On the Effectiveness of Insurance Mechanisms for the Elderly in China

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Regional Conference on Health and Socioeconomic Well-Being of Older Persons in Developing Asia: Role of Individual and Household Data
September 8, 2021

Background

- China has been aging at one of the fastest speeds around the globe (UN World Population Prospects, 2019)
- Yet, LTC and pension systems in China are still developing, making informal care and insurance critical (Hu, 2019).

- "What is the extent of sub-optimality of insurance mechanisms?"
- "Can the conventional test strategy, i.e., consumption smoothing across time and space (individuals), really tell efficiency of broad insurance?"

What do we do?

- To investigate effectiveness of insurance mechanisms against a variety of health shocks on well-being of the elderly (death of spouse; hospitalization; physical health deterioration; cognitive capacity deterioration)
- To perform the conventional consumption smoothing tests against health shocks
- To explore (self-insurance) mechanisms against health shocks
- To examine welfare impacts of consumption and self-insurance
- To check the (sub)optimality of insurance mechanisms
- (We believe the last two are novel)

Related literature I

- Potential needs of LTC
  - Projection of future demand for and necessary public expenditure on LTC services under different assumptions (Wittenberg et al., 2006; Zeng et al., 2015; Chung et al., 2009; Lou et al., 2014; Hu, 2019)
- Features of informal care givers and receivers
  - Ichimura et al, 2017: The elderly in Korea is more depressed than those in Japan and China but economic and social supports soften depressive symptoms;
  - Yuda and Lee 2016: In Japan, declining informal caregivers' health adversely affects care recipients' health;
  - Kim and Lim, 2014: In Korea, formal LTC is a substitute for informal care at the intensive margin, but not extensive margin;
  - Kondo and Shigeoka, 2013: In Japan, introduction of Universal Health Coverage (UHC) substantially increased health care demand and utilization, necessitating the government's significant financial response to the surge in the health care expenditures;
- Public transfers may crowd out private transfers, leading to weak net impacts
  - Kim and Lim, 2014: Subsidy for formal LTC crowds out private spending;
  - Finkelstein et al 2006, 2008, 2009, 2011: Crowding-out effect of medicaid; Oregon insurance experiment;
  - Cox 1987; Cox et al 1998, 2004: When private transfers occur among altruistically linked network, the crowding out effect can be large.

Related Literature II

- Motives behind private transfers
  - Altruism or warm-glow: Andreoni et al 1990, 2006, 2009; Engel, 2011; Kuroishi and Sawada, 2019
  - Imrohoroglu and Zhao 2018; OCP increases the net saving rate in China; Overlapping Generation Model with altruism;
- One Child Policy (OCP) and private transfers in China
  - Cai et al 2006: Altruistic motive for transfers at low levels of income, and transfer response is not sufficient to fully cover shortfalls;
  - Cameron et al 2013: OCP makes children less competitive, trust-worthy, trust other people, and less risk-taking;
  - Liu 2013: Quality-quantity trade-off;
- Overall consumption insurance mechanisms in intertemporal and cross-sectional dimensions (Zhang and Ogaki, 2004, JBES)
  - LC-PIH: Jappelli and Pistaferri, 2017 "Economics of Consumption: Theory and Evidence";
  - Complete consumption insurance or RSH: Mace, 1991 JPE, Cochrane, 1991 JPE, Townsend 1994 Econometrica; Hayashi et al., 1996 Econometrica; Ogaki and Zhang, 2001, Econometrica; Dubois et al. 2008 Econometrica; Attanasio and Pavoni 2011 Econometrica; Laczo, 2015, JEEA; Kinnan, 2020, JHR;
  - Welfare impacts of unemployment shock in the US and Indonesia: Chetty and Looney, 2006, 2007.

Data

- The dataset we used is China Health and Retirement Longitudinal Study (CHARLS)
  - A nationally representative panel of Chinese people above 45 years old. Baseline in 2011 including about 17,500 individuals in 150 counties and 450 villages, followed in 2013, 2015, and 2018.
  - "HRS Family" data: The field data collecting and data structure is comparable to the Health and Retirement Study (HRS) in the U.S..
  - CHARLS Harmonized data is available on `https://g2aging.org/`
- Information used from CHARLS
  - Four waves data from 2011, 2013, 2015, and 2018 in 126 cities;
  - Demographics;
  - Income, consumption, saving, and borrowing;
  - Deterioration of health (death of spouse, etc.);
  - Subjective well-being and depression;
  - (Intergenerational contact, interaction, and financial transfer)

Overall Insurance Effectiveness in Two Popular Models

- LC-PIH and RSH: Both models reduce to a similar econometric model
  - With log-linearlization or CRRA utility, a consumption growth equation
  - "Variable addition tests" by including shock variables on RHS

- MODEL I: Life-Cycle Permanent Income Hypothesis (LC-PIH)
  - An individual's intertemporal utility maximization problem:

$$\max E_t \sum_{s=t}^{\infty} \left(\frac{1}{1+\delta}\right)^{s-t} U(c_s)$$

$$s.t \sum_{s=t}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} (c_s - W_s) \leq A_t, A_t \, given$$

  - The consumption Euler equation as a necessary condition of LC-PIH. This is a condition of intertemporal consumption smoothing:

$$U'(c_t) = \frac{1+r}{1+\delta} E_t U'(c_{t+1})$$

  - With CRRA utility function, we obtain an estimable equation of consumption growth. LC-PIH implies $\beta_1 = 0$:

$$\Delta log\, c_{it} = \beta_0 + \beta_1 S_{it} + \delta_{city} + \delta_{year} + u_{it}$$

Overall Insurance Effectiveness in Two Popular Models

- MODEL II: Full Consumption Risk-Sharing Hypothesis (RSH)
  - Complete consumption risk-sharing within an insurance network with N members by a social planner problem:

$$\max \sum_{j=i}^{N} \lambda^j E_t \sum_{s=t}^{\infty} \left(\frac{1}{1+\delta} \right)^{s-t} U(c_{js})$$

$$s.t \sum_{j=1}^{N} c_{js} \leq \sum_{j=1}^{N} W_{js}, \forall s$$

  - Cross-sectional marginal utility equalization as the necessary condition:

$$\lambda^i U'(c_{it}) = \lambda^j U'(c_{jt})$$

  - With CRRA utility function and city-specific insurance network, we obtain an estimable equation of consumption growth. RSH implies $\beta_1^R = 0$:

$$\Delta log\, c_{it}^R = \beta_0^R + \beta_1^R S_{it} + \delta_{City}^R + \delta_{year}^R + u_{it}^R$$

Definitions of variables

Health shock variables:

death_spouse	death of spouse within 2011, 2013, 2015, or 2018;
inpatient	hospitalization last year;
dadl_6item	worsening of Activity of Daily Lives (ADL);
dmobility_lower	worsening lower body mobility;
dmobility_upper	worsening upper body mobility;
dmemory_iword	worsening of memory (word recalling);
dmemory_7serial	worsening of memory (7-serial number downward counting);

Outcome variables:

dlnconsumption_food $log(c_{t+1}^{food}) - log(c_t^{food})$

dlinconsumption_nofood $log(c_{t+1}^{nonfood}) - log(c_t^{nonfood})$, communication fee, utilities, fuels, fee for housekeeper, local transportation, household items, and entertainment;

dlnconsumption_other $log(c_{t+1}^{other}) - log(c_t^{other})$, clothing and bedding, traveling, heating, furniture, education, medical, beauty, automobiles, electronics, property management fee;

lncash_saving cash saving;

lndebt borrowing;

life_dissatisfaction 5-scale subjective assessment of life (dis)satisfaction;

CESD 20-item scale CES-D depression score

Consumption Smoothing Test Across Time and Space (Individuals)

VARIABLES	(1) dlnconsumption_food	(2) dlnconsumption_nofood	(3) dlnconsumption_other	(4) dlnexp_inpatient_oop
death_spouse	-0.351***	-0.167**	-0.341**	0.130
	(0.112)	(0.0794)	(0.151)	(0.144)
inpatient	-0.0163	0.0365	0.491***	6.430***
	(0.0399)	(0.0243)	(0.0497)	(0.136)
dadl_6item	0.00808	0.0112	0.0292	0.121***
	(0.0184)	(0.0121)	(0.0239)	(0.0440)
dmobility_lower	0.00542	0.0102	0.0563***	-0.0494
	(0.0173)	(0.00839)	(0.0171)	(0.0465)
dmobility_upper	-0.0415	-0.0125	-0.0383	0.0539
	(0.0278)	(0.0146)	(0.0273)	(0.0448)
dmemory_iword	0.0332*	0.0178***	0.0338***	-0.0125
	(0.0184)	(0.00512)	(0.0119)	(0.0102)
dmemory_7serial	0.00118	0.00375	0.0160	-0.00257
	(0.00869)	(0.00408)	(0.0108)	(0.0135)
Constant	1.136***	0.553***	0.0353	0.645
	(0.245)	(0.109)	(0.229)	(0.451)
City&Year FE	✓	✓	✓	✓
Controls	✓	✓	✓	✓
Observations	21,720	23,459	23,266	28,693
R-squared	0.053	0.021	0.017	0.308

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Insurance Mechanisms Identified by Health-Shock Coping Behavior

An individual's intertemporal budget constraints (consumption equals income minus saving): $c_{it} = y_{it} - s_{it}$. From this, we can derive consumption "finance" equation approximately:

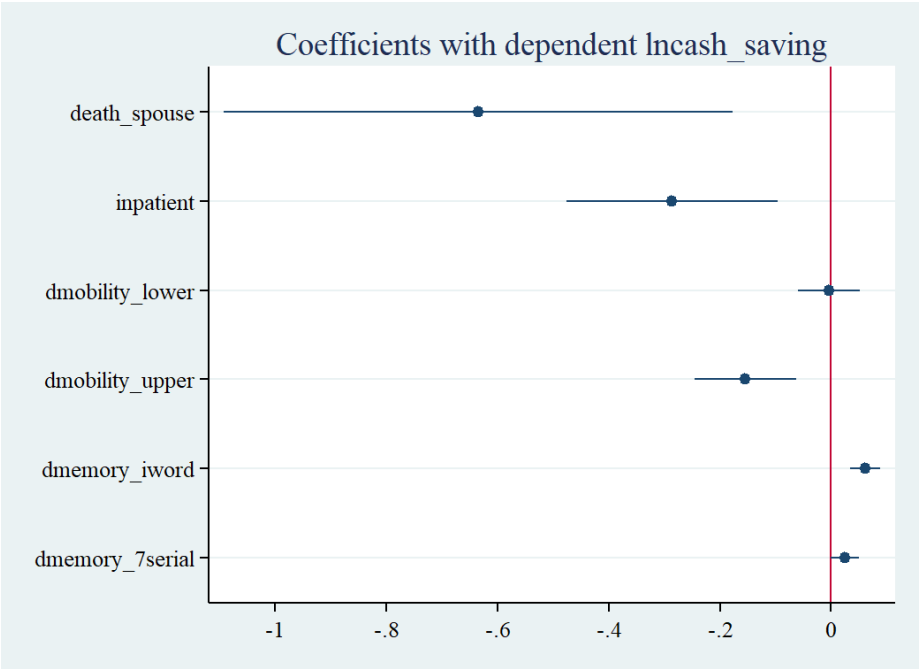
$$\Delta log\, c_{it} = \Delta log\, y_{it} - \Delta\, log(s_{it}/y_{it}).$$

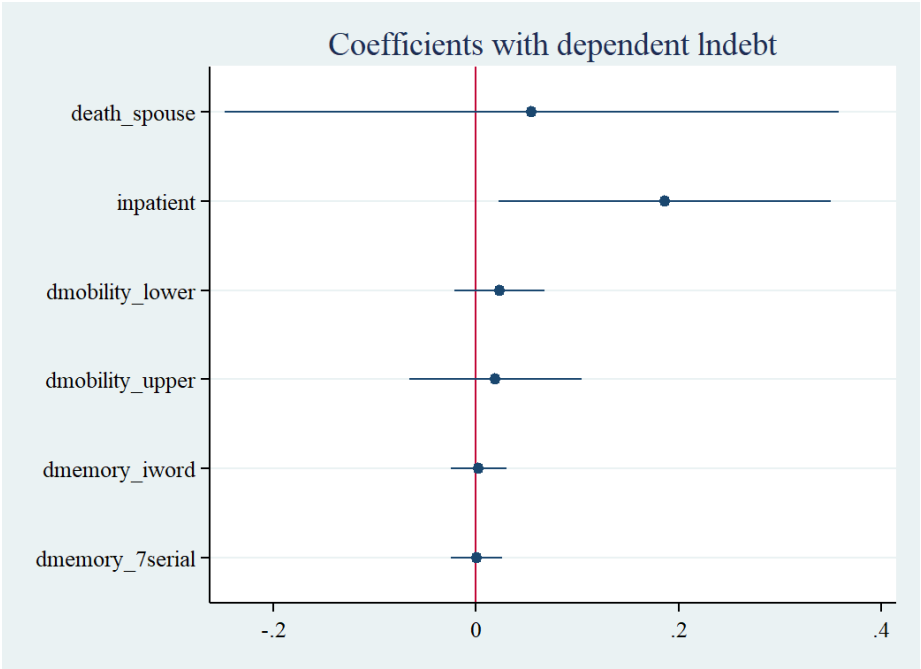
The RHS is a collection of private transfers, public transfers, and dissavings which finance consumption changes. With the consumption growth equation of LC-PIH and RSH, we can derive coping mechanism equations:

$$Y_{it}^k = \beta_0^k + \beta_1^k S_{it} + \beta_2^k X_{it} + \delta_{city}^k + \delta_{year}^k + \varepsilon_{it}^k$$

- Y_{it}^k A coping mechanism k which collectively finance consumption growth (particularly, saving and borrowing)
- S_{it} Shock variables
- X_{it} Demographics and family controls.
- δ_{it} Region and time fixed effects.
- ε_{it} Idiosyncratic error.

Coping Behavior: Dissaving (left) and Borrowing (right)





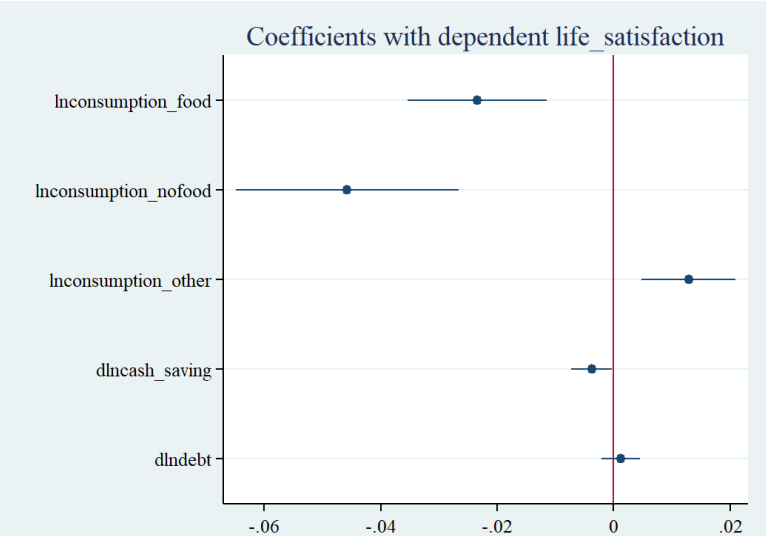
Overall Welfare Impacts

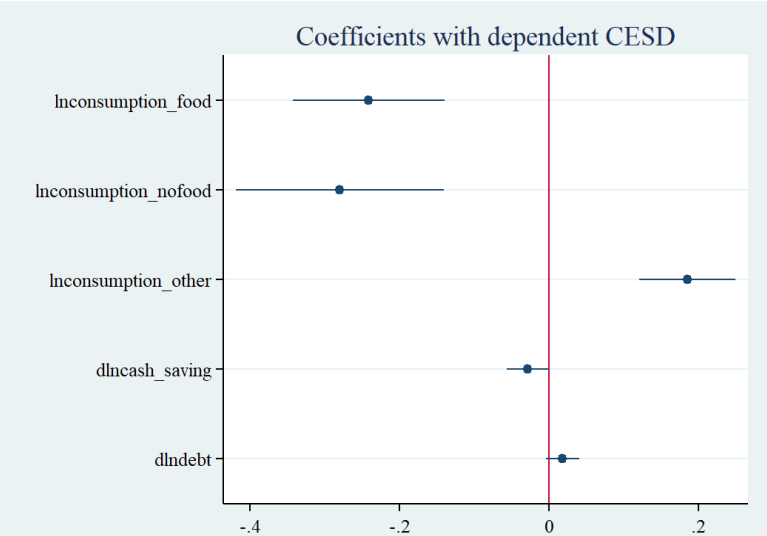
We follow Chetty & Looney (2006) to postulate welfare function (utility from consumption minus disutility from dissaving and borrowing):

$$W(c, \Delta s, \Delta d) = \alpha_1 log(c^{food}) + \alpha_2 log(c^{nonfood}) + \alpha 3 log(c^{other}) + \eta_1 \Delta s + \eta_2 \Delta d + \varepsilon, \quad (1)$$

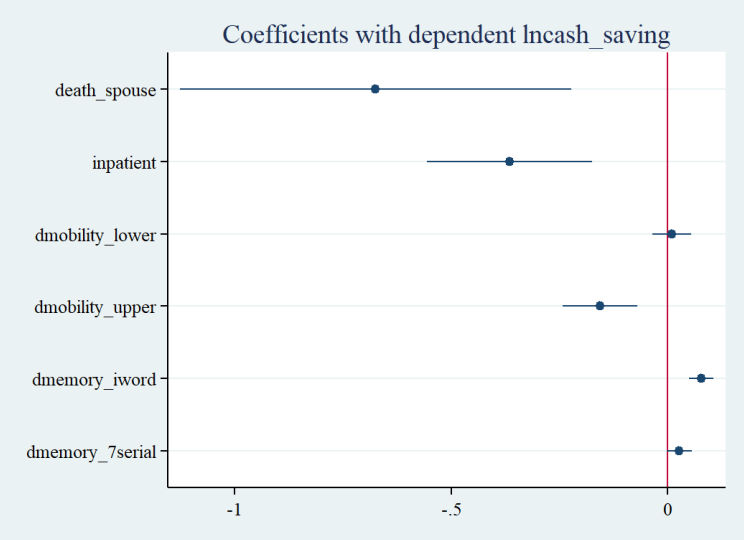
Welfare impacts of consumption, saving, and borrowing

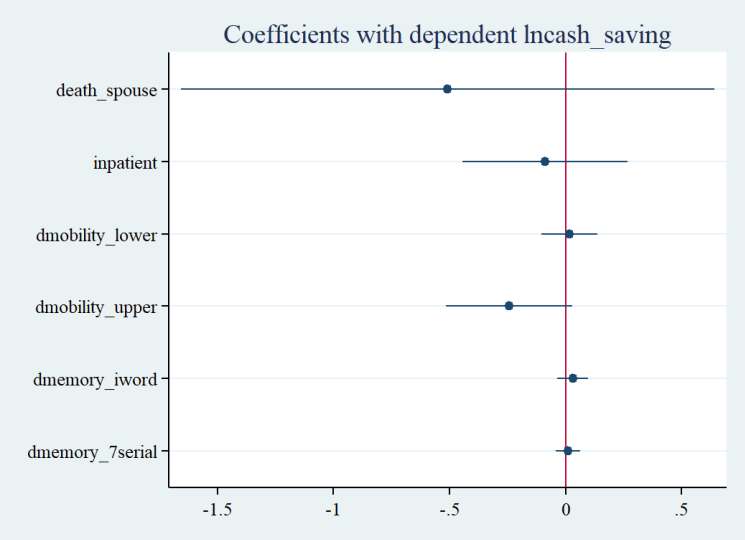
VARIABLES	(1) life_dissatisfaction	(2) life_dissatisfaction	(3) life_dissatisfaction	(4) CESD	(5) CESD	(6) CESD
lnconsumption_food	-0.021***	-0.020***	-0.023***	-0.309***	-0.303***	-0.241***
	(0.006)	(0.006)	(0.006)	(0.052)	(0.052)	(0.051)
lnconsumption_nofood	-0.037***	-0.037***	-0.046***	-0.385***	-0.384***	-0.280***
	(0.009)	(0.009)	(0.010)	(0.071)	(0.071)	(0.070)
lnconsumption_other	0.013***	0.013***	0.013***	0.145***	0.147***	0.185***
	(0.004)	(0.004)	(0.004)	(0.033)	(0.033)	(0.033)
dlncash_saving		-0.004**	-0.004**		-0.043***	-0.029**
		(0.002)	(0.002)		(0.014)	(0.014)
dlndebt		0.001	0.001		0.018	0.018
		(0.002)	(0.002)		(0.012)	(0.011)
City&Year FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Observations	15,880	15,880	15,880	15,880	15,880	15,880
R-squared	0.076	0.077	0.082	0.095	0.096	0.139



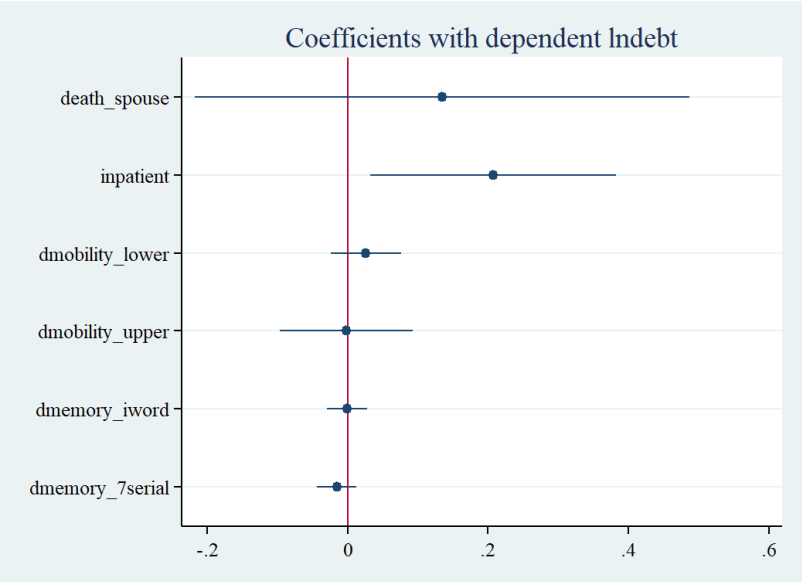


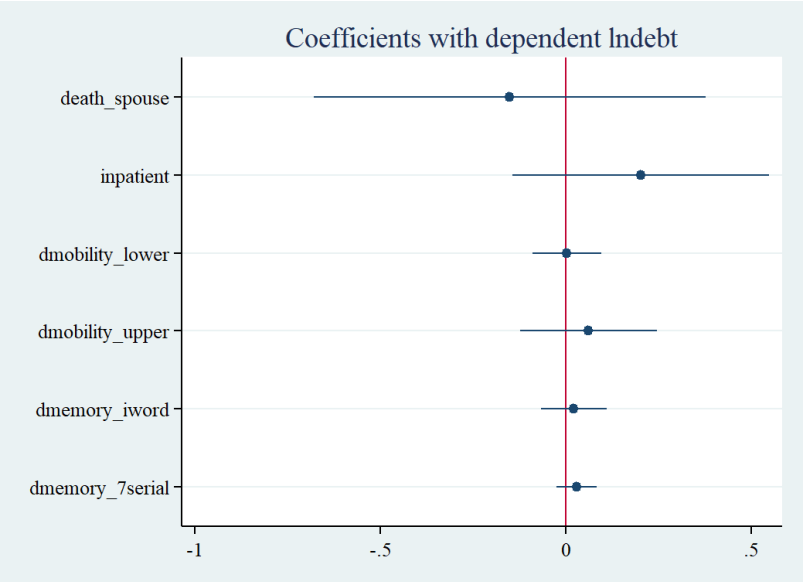
Coping Behavior: Rural (left) vs. Urban (right)





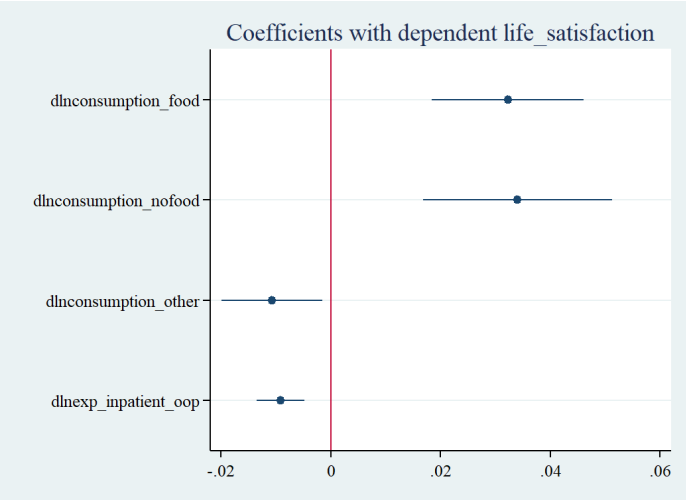
The effects of negative health shocks on saving

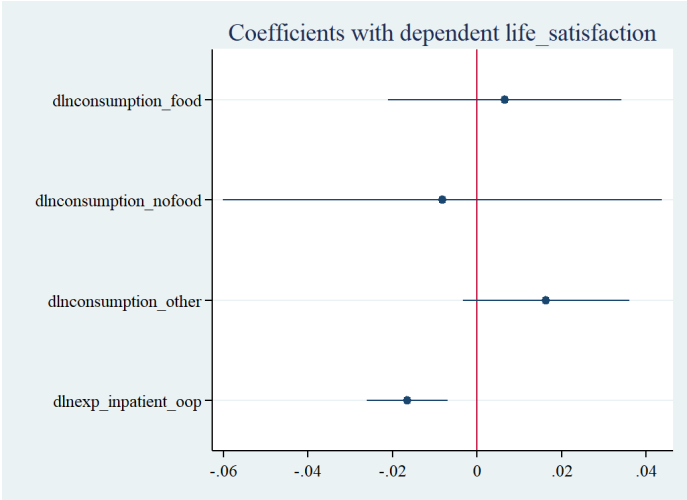




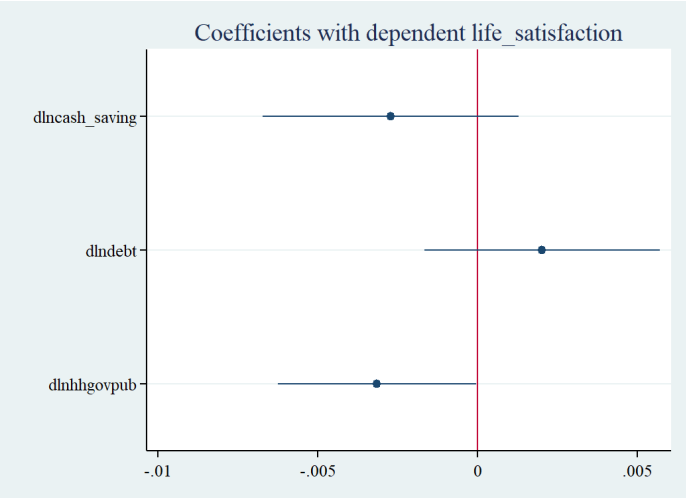
The effects of negative health shocks on debts (borrowing)

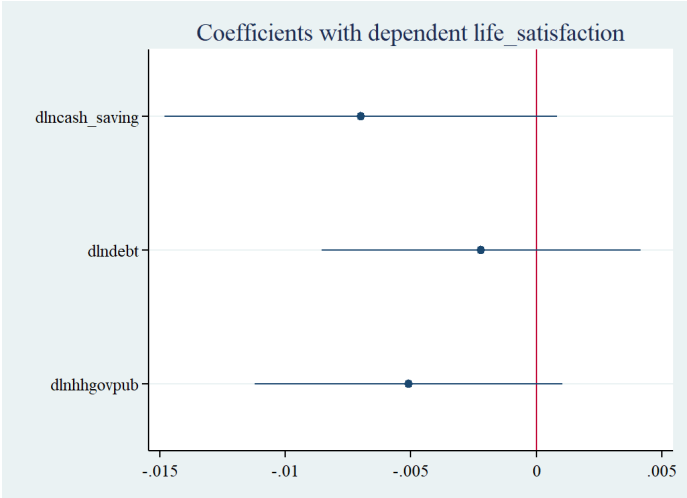
Overall Welfare Impacts: Rural vs. Urban





Rural (left) vs. urban (right) negative shocks on life satisfaction (consumption)





Rural (left) vs. urban (right) negative shocks on life satisfaction (savings)

Optimality of Social Insurance

- We follow Chetty and Rooney (2007) to check optimality of insurance
- Marginal welfare gain from getting access to formal insurance mechanism: $\Delta W = \gamma \Delta c/c$ where γ is coeff of RRA.
- Employ Ogaki and Zang (2001) DRR utility function: $\frac{(c-a)^{1-\alpha}}{1-\alpha}$
- Then $\gamma = \alpha \frac{c^{1-\alpha}}{c-a}$
- Welfare: $W(c, \Delta s, \Delta d) = \frac{(c-a)^{1-\alpha}}{1-\alpha} + \eta_1 \Delta s + \eta_2 \Delta d,\ \eta_1 > 0, \eta_2 < 0,\ \alpha \geq 1.$
- Theoretically speaking (Chetty and Rooney, 2006), each individual will select the following optimal consumption growth path when encountering a health shock: $\Delta c/c = 1 - \frac{\theta + a}{1+a}$ where $\theta = -\eta_1^{-1/\alpha}$ or $\theta = \eta_2^{-1/\alpha}$.
- Observed consumption smoothing against a health shock can be attributed to large value of θ which can be caused either by:
  - Small welfare cost of utilizing risk coping via dissaving or borrowing with small η_1 or η_2.
  - Large α or large RRA (γ) can also make smaller consumption growth. The marginal welfare gain from getting access to formal insurance mechanism, i.e., $\Delta W = \gamma \Delta c/c = \gamma(1 - \frac{\theta+a}{1+a})$ can still be substantial despite small consumption growth.

Quantitative Assessment of Welfare Losses due to the Lack of Social Insurance

Welfare loss due to the use of debt (left) and dissavings (right) to cope with health shocks

Remarks

- We found reasonable consumption smoothing against health shocks: The conventional tests supports full consumption insurance across time and individuals for essential consumption items by our data.
- The coping measures used by the individuals are closely associated with mental stress outcomes.
- Our results show the welfare costs of weathering health shocks are not necessarily small especially in rural areas because of the use of high-cost risk coping measures of borrowing and dissaving.
- Our results suggest that strengthened social safety nets can be welfare enhancing even when consumption is not very sensitive to shocks.