The Role of the Peer Effect in Forming Pension Expectations among the Middle-Aged: Existence and Mechanisms

Online Appendix

Appendix A

We define the statutory pension benefit as the benefit at the expected retirement age (i.e., 60 years), according to the Resident Basic Pension (RBP) pension benefit calculation rules and the individual contribution information. We notice that four programs emerged during the evolution of the RBP: Old Rural Resident Basic Pension (ORRBP), New Rural Resident Basic Pension (NRRBP), Urban Resident Basic Pension (URBP), and RBP. Because the ORRBP is significantly different from the other three programs in pension benefit calculation rules, individuals in our sample are grouped into two categories: Type 1 participants refer to those who never participated in ORRBP but participated in one of the other three programs; Type 2 participants refer to those who participated in both ORRBP and one of the other three programs. We calculate the statutory pension benefit for these two types of participants separately.

A1 Statutory pension benefit

For Type 1 participants, the statutory pension benefit is the sum of two components: individual account pension benefit (IPB) and basic pension benefit. The formula to compute the statutory pension benefit ($P_{RBP}^{statutory}$) is the following[1]:

$$P_{RBP}^{statutory} = \underbrace{\frac{1}{139} \times \sum_{t=Year_c}^{Year_R} \left[Contribution_t \times \prod_{j=t}^{Year_R} \left(1 + r_j\right) \right]}_{IPB} + BPB$$

where $Year_R$ and $Year_c$ refer to the pension eligibility year and the year of beginning participation in the pension program, i.e., NRRBP, URBP, or RBP, respectively; $Contribution_t$ refers to the contribution level in year t, which includes individual contributions, government subsidies, and collective subsidies; r_j refers to the interest rate in year j.

The individual pension benefit is determined by contribution years, pension eligibility age, and

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[1] The contribution and benefit rules follow Document No. 32 of the State Council in 2009, Document No. 18 of the State Council in 2011, and Document No. 8 of the State Council in 2014.

contribution level. We assume that the RBP participant will contribute the same amount[2] until the pension eligibility age is reached. The minimum amount of the basic pension benefit was 55 Yuan per month when NRRBP and URBP were first established, which increased to 70 Yuan per month in 2014, and further increased to 88 Yuan per month in 2018.[3] An individual can only choose one public pension program in which to enroll. We take the highest amount as the annual contribution in case the individuals report multiple program participation by mistake. We also assume that the participant needs to make a supplementary contribution in the last year if they have fewer than 15 years of contributions. We assume collective subsidies are 0 if not reported since collective subsidies are not statutory, and we assume the government subsidies follow the following rule[4]:

$$Government\_subsidies_t = 30 + \left\| \frac{Individual\_contribution_t - 100}{100} \right\| \times 8$$

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[2] The contribution levels set by the central government are {100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000, 1,500, 2,000}Yuan, while some respondents report contributions of less than 100 Yuan. This is probably because individual contributions are subsidized by the government, the community, or others. Document No. 32 of the State Council in 2009 documents that, "For the poor and the severely disabled group in rural areas, the local government should subsidize part of or all of the individual contribution according to the lowest level required by the central government." Therefore, we set the contribution level as 100 Yuan if the reported contribution level is less than 100 Yuan. Some respondents report contribution over the maximum contribution level shown in Table A.1. We set the contribution level as the reported contribution level divided by contribution years. We also winsorize the extreme values of the reported contribution level at 95% and the results remain consistent.

[3] We assume that the minimum basic pension benefit after 2019 increases at the same average growth rate over 2014–19. To reduce the estimation bias of the statutory pension benefit under this assumption, we restrict our sample to individuals who will retire before 2033. We also repeat our empirical analysis with the sample of individuals whose retirement year is before 2020 and our results remain consistent.

[4] Document No. 32 of the State Council in 2009, Document No. of the State Council in 2011, and Document No. 8 of the State Council in 2014 all document that the government should contribute according to the individual's contribution: "the government contribution is no less than 30 yuan/year and increases by the individual contribution level. The detailed contribution rule is decided by local government." Document No. 8 of the State Council in 2014 also documents that the government contribution is no less than 60 yuan/year if the individual contribution is more than 500 yuan/year. In practice, the local government often chooses a stepwise contribution policy. Therefore, we use the linear interpolation method to identify the government contribution with the assumption that it increases by 8 yuan/year if the individual contribution increases by 100 yuan/year, and the minimum government contribution is 30 yuan/year for the minimum individual contribution of 100 yuan/year.

Table A.1. Maximum annual contribution, by province and year (yuan)

Province	2011	2013	2015	2018
Anhui	1,000	1,000	3,000	3,000
Beijing	7,420	7,420	9,000	9,000
Fujian	2,000	2,000	3,000	5,000
Gansu	1,000	1,000	2,000	2,000
Guangdong	1,000	3,600	3,600	4,800
Guangxi	1,000	1,000	2,000	2,000
Guizhou	1,000	1,000	2,000	2,000
Hebei	1,000	1,000	3,000	3,000
Henan	2,000	2,000	5,000	5,000
Heilongjiang	1,000	1,000	2,000	2,000
Hubei	1,000	1,000	2,000	2,000
Hunan	1,000	1,000	3,000	3,000
Jilin	1,000	1,000	2,000	2,000
Jiangsu	1,200	1,200	2,500	2,500
Jiangxi	1,000	1,000	2,000	3,000
Liaoning	1,000	1,000	2,000	2,000
Neimenggu	1,000	1,000	3,000	3,000
Qinghai	1,000	2,000	3,000	4,000
Shandong	1,000	5,000	5,000	5,000
Shanxi	1,000	1,000	2,000	2,000
Shannxi	1,500	1,500	2,000	2,000
Shanghai	2,300	2,300	3,300	5,300
Sichuan	1,000	1,000	3,000	3,000
Tianjin	3,840	3,300	3,300	3,300
Xinjiang	1,000	1,000	3,000	3,000
Yunnan	1,000	1,000	2,000	2,000
Zhejiang	1,000	1,000	2,000	2,000
Chongqing	1,000	1,000	2,000	2,000

Note: The data are from the Municipal Human Resources and Social Security Bureau. The data for Hainan, Tibet, and Ningxia are not reported here since the China Health and Retirement Longitudinal Study does not cover these three provinces. The contribution level in this table is a nominal value.

The pension eligibility age is 60 years, as stated in the official documents (State Council, 2009; 2011; 2014), and the respondent reports the year of beginning participation in the RBP.[5] We can calculate the respondent's pension eligibility year accordingly with this information. The interest rate is set as the one-year fixed deposit rate released by the People's Bank of China, as shown in Table A.2.

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[5] Since the NRRBP and URBP were established in 2009 and 2011, respectively, we adjust the year of participation in these two programs to 2009 and 2011 if the individual reports beginning participation in these programs before the establishment year. Since the RBP was established in 2014, while some pilot areas chose to establish the RBP in 2011, we adjust the year of participation in the RBP to 2011 if the individual reports beginning participation in the RBP before 2011.

Table A.2. One-year fixed deposit rate (%)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Rate	7.86	7.56	9.41	10.98	10.98	9.17	7.11	4.91	2.91	2.25
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Rate	2.25	2.01	1.98	2.03	2.25	2.34	3.20	3.93	2.25	2.30
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rate	3.27	3.24	3.00	2.97	2.11	1.50	1.50	1.50	1.50	1.50
Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Rate	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50

Data source: The People's Bank of China.

For Type 2 participants, the statutory pension benefit of ORRBP (P_{ORRBP}^{policy}) is computed by the following formula:

$$P_{ORRBP}^{policy} = \frac{1}{139} \times \prod_{i=1999}^{Year_R} \left(1 + r_j\right) \times \sum_{t=Year_c}^{1999} \left[Contribution_t \times \prod_{j=t}^{1999} \left(1 + r_j\right) \right]$$

where $Year_R$ and $Year_c$ refer to the pension eligibility year and the year of beginning participation in the ORRBP, respectively; $Contribution_t$ refers to the contribution level in year t, which includes individual contributions and collective subsidies; and r_j refers to the interest rate in year j.

The respondent reports the annual contribution level, and we assume the respondent contributed the same amount each year until the ORRBP was suspended. It is difficult to identify the extreme values of contributions to the ORRBP since we could not find the relevant official documents. Thus, we assume the annual contribution level is the respondent's reported level divided by contribution years if the reported level is more than 500 Yuan per year, according to Document No. 32 of the State Council in 2009. Collective subsidies are 0 if not reported since collective subsidies are not statutory in the ORRBP.

The pension eligibility age in the ORRBP is still 60 years, as the official document requires. The year of beginning participation in the ORRBP should be between 1991 and 1999, as the ORRBP was conducted during this period. If the reported year of participation in the ORRBP is before 1991, we assume the respondent participated in the ORRBP in 1991. We notice the reported year of participation in the ORRBP is around 2009 if the reported year of participating in the ORRBP is after 1999. This may be because the respondent mistook the information about the NRRBP for the information about the ORRBP since the NRRBP was established around 2009. Therefore, we regard those respondents who reported participating in the ORRBP around 2009 as participants in the NRRBP. With this information, the pension eligibility year can be set accordingly. Moreover, considering that the ORRBP was suspended in 1999, we assume that the accumulated contributions increase with the interest rate in Table A.2 to the pension eligibility year.

Document No. 32 of the State Council in 2009 documents that for individuals who participated in the ORRBP who have not reached the age of 60, and have not received the pension, they should continue to contribute to the NRRBP to receive pension benefits, and the individual contribution account balance in the ORRBP can be incorporated into the NRRBP individual contribution account. Therefore, the statutory

pension benefit for Type 2 participants is the sum of the statutory pension benefit in the ORRBP and the statutory pension benefit in the NRRBP or RBP. Specifically, if ORRBP participants did not report their contributions to the NRRBP or RBP after 2009, we assume they contributed the average contribution level.

A2 Gap between the statutory pension benefit and the national average pension benefit

We calculate the statutory pension benefit as shown in section A1, and we assume that the statutory pension benefit can represent the actual pension benefit in our analysis. However, the China Health and Retirement Longitudinal Study (CHARLS) only has four waves, so we cannot directly compare the statutory pension benefit and the actual pension benefit for the same respondents.[6] Therefore, we calculate the average statutory pension benefit among respondents who would reach pension eligibility age in specific years and compare it with the national average pension benefit of RBP pension receivers reported by the Ministry of Human Resources and Social Security (MHRSS)[7]. The results are shown in Table A.3. The p-value indicates that the statutory pension benefit is not statistically different from the national average pension benefit, except for 2017 and 2019. It indicates that the statutory pension benefit we calculated from CHARLS can represent the actual national average pension benefit for the respondents.

Table A.3. Gap between the statutory and national average pension benefits (Yuan/Year)

Year	2012	2013	2014	2015	2016	2017	2018	2019
Statutory benefit in CHARLS	1,025	1,060	1,154	1,371	1,395	1,384	1,792	1,719
National average benefit in MHRSS	880	979	1,098	1,430	1,408	1,521	1,828	1,942
Gap	146	81	56	-59	-13	-137	-36	-223
P-value	0.050	0.145	0.066	0.150	0.685	0.000	0.277	0.000

Note: The statutory pension benefit is calculated from data from the CHARLS. The national average pension benefit is from the annual report of the Ministry of Human Resources and Social Security. The pension benefit in each year is the nominal value. The table also reports the p-value of the t-test of the difference between the statutory pension benefit and the national average pension benefit.

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[6] In CHARLS, only 49 respondents reported both the contribution information before retirement and the actual pension benefit in the survey year, i.e., they were retired during the survey years.

[7] See http://www.mohrss.gov.cn/SYrlzyhshbzb/zwgk/szrs/tjgb/202306/t20230620_501761.html for detailed information.

Appendix B

Table B.1. Exogenous condition of the instrumental variable

	(1)	(2)
Model	Probit	OLS
Dependent variable	OPT	Residual
OPT_C	0.199***	
	(0.012)	
Unhealthy	**-0.002**	**-0.003**
	(0.003)	**(0.004)**
Observations	22,125	22,125
Wald p-value	0.000	
R^2		0.000
Contextual effects	YES	YES
Control variable	YES	YES
Year fixed effects	YES	YES
Province fixed effects	YES	YES

Note: The sample contains middle-aged respondents in China (45-59 years old) surveyed by the CHARLS from 2011 to 2018. An individual is classified as an optimist (OPT) if she/he has optimistic pension expectations. OPT_C captures the proportion of optimists in the community where the individual lives. The instrumental variable, *Unhealthy*, is the average health status of peers' parents. We report the average marginal effects of the estimates in the probit model. Constants, contextual effects, and control variables are included in the regressions but not reported. Robust standard errors are provided in parentheses. *, **, and *** indicate that the coefficients significantly differ from 0 at the 10%, 5%, and 1% levels, respectively. Following Nevo and Rosen (2012), we apply "imperfective" in Stata to estimate the endogenous variable's lower and upper bound coefficient at the 95% confidence interval level. The lower bond estimate and upper bound estimate are 0.353 and 1.078, respectively.

Table B.2. Robustness tests 7: change the pension benefit growth rate and the fixed deposit rate

	(1)	(2)	(3)	(4)	(5)	(6)
Pension growth rate	5-year average growth rate			3-year average growth rate		
One-year fixed deposit rate	1%	1.5%	2%	1%	1.5%	2%
Dependent variable	OPT	OPT	OPT	OPT	OPT	OPT
OPT_C	0.308*	0.309*	0.311*	0.371**	0.362**	0.361**
	(0.169)	(0.169)	(0.169)	(0.156)	(0.158)	(0.158)
Observations	22,125	22,125	22,125	22,125	22,125	22,125
Wald p-value	0.000	0.000	0.000	0.000	0.000	0.000
Contextual effects	YES	YES	YES	YES	YES	YES
Control variable	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES	YES

Note: The sample contains middle-aged respondents in China (45-59 years old) surveyed by the CHARLS from 2011 to 2018. An individual is classified as an optimist (OPT) if she/he has optimistic pension expectations. OPT_C captures the proportion of optimists in the community where the individual lives. We report the average marginal effects of the estimates in the probit model. Constants, contextual effects, and control variables are included in the regressions but not reported. Robust standard errors are provided in parentheses. *, **, and *** indicate that the coefficients significantly differ from 0 at the 10%, 5%, and 1% levels, respectively. Our baseline model assumes that the one-year fixed deposit rate after 2023 is 1% and 2% instead of 1.5%. We assume that pension benefits after 2021 increase at the same average growth rate over 2018-2021 (3-year average growth rate) instead of the same average growth rate over 2016-2021 (5-year average growth rate).

Table B.3. The peer effect on pension expectation bias

	(1)	(2)
Model	2SLS	OLS
Dependent variable	Pension expectation bias	Pension expectation bias
Pension expectation bias_C	0.616**	
	(0.258)	
Pension expectation bias_C _lag		1.056***
		(0.028)
Observations	22,125	13,345
R^2	0.174	0.154
Contextual effects	YES	YES
Control variable	YES	YES
Year fixed effects	YES	YES
Province fixed effects	YES	YES

Note: The sample contains middle-aged respondents in China (45-59 years old) surveyed by the CHARLS from 2011 to 2018. An individual is classified as an optimist (OPT) if she/he has optimistic pension expectations. OPT_C captures the proportion of optimists in the community where the individual lives. We report the average marginal effects of the estimates in the probit model. Constants, contextual effects, and control variables are included in the regressions but not reported. Robust standard errors are provided in parentheses. *, **, and *** indicate that the coefficients significantly differ from 0 at the 10%, 5%, and 1% levels, respectively.

"Pension expectation bias" (P^{bias}) is a percentage measure of the pension benefit bias defined in Equation (3).

"Pension expectation bias_C" refers to community-level average "Pension expectation bias."

"Pension expectation bias_C_lag" refers to the lagged term of "Pension expectation bias_C."

Table B.4. The effect of optimism on pension contribution

	(1)	(2)
Model	2SLS	OLS
Dependent variable	Contribution	Contribution
OPT_C	401.787*	
	(225.960)	
OPT_C_lag		175.883***
		(21.283)
Observations	22,125	13,345
R^2	0.078	0.109
Contextual effects	YES	YES
Control variable	YES	YES
Year fixed effects	YES	YES
Province fixed effects	YES	YES

Note: The sample contains middle-aged respondents in China (45-59 years old) surveyed by the CHARLS from 2011 to 2018. OPT_C captures the proportion of optimists in the community where the individual lives. We report the average marginal effects of the estimates in the probit model. Constants, contextual effects, and control variables are included in the regressions but not reported. Robust standard errors are provided in parentheses. *, **, and *** indicate that the coefficients significantly differ from 0 at the 10%, 5%, and 1% levels, respectively.

"Contribution" refers to annual individual contributions in RBP.

"OPT_C_lag" refer to the lagged term of "OPT_C."