median residuals of these regressions represent each subgroup j's income and consumption for each and are applied to further calculation procedures of the MPC. Finally, the following equations are applied to compute the MPC for each main income group (i):

$$\phi_i = \frac{Cov_i(c_{j,t}, y_{j,t})}{Cov_i(y_{j,t}, y_{j,t+1})} \tag{10}$$

$$MPC_i = \frac{E_i(c_j)}{E_i(y_j)} * \phi_i \tag{11}$$

The results of the MPC calculation differ by our assumption on what share of durable consumption is included in the total consumption computation. Some suggest that durable consumption must be excluded from the MPC calculation. However, finds that inclusion of durable consumption does not change the conclusions of the re-distributional impact on the total consumption. Table 7 in the Appendix summarizes the calculations of MPCs for all five groups with different (ϵ), as well as those coefficients of re-distributional channels on consumption. Our result also suggests there are no significant differences across the different assumptions on the share of durable goods consumption, which is included in the total consumption computation. Having considered this, we assume the share of durable consumption $\epsilon = 0.5$ as our benchmark calculation.

Table 5 compares and summarizes, for the five different income groups, the calculated MPCs using the HSES Survey, and normalized household incomes, unhedged interest rate exposures (URE) and net nominal positions (NNP) by average consumption in 2018 using the HFCS Survey.

Table 5
Main Variables by Different Income Groups

#	Indicator	I (lowest)	II	III	IV	V (Highest)
1	MPC ($\epsilon = 0.5$)	0.16	0.43	0.61	0.20	0.19
2	Normalized income	0.61	1.03	1.37	1.82	3.04
3	Normalized URE	-0.38	-0.35	-0.11	0.20	1.04
4	Normalized NNP	3.64	3.95	4.38	4.43	5.71

Source: Authors calculation.

Except for the highest income group (V), the income gaps between the remaining groups are relatively constant around 0.35 and the average normalized income varies from 0.61 to 1.82. The largest income group, however, earns five times higher than the lowest income group, calculated as 3.04 in normalized term by average consumption in 2018, as well as two times higher than the second largest income group (IV). This suggests that the income distribution of Mongolian households is highly skewed for the highest income group, so that very few households earn a large share of the total income in Mongolia.

Generally, it is expected that the lower income households or "hand to mouth" households tend to have higher MPCs because they consume all of their income while higher income households tend to have lower MPCs since they rather save most of their additional income. However, Mongolian household data reveals a very small MPCs for the lowest income groups (I and II) calculated as 0.16 and 0.43 respectively. This might be because these households are highly indebted - negative normalized UREs are computed as -0.38 and -0.35 respectively, shown in Table 5. It means that their interest-bearing liabilities exceed assets. Mongolia traditionally has experienced relatively high interest rates, so that the interest costs make up a considerable share of household expenditures. Thus, the households with lower incomes may not be able to increase consumption following the increase in income due to their debt pressure. The households data in 2018 shows that 7.0 percent of the total income is for debt repayment for the lowest income group (I), while 2.3 percent for the highest income group.

The largest income group households in Mongolia have relatively small and similar MPCs at 0.20 and 0.19 respectively. This is in line with the theoretical prediction that high income households seem to have lower MPCs. Not only with the high income, they also have positive normalized UREs amounting to 0.20 and 1.04 respectively. Furthermore, these households in the middle income group (III) have the highest MPC of around 0.61 among the various groups. Similarly, this is because these households tend to have relatively balanced URE at -0.11 or less indebted compared to the two lowest income groups.

Finally, we find that except for the largest income group (V), there is not a large variation in the normalized net nominal positions across the remaining four groups. In particular, there is a only slight increase between groups I and II, and groups III and IV, and they are computed as 3.64, 3.94, 4.38, and 4.43, respectively. These indicators lead us to predict a smaller redistributional effect of monetary policy through the Fisher effect which is induced by the asset price change.

6.2   Redistribution Channel

To assess the redistribution impact of monetary policy for Mongolia, we modify Theorem 3 which is specified in the Section 3 in the following equation to compute the partial elasticity coefficients of aggregate consumption due to a temporary change in (i) aggregate income, (ii) price, and (iii) interest rate as (Auclert, 2019) does. The result is summarized in Table 6, where the elasticity coefficient for United States (US) data are presented here for comparative purposes. Here, ϵ_Y, ϵ_P and ϵ_R are redistribution elasticity fo Y, P and R respectively. In addition, $\hat{S}$, γ and $\mathcal{M}$ are the Hicksian scaling factor, income weighted MPS and elasticity of agent i's to relative income respectively.

$$\frac{\partial C}{C} = (\mu + \gamma \epsilon_Y) * \frac{\partial Y}{Y} - \epsilon_P * \frac{\partial P}{P} + (\epsilon_R - \sigma S) * \frac{\partial R}{R} \tag{12}$$

Table 6 shows the seven cross-sectional moments that determine the changes in consumption expressed by Theorem 3 in the equation (9). The two exceptional coefficients are the elasticity of inter-temporal substitution σ_i, which needs to be obtained from other sources, and $dY_i - Y_i \frac{dY}{Y}$, which, in general, depends on the driving force behind the change in output. These include: the income redistribution elasticity ($\epsilon_y < 0$) in Mongolia which was estimated at -0.05. Furthermore, the relative sensitivity (γ) of given group's income to aggregate income was negative for some groups, positive for some, and on average, it was negative (-0.40). These facts suggest that the inequality of income in Mongolia amplifies the effect of monetary policy on the total consumption by changing aggregate income. However, it is significantly lower compared to the one in the United States, reflecting lower income inequality in Mongolia than the US. According to the World Bank data, the GINI coefficients for Mongolia and the US were respectively 32.3 and 41.4 in 2016.

Table 6
Seven Cross-sectional Moments that Determine Consumption

	Formula	Mongolia	US (CES)	Description	Channel
ϵ_Y	$Cov_I(MPC_i, \frac{Y_i}{E_I[c_i]})$	-0.05	-0.25	Redistribution elasticity for Y	Earnings heterogeneity
$\hat{S}$	$E_I[(1 - MPC_i) * \frac{c_i}{E_I[c_i]}]$	0.69	0.65	Hicksian scaling factor	Substitution
ϵ_P	$Cov_I(MPC_i, \frac{NNP_i}{E_I[c_i]})$	-0.03	-0.15	Redistribution elasticity for P	Fisher
ϵ_R	$Cov_I(MPC_i, \frac{URE_i}{E_I[c_i]})$	-0.04	-0.59	Re-distributional elasticity for R	Interest-rate exposure
$\mathcal{M}$	$E_I[\widehat{MPC}_i * \frac{Y_i E_I(c_i}{)}$	0.46	0.51	Income-weighted MPC	Aggregate income
γ	$\gamma_i = \frac{\partial(\frac{Y_i}{Y}-1)}{\frac{Y_i}{Y}-1} \frac{Y}{\partial Y}$	-0.40 (mean)		Elasticity of agent i's to relative income	

Source: Authors Calculation.

Furthermore, the negative price redistribution elasticity ($\epsilon_p < 0$) for Mongolia, which is -0.03 also shows that unequally distributed income and wealth in Mongolia lead to a higher impact of monetary policy on the economy by changing nominal price. Similarly, in the case of Mongolia, the coefficient is much less than in the United States which was calculated as -0.15.

Finally, the interest rate redistribution elasticity ($\epsilon_r < 0$) was negative (-0.04) for Mongolia, which is low compared to the US. Negative value here suggests the amplifying effect of monetary policy tightening on aggregate consumption due to heterogeneity of household income.

Taken together, all these sensitivity coefficients are consistent with the results from theoretical and other empirical research, suggesting that heterogeneity in household income and wealth in Mongolia may have an amplifying effect of monetary policy on aggregate consumption. However, the elasticities we have calculated are relatively small in the absolute sense in Mongolia compared to those calculated for the US. It may be due to the relatively high-income inequality in the US than Mongolia. The signs of the effects are consistent in these countries.

7.   Concluding Remarks

This study investigated the redistribution channels of the monetary policy transmission mechanism in Mongolia using a simple heterogeneous-agent model for household-level income, expenditure and balance sheet data. The main finding of this study is that the monetary policy in Mongolia, depending on the level of financial and capital positions, has a different impact on the consumption of various income groups. This is due to different marginal propensities to consume (MPC).

Results show that monetary policy tightening tends to increase the vulnerability of the poor and highly indebted households. This, in turn, reduces aggregate incomes as well as increases the interest expenditure of these families. In this worsened situation, the households borrow more to sufficiently finance their living costs which later increases their interest rate pressure on their financial positions even further. At the same time, the borrowing rate, which is currently over 20 percent in Mongolia, is pushing these households to have a relatively small MPC due to the high substitution cost. This fact is unique for Mongolia as the MPC is usually high in lower income families in general cases.

Conversely, besides the lower MPC or higher tendency to save, the high-income households have higher positive net interest-bearing assets. This helps them to earn higher interest income in response to strict monetary policy although there is reduced aggregate income in the economy. Thus, monetary policy tightening tends to have a relatively less negative effect for these households.

We also find that heterogeneity of household income, interest bearing asset and wealth amplifies the monetary policy effect on the Mongolian economy through the redistribution channel. However, this channel is not as strong as the United States. The redistribution channel composes three different components, including the interest rate, price and income channels.

In particular, the small and negative correlation between MPC and unhedged interest rate exposure suggests that monetary policy tightening tends to reduce aggregate consumption more than the case of no heterogeneity in the household interest-bearing assets. Additionally, there is a negative and small relation between the MPC and the NNPs or household nominal wealth, which is likely to increase the impact of the Fisher effect. Finally, due to the small negative relation between household income and the MPC, there is a tendency for the effects of monetary policy shock to be slightly amplified when high heterogeneity in the household income occurs.

In conclusion, income and wealth inequality has a significant impact on the monetary policy transmission mechanism. Monetary policy tightening is redistributing resources from the group with low income to the group with high income through the redistribution channel. Finally, we also conclude that it is necessary to use heterogeneous-agent models for studying monetary policy and their transmission mechanisms for Mongolia. In particular, the monetary policy authority should take this fact into account when it increases its policy rate, considering its redistribution effect and biased impacts on different income groups.

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Appendix

Figure 3
NSO-HSES 2018: Household Income by Factors

a. by Pension Status of Household Head
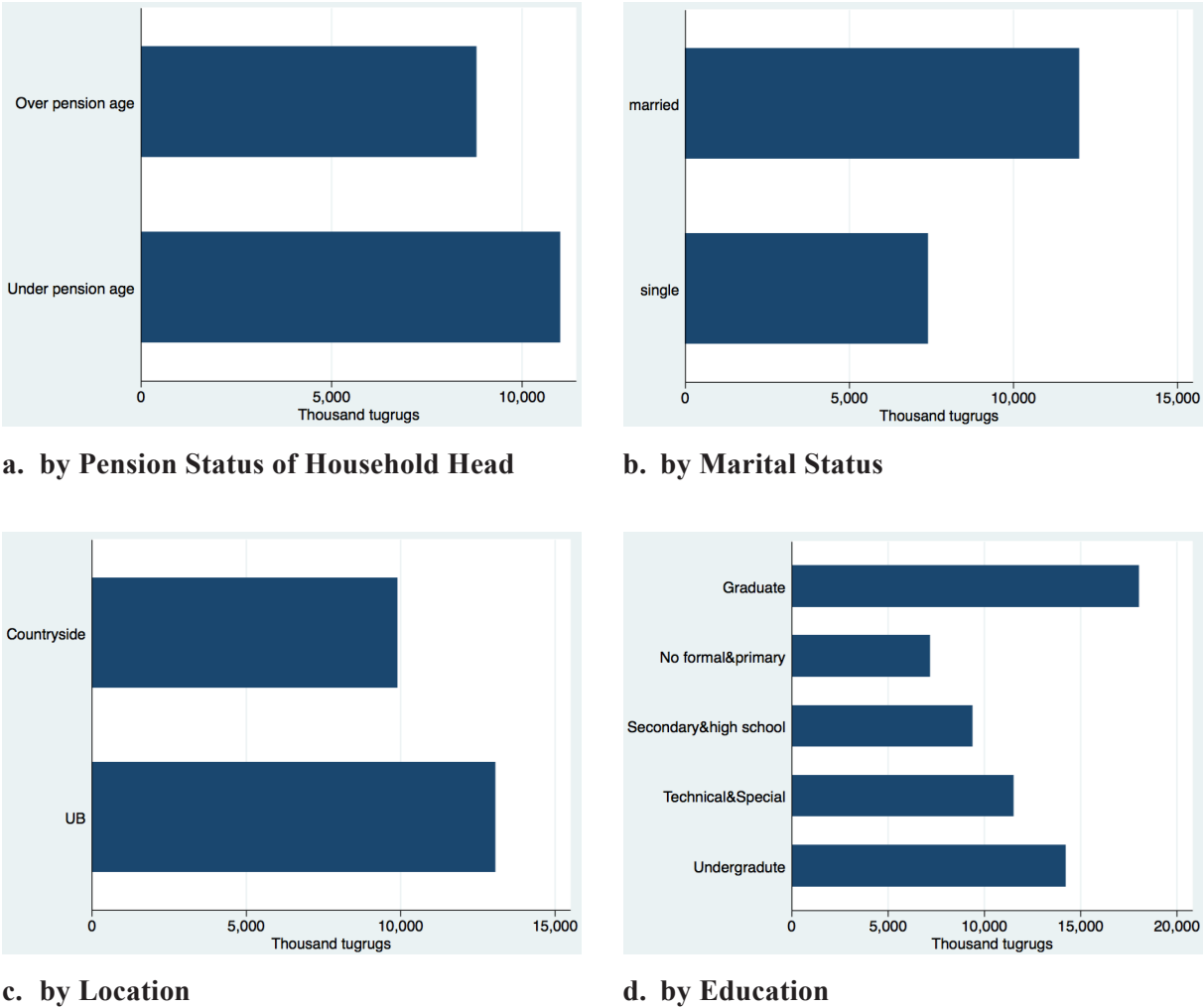

b. by Marital Status

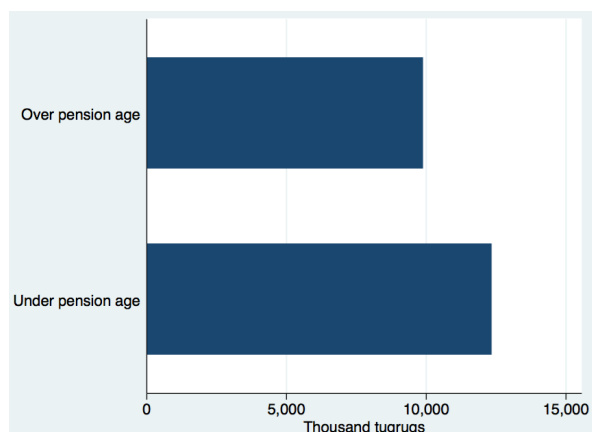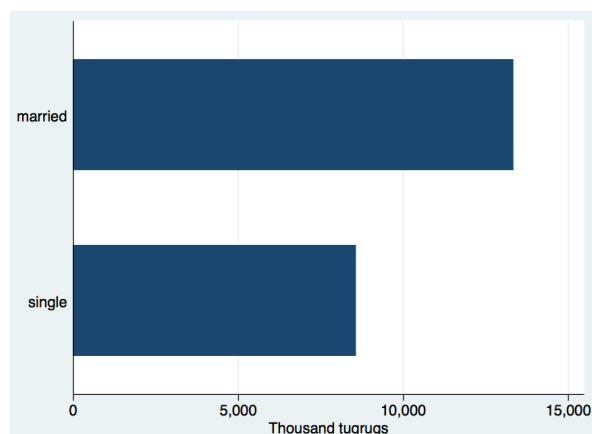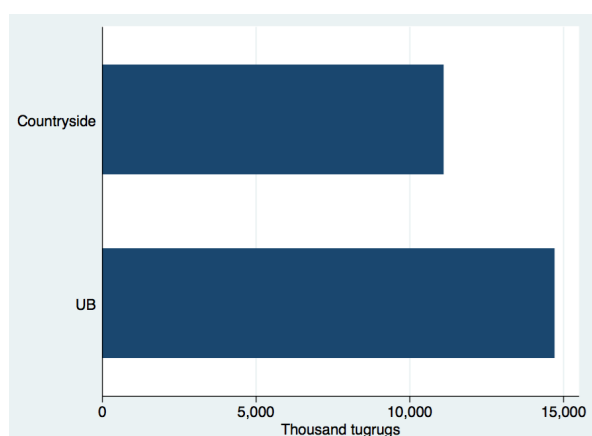

c. by Location

d. by Education

Figure 4
NSO-HSES 2018: Household Expenditure by Factors
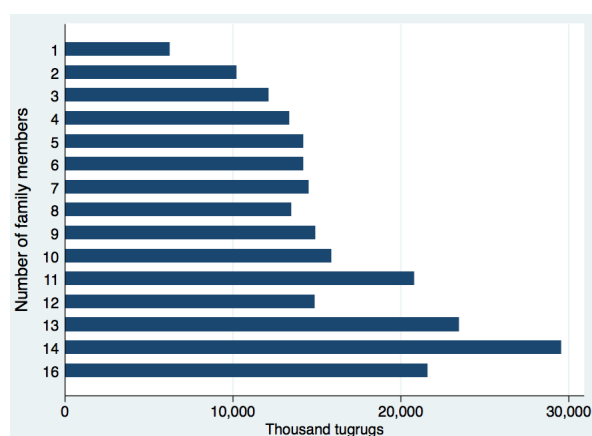

a. by Pension Status of Household Head

b. by Marital status

c. by Location

d. by household size

Table 7
MPC and Elasticities' Calcuations (ϵ)

Indicator	$\epsilon = 0.00$	$\epsilon = 0.25$	$\epsilon = 0.50^*$	$\epsilon = 0.75$	$\epsilon = 1.00$
Marginal propensity to consume					
Group 1	0.17	0.17	0.16	0.17	0.15
Group 2	0.44	0.44	0.43	0.46	0.47
Group 3	0.68	0.61	0.61	0.60	0.66
Group 4	0.24	0.21	0.20	0.20	0.20
Group 5	0.30	0.24	0.19	0.21	0.19
Redistribution channels and coefficients					
Income weighted MPC $\mathcal{M}$	0.57	0.50	0.51	0.48	0.49
Elasticity of agent i's to relative income γ	-0.43	-0.40	-0.40	-0.21	-0.32
Hicksian factor $\hat{S}$	0.63	0.67	0.69	0.68	0.67
ϵ_y	-0.01	-0.03	-0.05	-0.05	-0.05
ϵ_p	-0.004	-0.02	-0.03	-0.03	-0.03
ϵ_r	-0.02	-0.03	-0.04	-0.04	-0.05

Source: Authors calculation.