Life Cycle Remittance of Rural-Urban Migrants*

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Abstract

Using China Household Income Survey data, I document an inverse U-shaped income and a declining remittance profile over life cycle for rural-to-urban migrants to their family members left in the rural sector. I formulate and calibrate a life-cycle model with agents heterogeneous in demographical characteristics making migration and remittance decision, which is motivated by the altruism to family members. I identify a huge migration cost associated with land, a fixed benefit of living in the urban and an exogenous exit rate out of urban. My decomposition exercise indicates that evolution of household characteristics is determinant for declining remittance over ages. Policy related counterfactual analysis suggests abolishing land associated cost and exogenous exit from urban result in migration rates of 12.87% and 83.31% respectively compared with current rate of 27.51%.

JEL Classification: D13, D15, J6

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1 Introduction

Internal migration is widespread in developing world, partly due to the great inequality within the economy. In China, the stock of migration soars to 215.7 millions in 2015, according to Hao, Sun, Tombe, and Zhu (2020). Migrants work in sector with higher income and may transfer back as remittance for family member left behind. However, the motivation of remittance is unsettled in the literature, and the effects of migration policy on intra-household transfer are less visited. What is the life cycle pattern of remittance for migrants, and what is the potential motivation behind? In what extent the migration policy will affect migration rate and the magnitude of remittance? I will try to answer these questions in this paper.

In this research, I restrict my attention on Rural-Urban Migrants in China. Alongside the decreasing pattern of life cycle remittance over life cycle, I also empirically discover an inverse U-shaped income profile and evidence of altruism motivated remittance, which are documented as stylized facts in this paper. My goal is to build a dynamic stochastic general equilibrium model, given income profile and altruism motivation to fit the pattern of life cycle remittance. To capture these patterns, the theoretical model consists of heterogeneous agents with different ages, initial land endowments and capital stocks, and transitory shocks on income per period. I allow a Markov process to highlight the evolution of household characteristics. Based on the number of parents alive and age-related income profile and transitory shock, rural agents make decision of migration and if they migrate, they make remittance decision. To better characterize the policy in contemporary China, I invite an exogenous rate of exiting the urban sector, a land associated cost for migrants to capture the current land policy, and a fixed benefit of living in the urban sector.

My model fits the data moments and stylized facts very well. And the results are robust. Counterfactual analysis indicates that the declining number of family member over time plays a crucial role for decreasing remittance over ages, which reinforces my baseline hypothesis of altruism motivated remittance. Policy related experiments show that the current land policy incurs a great cost for rural-urban migrants. There is also a fixed benefit of living in the urban sector. The model tells us what would happen if policy were changed and who would migrate under the new policy and what the life cycle remittance would look like.

The contribution of this paper is manifolds. First, my research complements the research on motivation of remittance and internal migration. Carling (2008) provides detailed literature review for remittance motivation and Lucas (1997) reviews literature of internal migration in developing countries. To my best knowledge, the earliest research on motivation of remittance is Lucas and Stark (1985), who highlights the potential mechanisms, including pure-altruism, i.e., the care of left behind from a migrant perspective, and self-interest, for example, the aspiration to inherit, home investment etc, or a hybrid of both channels called enlightened-altruism. Their results, however, suggest pure altruism may not be the major motivation for remitting, in favor of co-insurance mechanism. Other research also emphasizes the role of mutual contracts and co-insurance mechanism, consisting of Gröger and Zylberberg (2016), Dillon, Mueller, and Salau (2011) etc. In my paper, however, I find evidence of altruism motivated life cycle remittance in China for migrants, shutting down the co-insurance mechanism since my model does not take rural sector risk into consideration. This paper also complements migration literature. One canonical work by Carrington, Detragiache, and Vishwanath (1996) specifies a dynamic model of labor migration and highlight a decreasing moving costs with the number of migrants in the destination labor market. My work also includes a great variety of migration regulatory obstacles but differs from Carrington, Detragiache, and Vishwanath (1996) decreasing and endogenous cost.

In addition, my research relates to the literature on life-cycle analysis, including Jovanovic and MacDonald (1994) for shake-off life cycle of a competitive industry, Hsieh and Klenow (2014) for the life cycle and size distribution in India and Mexico, Feng (2018) for declining dispersion of capital misallocation motivated by firm Bayesian learning in a market with information friction, Low, Meghir, Pistaferri, and Voena (2018) for specifying a life-cycle model including marriage, labor supply and divorce under limited commitment to analyze policy reform impact. My paper closely relates to Gourinchas and Parker (2002), which investigates the inverse U-shaped life cycle profile of income and consumption. But previous literature is silent for documenting and understanding intra-household transfer over the life cycle.

Lastly, this paper also closely aligns to the analysis of internal migration and related policy evaluation. Zhao (1999) argues, existing land policy is a potential barrier for migration decision, despite the great benefit of leaving the countryside for rural residents in China. And my model gives us similar implication from Zhao (1999). Lagakos, Mobarak, and Waugh (2018) point out a substantial non-monetary disutility of migration and indicate that the migration subsidies raise the welfare of migrants mainly by providing better insurance for vulnerable households instead of relaxing the credit constraint. Tombe and Zhu (2019) evaluate the impact of reduction in internal trade and migration cost on economic growth in China using a multi-sector model. Sieg, Yoon, and Zhang (2020) evaluate the internal migration controls in China, which hinders migrants to get access for urban public good and affects the human capital accumulation in the economy. They also propose an alternative policy, decreasing the internal inequality and promoting growth by raising the overall level of human capital investment. I embed insights from Zhao (1999) into a dynamic model. Compared with Lagakos, Mobarak, and Waugh (2018), I integrate the consideration of those left behinds for migrants. I also relate with Sieg, Yoon, and Zhang (2020) and provide another angle to understand internal inequality facilitated by remittance channel.

The remaining part of the paper is organized as follow. Section 2 outlines the dynamic model and characterizes the equilibrium. Section 3 presents the empirical evidence, on which the model assumptions are grounded. Section 4 calibrates the model and provides estimation results. Section 5 conducts decomposition and policy-related experiments. Section 6 concludes.

2 Model

2.1 Environment

Agents of age a_i, born in the rural area, is initially endowed with land of size L_i. In each period, they make a decision to migrate or not, depending on their life-long utility of these two alternatives. If agent decides to migrate, she will bear a land associated cost ζL_i and suffer a time-invariant non-monetary cost or benefit scaled by f per period. The land cost is motivated by current land policy. And the setting about f implies that agent may suffer a migration cost, giving rise to $f < 0$; Or, alternatively, that agent may gain human capital, access to public goods in urban sector or potential possibility of getting a urban Hukou, which suggests a positive value of f. Migration is a risky adventure: a household gives up some income in the rural sector for a chance of getting income at the urban destination. In each period, the migrants suffer an exogenous probability θ of exiting the urban area, which can be interpreted as unemployment, entering the informal urban sector, or exodus due to policy reasons, echoing Todaro (1969) and Harris and Todaro (1970).

2.1.1 Stochastic Process

At each period, the migrant expects to receive a flow of income y_a^j. The income flow for migrants is age-related, suggested by the micro-level empirical evidence of Fact 1, following a simplified process of Zeldes (1989), Gourinchas and Parker (2002) and Low, Meghir, Pistaferri, and Voena (2018). And the agent, who decides to stay in the rural sector, only earns rural income of W^R. More formally, I write y_a^j as

$$\log y_{ia}^j = \eta_0 + \eta_1 a + \eta_2 a^2 + \log(e_{ia}) \text{ where } \log[e_{ia}] \sim \mathbb{N}(0, \sigma_e^2) \qquad \text{if } j = U, \tag{1}$$

$$= W^R \qquad \text{if } j = R. \tag{2}$$

Also, family member has an exogenous death rate of δ over the life cycle of potential migrants. To simplify the model, I only consider parents left in the rural as family member. Each row represent current state and column represent state next period. The first, second and third rows or columns represent status with 0, 1 and 2 living parents, respectively. I writes the transitional matrix as

$$\begin{array}{c} \\ n=0 \\ n=1 \\ n=2 \end{array} \begin{array}{c} \begin{array}{ccc} n=0 & n=1 & n=2 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 \\ \delta & 1-\delta & 0 \\ \delta^2 & 2\delta(1-\delta) & 1-\delta^2-2\delta(1-\delta) \end{pmatrix} \end{array} \tag{3}$$

2.1.2 Preferences, Cost and Instantaneous Utility

Agents are infinitely lived and maximize their expected discounted utility during their life-cycles. Here I restrict my attention on potential migrants, whose utility at period t is divided into the consumption level $c_t^j, j \in \{U, R\}$, where U is for urban and R is for rural. Agents can choose working in the urban or rural at the beginning of every period based on their expected utility. Denote the average consumption of family member of agent choosing area j at time t as $\overline{c_t}^j$. The instantaneous utility for agent follows

$$U(c_t^j, \overline{c_t}^j) = u(c_t^j) + A(n_i)n_i \times u(\overline{c_t}^j) \tag{4}$$

where $u(\bullet)$ features a non-homothetic constant elasticity of substitution form and $A(n_i)$ represents the degree of altruism that migrants associate with their family members. In this model I specify that,

$$u(c_t) = \frac{[c_t^j]^{1-\gamma} - 1}{1-\gamma} \tag{5}$$

where γ captures relative risk aversion with $0 < \gamma < 1$. This setting suggests trade-off for migrants. A higher level of remittance T_t will lower the level of consumption c_t^U, but will give rise to a higher consumption level for family members left behind. The marginal cost of remittance associated with lower consumption level for migrants themselves must equal the marginal benefit of remittance related to a higher standard of consumption for parents with a pass-through effect of $A(n_i)$ per person. The expression of T_t is given in the appendix. The pure-altruism is given by $A(\bullet)$ with a weight of $\alpha \in (0,1)$, and curvature parameter $\psi \in (0,1)$ á la Barro and Becker (1989).

$$A(n_i) = \alpha n_i^{-\psi} \tag{6}$$

2.1.3 Budget Constraint

For the potential migrant, the budget constraint is given by

$$y_t^j + (1+r)k_t^j = c_t^j + k_{t+1}^j + \mathbb{1}(x_t)T_t \text{ for } j \in \{U, R\}. \tag{7}$$

where r is the net return from asset k, $\mathbb{1}(x_t)$ is the indicator function returns to 1 if type-x_t agent decides to migrate or stay in the urban area. For simplicity, I omit i if there is no ambiguity about the notation. The total income comes from last period asset investment and current period income, spent on the individual consumption c_t^j, asset investment k_{t+1}^j and transfer for family members T_t^M if agent lives in the urban sector at time t. For simplicity, I assume family members do not save, that is,

$$\mathbb{1}(x_t)[T_t/n_t] + {w_t}^R = \overline{c_t}^j, \tag{8}$$

where the first term is the return from land for non-migrant at a rate of μ per period, and the second term implies that family member will split transfer equally if they receive it from migrant.

2.1.4 State Variables

To summarize, the state variables are stored in a vector, denoted as $x_{it} = (a_{it}, L_{it}, e_{it}, n_{it})$ since the income profile is dependent on age for simplification. And the state space $\mathfrak{S} = [\underline{a}, \overline{a}] \times \mathfrak{L} \times \mathfrak{E} \times \{0, 1, 2\}$.

2.2 Value Functions

The agent utility at period t is a maximum of utility of migration or staying in the urban area, that is,

$$V(k_{it}, x_{it}) = \max_{j \in \{U,R\}} \{V^U(k_{it}, x_{it}), V^R(k_{it}, x_{it})\} \tag{9}$$

The value function of agent type x_{it} with migration decision, $V^U(k_{it}, x_{it})$ in a recursive form, is

$$V^U(k_{it}^U, x_{it}) = \max_{k_{t+1}} \overline{U}(c_{it}^U, \overline{c_{it}}^U) + f - \zeta L_{it} + \beta\theta V^R(k_{it}^R, x_{it}) + \beta(1-\theta)\mathbb{E}V(k_{it+1}, x_{it+1}), \tag{10}$$

The first line is current period utility derived from consumption for migrant herself and her family member, an idiosyncratic migration utility, and a fixed benefit (or cost) of migration. The second line captures the exogenous shock for exiting urban sector or failure of migration with probability θ. The third line demonstrates that migrant enjoys a flow of maximized utility with the remaining probability $1-\theta$. The expectation $\mathbb{E}$ is over the whole state space $\mathfrak{S}$.

$$V^R(k_{it}^R, x_{it}) = \max_{k_{t+1}} \overline{U}(c_{it}^M, \overline{c_{it}}^M) + \beta \mathbb{E} V(k_{it+1}, x_{it+1}) \tag{11}$$

where $\overline{U}(c_t^j, \overline{c_t}^j)$ is the indirect utility function of agent with decision j and the indicator function is defined by

$$\imath(x_{it}) = 1 \text{ if } V^U(k_{it}, x_{it}) > V^R(k_{it}, x_{it}) \tag{12}$$

which, in some senses, echoes Greenwood, Hunt, Rickman, and Treyz (1991). Thus the measure of migrants in urban area is given by

$$(1-\theta) \int_{\mathfrak{S}} \imath(x_{it}) d\mathfrak{S} = \tilde{M}, \tag{13}$$

where $\tilde{M}$ is number of rural-urban migrants set by the policy maker, which is exogenous to my model.

2.3 Market Equilibrium

Definition 1. A stationary equilibrium is a set of policy functions $\{T^{M*}(k_t, x_t), , k^{j*}(k_{it}^j, x_t)\}_{j \in \{M,S\}}$ and a set of value functions $\{V^j(k_{it}, x_{it}), V(k_{it}, x_{it})\}_{j \in \{M,S\}}$, and stationary distribution of migrants over ages, given the indirect utility function which solves agent maximization problem of equation such that

- The policy functions $\{T^*(k_t, x_t), , k^{j*}(k_{it}^j, x_t)\}_{j \in \{M,S\}}$ jointly solve optimization problem defined by equations (4), (7) and (8);
- The value functions $\{V^j(k_{it}, x_{it}), V(k_{it}, x_{it})\}_{j \in \{M,S\}}$ satisfy equation (9), (10) and (11), taking the indirect utility function as given;
- The labor market clearing conditions for rural-urban migrants, expressed as (13), holds.

2.4 Discussion of Motivation of Remittance

The remittance T_t^M is given by

$$T_t^M = \frac{y_t^U + (1+r)k_t^U - k_{t+1}^U - A(n_t)^{-1/\gamma}[\overline{w}^R]}{1 + A(n_t)^{-1/\gamma}/n_t}, \tag{14}$$

implying that

$$\frac{\partial T_t^M}{\partial y_t^U} > 0, \frac{\partial T_t^M}{\partial A(n_t)} > 0 \text{ and } \frac{\partial T_t^M}{\partial w^R} < 0. \tag{15}$$

This proposition firstly shows that the remittance is increasing with the migrant income earned in the urban sector. Secondly, the higher the level of altruism, the higher the remittance, since since the migrant impose a higher weight on family members. Lastly, the higher the rural wage for family left behind, the lower the remittance.

The motivation of remittance closely echos Lucas and Stark (1985). The migrant balances the marginal benefits and costs through remittance. A rising remittance induces a higher level of consumption for the left-behind, and thus raise their utility, which enters in the migrant utility in a revised-dynastic utility form. But it also lower the consumption by herself.

In Meghir, Mobarak, Mommaerts, and Morten (2019) and Morten (2019), the *inter*-household transfer (remittance) for internal migrant to non-migrant is formalized in a risk sharing social safety net. This type of transfer results from before-migration and after migration incentive compatibility constraints as well as a promise-keeping constraint. In this paper, I do not include the risk-sharing motives and only focuses on the altruism channel, and explore the validity of this channel to explain the findings analyzed from the data.

3 Data and Empirical Evidences

3.1 Dataset

The micro-level data comes from China Household Income Projects (CHIPS), with a coverage of five wave of household level surveys in the mainland China in 1989, 1996, 2003, 2008 and 2013. These surveys were carried out as part of a collaborative research project on incomes and inequality in China organized by Chinese and international researchers, with assistance from the National Bureau of Statistics (NBS). Before 2002, CHIPS only contains survey for rural and urban household. Due to the increasing importance of rural-to-urban migration, and because the urban and rural household subsamples do not adequately cover migrants, the 2002 survey added a survey of rural-to-urban migrants. The same procedure was adopted for the 2007 survey. This structure reflects China's urban-rural division and the increased number of rural individuals who have migrated into the urban areas, especially during the last two decades. In this paper, I restrict my attention on the survey in 2008 for the availability of remittance data for the migrants. Moreover, in this paper, I only consider the primed-age male migrants for simplicity. I rule out the outliers for income and remittance, for example, some negative values, and calculate the mean of logged income and remittance over age group with bin width of 1 year. Since there are zero values of remittance, I calculate log(1 + remittance) instead. Considering the agents I am curious about with rural origin, I also use the CHIPS rural household survey in the same year as an auxiliary dataset to obtain the initial distributions of fundamentals such as land size etc.

3.2 Empirical Evidences

This paper mainly focuses on the following three stylized facts about income and remittance profile over ages as well as evidence of pure-altruism motivated remittance, summarized below:

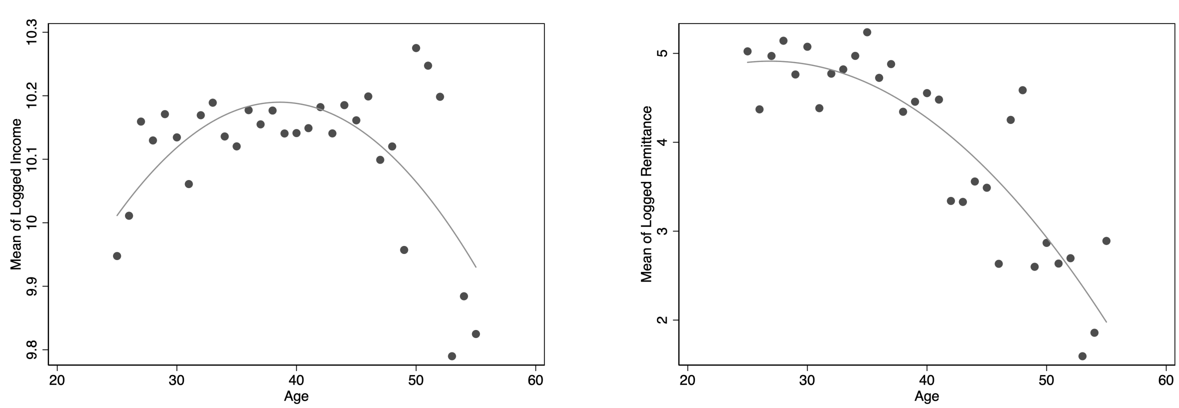
Fact 1. *Rural-urban migrant has a inverted U-shaped income profile with respect to age.*

Fact 2. *Rural-urban migrant has a declining remittance profile with respect to age.*

Fact 3. *Rural-urban migrant has a inverted U-shaped consumption profile with respect to age.*

Figures 1 demonstrates Fact 1 and 2. The greyish dots in the graph represents the average of logged variables in different income group. The lines are the quadratic fitted line. I also use local polynomial kernel estimation to estimate income and remittance profile, respectively, which are demonstrated in Appendix with similar pattern. The hump-shaped income profile is consistent with the trend of literature, including Gourinchas and Parker (2002). For an OLS estimation, I leave it in the Appendix.

Figure 1: Income and Remittance Profile of Migrants Over Life Cycles



Notes: The left and right panel show the income and remittance profile over life cycle for rural-urban migrants. I calculate the mean of $log(1 + income)$ and $log(1 + remittance)$ with the age bin of 1 year after ruling out the outliers with the special restriction of agent age from 25 to 55. The grey line is the quadratic fit of the means. The income profile increases before age 40 and declines thereafter. However the remittance profile is monotonically decreasing.

Fact 4. *The land endowment is time-invariant and is irrelevant with age.*

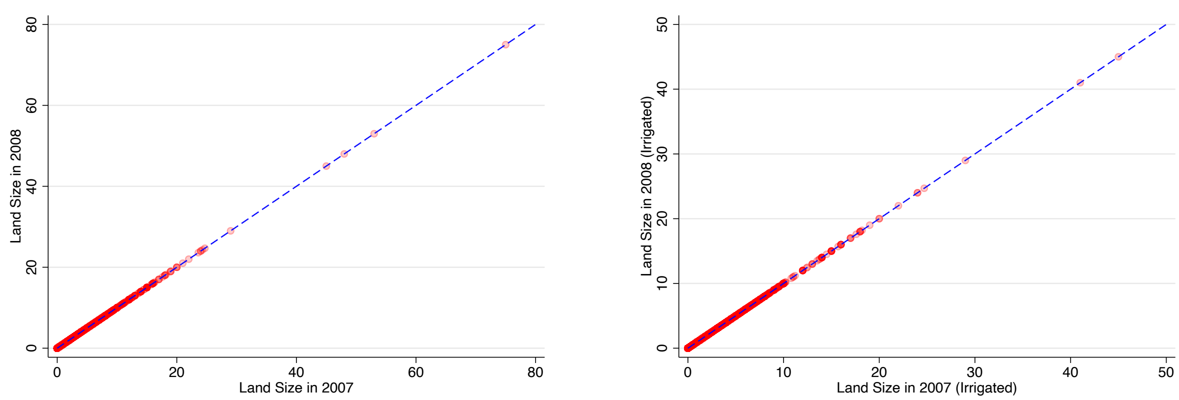
To show the validity of 4, I firstly match the migrants in 2007 and 2008 rural survey, and plot the relationship of land endowment in these two years in Figure 2. Moreover, to demonstrate that land endowment is irrelevant with agents age, I regress the land dummy and logged land size (total or irrigated) on age of the rural residents. Table 1 reports the coefficients, which is neither economically nor statistically significant. I also regress variables related with land on a set of age dummies. The regression results are similar, which are shown in the Appendix.

Table 1: Land Endowment and Age

	Binary		Logged Size	
	Total (1)	Irrigated (2)	Total (3)	Irrigated (4)
Age	0.001	0.002	0.003	0.002
	(0.001)	(0.001)	(0.003)	(0.003)
Observations	2610	2610	2325	2158

Fact 5. *The age distribution of rural-urban migrant is positively skewed.*

Figure 2: Land Endowment Comparison



Notes: This figure shows the relationship of land endowment in 2007 and 2008 for matched rural residents. The left panel uses total land size and the right panel uses irrigated land size. The dots lie on the 45 degree line.

4 Calibration Strategy and Results

4.1 Identification

Table 3 lists the choice of values of parameters below. Firstly, I set the following parameters exogenously. The discount rate β is assigned at 0.97, and $r = 0.03$ to match the return of 10-year treasury bond of China. I set a common value of $\gamma = 2$ as coefficient of constant relative risk aversion utility. The income rate w^R ($\exp(8.85)$) matches the mean of income for rural residents in 2007 CHIP rural database.

Secondly, I use the China Household Income Panel to empirically identify the following moments. The mean of logged income parameters (η_0, η_1, η_2) in equation (1) is obtained by OLS. The distribution of land property is extracted from rural panel of CHIP in the same year. A share of $s_l = 0.14$ agents is endowed with no land, which is a fact I observe from CHIP rural data. Conditional on agents with land, the distribution of land follows $(\mu_l, \sigma_l^2) = (1.43, 0.74^2)$.

Then, to model the initial distribution of capital, I assume that $\log k_{25} \sim \mathbb{N}(\mu_k, \sigma_k^2)$, which is calibrated to match the mean and standard deviation of logged consumption over the life cycle. To back out the death rate, I minimize the difference of mean of parents from model and data. I get a reasonable δ with a value of 6%, a magnitude lies in the range of literature. To identify altruism related parameter $\{\alpha, \psi\}$, I target mean of logged remittance over groups of migrants with different number of parents. The mean of $\log(1 + \text{remittance})$ for 1 and 2 parents are 5.02 and 5.10 respectively, which is consistent with my baseline hypothesis of pure-altruism motivated remittance channel. Similarly, I get the mean and standard deviation of $\log(1 + \text{consumption})$ and $\log(1 + \text{saving})$.

To find out the land related cost of ζ, I match the mean of logged land size for migrants, which is extracted from CHIP Migrants Panel, where $(\tilde{\mu}_l, \tilde{\sigma_l^2}) = (1.00, 0.45)$. This result is consistent with the finding from Bazzi (2017) that migrants are drawn from the middle of the land-holding distribution because a low level of land might be a liquidity constraint for migration, and, on the contrary, a high level of land endowment dis-incentives migration.

I also target the standard deviation of logged income for migrants age 25 to obtain transitory shock variance σ_e^2. To capture the migration related parameters $\{f, \theta\}$, I use migration rate of rural agents and average duration staying at urban sector as two targets. Migration rate is calculated from Hao, Sun, Tombe, and Zhu (2020), which is recapitulated in Table 2 and China's census data in 2005 and 2010. Average duration of their stay outside the Hukou location in China is only 7 years, according to Meng (2012).

The set of calibrated parameters is given by

$$\Omega = \{\delta, \sigma_e^2, \alpha, \psi, f, \theta, \sigma_{k_{25}}^2, \zeta\}, \tag{16}$$

I follow the similar methodology in Akcigit, Caicedo, Miguelez, Stantcheva, and Sterzi (2018) to minimize the weighted sum of the absolute difference between data moments and model-generated moments $\mathcal{L}(\Omega)$ with equal weights,

$$\mathcal{L}(\Omega) = \min_{\Omega} \sum_{i=1}^{8} \frac{|\text{model}(i) - \text{data}(i)|}{\frac{1}{2}|\text{model}(i)| + \frac{1}{2}|\text{data}(i)|}. \tag{17}$$

Table 2: Migrant Stock in 2005 and 2010

	Intra-provincial		Inter-provincial	
Year	2005	2010	2005	2010
Migrant stock	132.6	176.2	47.0	79.2
Share of Employment				
Total Migrant	17.8	22.9	6.5	10.3
Agriculture to Non-Agriculture Migrant	16.5	21.6	5.2	8.6

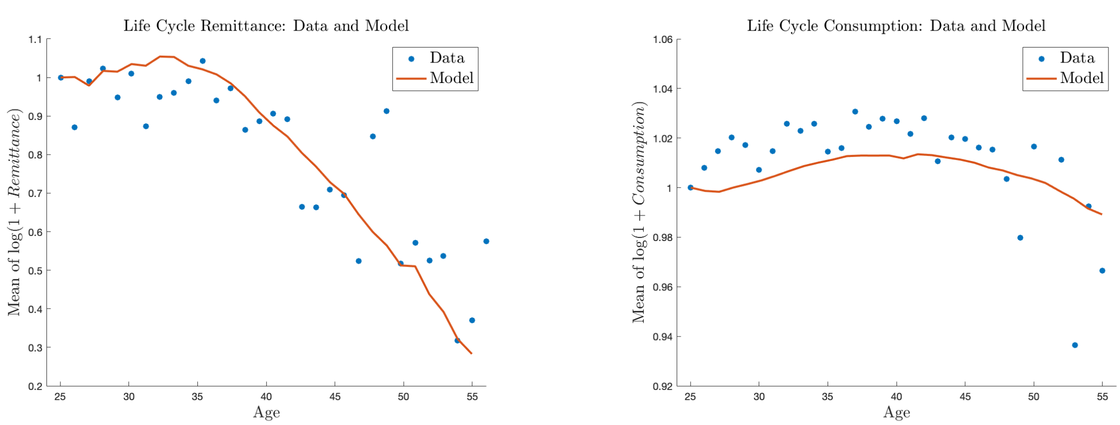
Notes: The data in this table comes from Hao, Sun, Tombe, and Zhu (2020). Since my focus is migrant stock from rural to urban in year 2007, I take the average of the migration stock of year 2005 and 2010 for approximation. I focus on stock of agriculture to non-agriculture migrants both intra-provincial and inter-provincial, which are 160.52 million ($132.6 \times 16.5/17.8 + 47.0 \times 5.2/6.5$) and 232.33 million ($176.2 \times 21.6/22.9 + 79.2 \times 8.6/10.3$), respectively. I obtain the total stock of rural residents aging from 25 to 55 from China's Census Data, taking the average of 2005 and 2010 census data.

4.2 Estimation Results

Table 3 summarizes estimated parameters. To justify the value of remittance, I get a low level of pure altruism weight and curvature parameter. The annual death rate of 1 parent lies in a reasonable range, taking into the consideration of age and health status of parents in rural China. I find a positive value of f, suggesting migrants enjoys a flow of positive utility each period at urban sector. The exogenous rate of exit is 15.69%, indicating a large barrier of entering the city. The land related loss per period is also significant with the rate of $\zeta = 0.79$ proportional to land size, given the time period in the model is 1 year.

Figure **??** plots model-generated life cycle remittance pattern. I normalize the mean of logged remittance at age 25 as 1. And the result is very consistent with what I highlight in Fact 2.

Figure 3: Goodness of Fitness: Remittance and Consumption of Migrants Over Life Cycles



Notes: The left and right panel show the life cycle of remittance and consumption for rural urban migrants respectively. For a better visualization, I normalize the remittance and consumption level at age 25 as 1 in two panels respectively. The blue dots represent the moments calculating from CHIP 2007. The model fits a decreasing remittance profile and a hump shaped consumption profile.

Table 3: Parameter Values

Parameter (Interpretation)		Value	Source or Targeted Data
Panel A: Pre-assigned Parameters			
β	Discount factor	0.97	Return of treasury bill in China
γ	RRA coefficient	2.00	Common value in literature
w^R	Rural income	exp(8.85)	CHIP Rural 2007
r	Net real return of capital	0.03	Return of treasury bill in China
η_0	Constant: migrant income profile	8.30	CHIP Migrants 2007
η_1	First order parameter: migrant income profile	9.8×10^{-3}	CHIP Migrants 2007
η_2	Second order parameter: migrant income profile	-1.25×10^{-3}	CHIP Migrants 2007
s_l	Share of rural residents without land	14%	CHIP Rural 2007
μ_l	Mean of logged land for rural residents with land	1.34	CHIP Rural 2007
σ_l	Std. of logged land for rural residents with land	0.74	CHIP Rural 2007
$\mu_{k_{25}}$	Mean of logged initial capital	8.85	Mean income in rural area
μ_e	Mean of transitory shock	0.00	Model setting
Panel B: Calibrated Parameters			
δ	Annual death rate of 1 parent	6.28%	Matching with simulated data
σ_e^2	Std. of income shock	0.3138	Std. of income for age-25 migrants
α	Pure altruism weight	0.0933	remittance over groups with parents
ψ	Pure altruism elasticity	0.0102	remittance over groups with parents
f	Fixed cost or benefit of migration	0.9804	Migration rate
θ	Exogenous rate of exiting the urban area	0.1569	Mean duration of staying in urban
$\sigma_{k_{25}}$	Std. of logged initial capital	1.9671	Std. of consumption over life cycle
ζ	Land related loss	0.7886	Mean of logged land for migrants

4.3 Goodness of Fitness

My calibration fits the targeted moments and captures the desired features from the data. The result is summarized in Table 4. For migration, my model over-predicts the migration rate a little bit and the average duration of migration. Moreover, the moments for mean of remittance over different parents group from the model fit the data quite well, shedding some lights on pure-altruism motivated remittance as I hypothesize beforehand. Also, my model speaks to consumption distribution over the life cycle, see the right panel of Figure **??**. Lastly, the scale of mean of logged land is a little bit smaller than the data, since my model only captures the disincentives of migration for sizable land owner, but I omit the potential liquidity constraint provided by smaller size of land.

Panel B reports some non targeted moments. Firstly, the model has a slightly lower average logged remittance over the whole population, suggesting that the model generates more members with zero remittance. Lastly, the land distribution for migrants is more scattered in the model than in the data, suggesting that the land associated loss may be insufficient to fully capture what really happens in reality. Finally, my model also has a desired property of hump shaped consumption pattern over life cycle as Figure **??**. Similar pattern is also documented in Gourinchas and Parker (2002).

Table 4: Targeted and Non-Targeted Moment

Moments	Data	Model
Panel A: Targeted Moments		
Average deviation of mean number of parents	/	0.17
Migration rate	27.51%	33.93%
Average duration of Migration	7	12.45
Mean of $\log(1 + \text{remittance})$ (no. parent = 1)	5.02	5.05
Mean of $\log(1 + \text{remittance})$ (no. parent = 2)	5.10	5.16
Std. of migrant income at age 25	0.49	0.58
Mean of $\log(1 + \text{consumption})$	9.48	10.18
Std. of $\log(1 + \text{consumption})$	0.70	0.61
Mean of $\log(1 + \text{land})$	1.00	0.90
Panel B: Non-Targeted Moments		
Mean of $\log(1 + \text{saving})$	1.46	2.08
Mean of $\log(1 + \text{remittance})$	4.73	3.69
Std of $\log(1 + \text{land})$	0.45	0.81

4.4 Robustness Check

Some may question about the setting of the hump shaped income profile characterized by a quadratic form of mean of logged income in the model. To allow more flexibility, I estimate the income profile with respect to age using local polynomial kernel density estimation with binwidth of 1. The hump shaped pattern for migrants income over life cycle preserves, see Appendix. I re-calibrate the model taking the estimated logged income over ages as given. The result from the robustness check inherits a declining remittance profile over ages.

5 Counterfactual Analysis

There are two mainstreams of my counterfactual analysis. First, I decompose the mechanism of downward sloping remittance over the life cycle. My baseline hypothesis for this pattern is concave income profile for migrants and the changing number of family member over ages. I firstly shut down the concavity of income profile, setting the migrant income over the life cycle as $\exp(10)$, which is the average logged income for all migrants regardless of income. Then, I assume that there is no changing number of family member over time. The moments both targeted and non-targeted are demonstrated in Table 5.

5.1 Decomposition

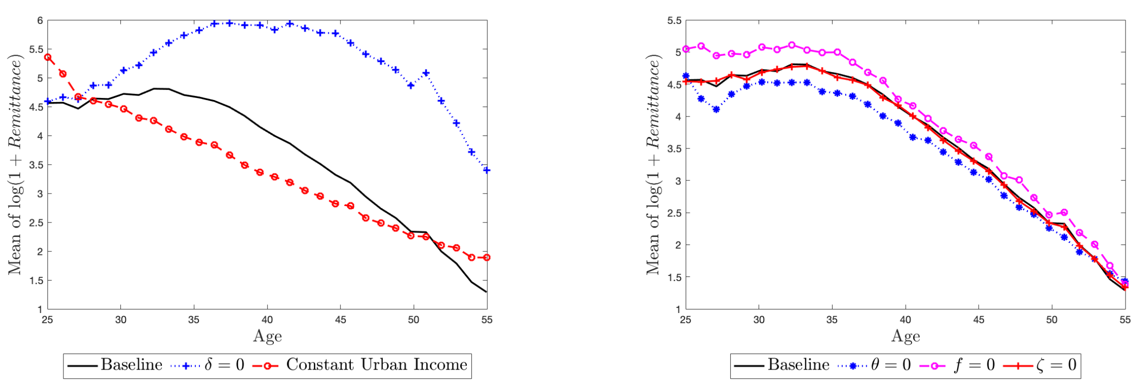
The decomposition exercise verifies my baseline hypothesis. If I shut down the change of the number of family member, the average logged remittance climbs from age 25 to 40, and declines afterwards, which is very similar with monotonicity of income pattern as Figure 1.

Table 5: Policy Related Counterfactual Analysis

Moments	Baseline		Decomposition		Policy Related		
	Data	Model	$\delta = 0$	w^U	$\theta = 0$	$f = 0$	$\zeta = 0$
Panel A: Targeted Moments							
Average deviation of mean number of parents	/	0.17	/	0.89	0.18	0.18	0.19
Migration rate	27.51%	33.93%	33.93%	33.93%	33.93%	12.87%	84.31%
Average duration of Migration	7	12.45	12.48	12.48	12.48	4.73	31.00
Mean of $\log(1 + \text{remittance})$ (no. parent = 1)	5.02	5.05	/	4.61	4.79	5.42	5.06
Mean of $\log(1 + \text{remittance})$ (no. parent = 2)	5.10	5.16	5.21	4.90	5.01	5.60	5.18
Std. of migrant income at age 25	0.49	0.58	0.56	0.56	0.56	0.56	0.56
Mean of $\log(1 + \text{consumption})$	9.48	10.18	10.16	9.35	10.13	10.22	10.18
Std. of $\log(1 + \text{consumption})$	0.70	0.61	0.61	1.03	0.98	0.51	0.61
Mean of $\log(1 + \text{land})$	1.00	0.90	0.90	0.90	0.90	0.43	1.15
Panel B: Non-Targeted Moments							
Mean of $\log(1 + \text{remittance})$	4.73	3.69	5.21	3.45	3.55	3.95	3.68
Std of $\log(1 + \text{land})$	0.45	0.81	0.81	0.81	0.81	0.71	0.75

This suggests that evolution of family member is determinant for declining remittance profile over life cycles. Additionally, I model if migrant faces a constant urban income over life cycle. The pattern is also declining over ages, but it has lower level of remittance from age 30 to 50, which suggests that the hump shaped income profile is responsible for a slower rate of declining between this period.

Figure 4: Counterfactual: Income and Remittance Profile of Migrants Over Life Cycles



Notes: The black lines in two panels are the baseline modelling results. The left panel shows the remittance life-cycle pattern under decomposition exercise, which includes no evolution of parents number ($\delta = 0$) and constant urban income (w^U) for migrants. One can identify that evolution of parents number is a crucial driven force for declining remittance pattern. The slow decreasing rate of remittance from age 30 to 45 is motivated by the hump shape income profile for migrants. The right panel highlights the life cycle remittance under policy-related experiment. The remittance profile is always downward sloping in all of these experiments.

5.2 Policy Related Experiments

The second set of experiments I am curious about are mostly policy oriented. What if there were no fixed cost and benefit per period for migrants? Or, what will happen if there were no exogenous exit from the urban sector? Additionally, if there were no land associated cost, what would the changes for migration and remittance decision over the life cycle? I hope this set of experiments can offer us some policy-related insights in the real world. All of these changes will affect the decision of micro household, which will have a pass-through effect in the aggregated economy.

Panel B of Table 5 compares three scenarios of remittance pattern. The declining profile hold for all of these three experiments. The last three columns of Table 5 give us the fundamental moments. If I shut down the exogenous exit from urban area, I get a higher level of migration rate and slightly longer average duration of migration. And if I shut down the benefit of migration, that is $f = 0$, the migration rate decreases to 12.87% and average duration of staying in the urban sector shortens to 4.73 years, implying a huge migration benefit of living in the urban sector in reality. The average logged remittance for subgroup with 1 and 2 parents goes up to 5.42 and 5.60 respectively. Since seeking the opportunity in the urban sector is less attractive, it crowds out some migrants with relatively greater land endowment, which speaks to the average logged land property declines from 0.90 in the baseline model to 0.43 in this experiment. Lastly, I ask how the land policy would change the result by setting $\zeta = 0$, i.e., no land associative cost. Predictably, the migration rate soars to 84.31%, which is almost three times as the baseline result. Then average duration jumps to 31 years, suggesting a huge land loss for migrants moving into the urban area under the current policy. Due to the disappeared land cost, the average logged land endowment for migrants goes up to 1.15 correspondingly, since the large-land holder will also find migration attractive.

6 Conclusion

In this paper, I document stylized facts of income and remittance for migrants over life cycle and contribute to the literature finding altruism motivated remittance pattern. Grounded on these evidences, I build and calibrate a heterogeneous agents dynamic model including life cycle decision on migration and remittance.

My contribution is to bridge the empirical evidence from micro data with macro model, which facilitates as a workhorse to evaluate macro-policy on decision within individual household. For current policy, my analysis suggests a huge fixed benefit in the urban per period, and a great land associate cost and exogenous exit rate from urban sector. To understand life cycle pattern of remittance, my decomposition suggests evolution of parents number is determinant force shaping the declining remittance pattern over ages, which reinforces my altruism motivated remittance evidence.

References

AKCIGIT, U., S. CAICEDO, E. MIGUELEZ, S. STANTCHEVA, AND V. STERZI (2018): "Dancing with the Stars: Innovation Through Interactions," .

BARRO, R. J. AND G. S. BECKER (1989): "Fertility Choice in a Model of Economic Growth," *Econometrica*, 57, 481–501.

BAZZI, S. (2017): "Wealth Heterogeneity and the Income Elasticity of Migration," *American Economic Journal: Applied Economics*, 9, 219–55.

CARLING, J. (2008): "The Determinants of Migrant Remittances," *Oxford Review of Economic Policy*, 24, 581–598.

CARRINGTON, W. J., E. DETRAGIACHE, AND T. VISHWANATH (1996): "Migration with Endogenous Moving Costs," *The American Economic Review*, 909–930.

DILLON, A., V. MUELLER, AND S. SALAU (2011): "Migratory Responses to Agricultural Risk in Northern Nigeria," *American Journal of Agricultural Economics*, 93, 1048–1061.

FENG, Y. (2018): "Firm life-cycle Learning and Misallocation," .

GOURINCHAS, P.-O. AND J. A. PARKER (2002): "Consumption Over the Life Cycle," *Econometrica*, 70, 47–89.

GREENWOOD, M. J., G. L. HUNT, D. S. RICKMAN, AND G. I. TREYZ (1991): "Migration, Regional Equilibrium, And the Estimation of Compensating differentials," *The American Economic Review*, 81, 1382–1390.

GRÖGER, A. AND Y. ZYLBERBERG (2016): "Internal Labor Migration as a Shock Coping Strategy: Evidence from a Typhoon," *American Economic Journal: Applied Economics*, 8, 123–53.

HAO, T., R. SUN, T. TOMBE, AND X. ZHU (2020): "The Effect of Migration Policy on Growth, Structural Change, and Regional Inequality in China," .

HARRIS, J. R. AND M. P. TODARO (1970): "Migration, Unemployment and Development: A Two-Sector Analysis," *The American economic review*, 60, 126–142.

HSIEH, C.-T. AND P. J. KLENOW (2014): "The Life Cycle of Plants in India and Mexico," *The Quarterly Journal of Economics*, 129, 1035–1084.

JOVANOVIC, B. AND G. M. MACDONALD (1994): "The Life Cycle of a Competitive Industry," *Journal of Political Economy*, 102, 322–347.

LAGAKOS, D., A. M. MOBARAK, AND M. E. WAUGH (2018): "The Welfare Effects of Encouraging Rural-Urban Migration," *R&R Econometrica*.

LOW, H., C. MEGHIR, L. PISTAFERRI, AND A. VOENA (2018): "Marriage, Labor Supply and the Dynamics of the Social Safety Net," .

LUCAS, R. E. (1997): "Internal Migration in Developing Countries," *Handbook of population and family economics*, 1, 721–798.

LUCAS, R. E. AND O. STARK (1985): "Motivations to remit: Evidence from Botswana," *Journal of political Economy*, 93, 901–918.

MEGHIR, C., A. M. MOBARAK, C. D. MOMMAERTS, AND M. MORTEN (2019): "Migration and Informal Insurance," *NBER Working Paper*.

MENG, X. (2012): "Labor Market Outcomes and Reforms in China," *Journal of Economic Perspectives*, 26, 75–102.

MORTEN, M. (2019): "Temporary Migration and Endogenous Risk Sharing in Village India," *Journal of Political Economy*, 127, 1–46.

SIEG, H., C. YOON, AND J. ZHANG (2020): "The Impact of Migration Controls on Urban Fiscal Policies and the Intergenerational Transmission of Human Capital in China," .

TODARO, M. P. (1969): "A Model of Labor Migration and Urban Unemployment in Less Developed Countries," *The American economic review*, 59, 138–148.

TOMBE, T. AND X. ZHU (2019): "Trade, Migration, and Productivity: A Quantitative Analysis of China," *American Economic Review*, 109, 1843–72.

ZELDES, S. P. (1989): "Optimal Consumption with Stochastic Income: Deviations from Certainty Equivalence," *The Quarterly Journal of Economics*, 104, 275–298.

ZHAO, Y. (1999): "Leaving the Countryside: Rural-to-Urban Migration Decisions in China," *American Economic Review*, 89, 281–286.

7 Appendix

7.1 Details of Stylized Fact 1 and 2

Table 6 reports a hump shaped income profile for migrants under different specification. Through OLS result, I can identify a significant positive first order parameter and a significant negative second order parameter with p-value less than 1%. I add no control in the first column and the estimated result is similar with the estimated triple (η_0, η_1, η_2) in Section 4. I gradually add control for education, migration time and rural income and the inversely V shaped life cycle income pattern is robust. Logged income reaches at the highest level at about age 37 $[0.075/(2 \times 0.001)]$.

Table 6: Robustness: Empirical Evidence of Stylized Fact 1

	(1) log(income) OLS	(2) log(income) OLS	(3) log(income) OLS	(4) log(income) OLS
Age	0.075^{***}	0.083^{***}	0.075^{***}	0.078^{***}
	(0.013)	(0.013)	(0.014)	(0.014)
Age Squared	-0.001^{***}	-0.001^{***}	-0.001^{***}	-0.001^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	8.766^{***}	8.518^{***}	26.744^{***}	21.735^{***}
	(0.242)	(0.251)	(3.817)	(3.732)
Education	No	Yes	Yes	Yes
Migration Time	No	No	Yes	Yes
Rural Income	No	No	No	Yes
Observations	2814	2813	2664	2664

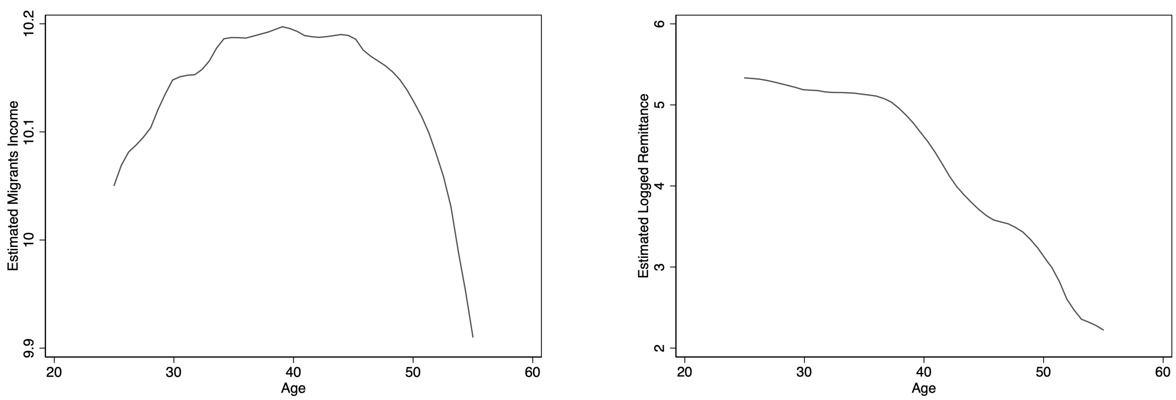
Table 7 highlights the estimation for log remittance. Without any control, I identify a decreasing remittance over life cycle, as in column 1. In column 2, remittance is positive correlated with number of parents , and column 3 suggests that it is a driven factor for remittance. I add more controls for the specification in column 4 and 5, and the scale of coefficient of age is similar and significanly negative at 1% level.

Furthermore, I estimate the life cycle of income and remittance using local polynomial kernel density estimation in Figure , which gives us very similar pattern as Figure 5, which is similar with the result in Figure 1.

Table 7: Robustness: Empirical Evidence of Stylized Fact 2

	(1) log(remit) OLS	(2) log(remit) OLS	(3) log(remit) OLS	(4) log(remit) OLS	(5) log(remit) OLS
Age	-0.095***		0.002	-0.090***	-0.096***
	(0.008)		(0.009)	(0.009)	(0.009)
No. Parents		2.140***	2.151***		
		(0.082)	(0.093)		
Constant	8.112***	1.447***	1.355***	4.866***	70.090**
	(0.299)	(0.138)	(0.401)	(1.078)	(21.315)
Education	No	No	No	Yes	Yes
Rural Income	No	No	No	Yes	Yes
Migrant Time	No	No	No	No	Yes
Observations	2774	2774	2774	2773	2627

Figure 5: income and Remittance Profile of Migrants Over Life Cycles



Notes: The left and right panel show the income and remittance profile over life cycle for rural-urban migrants estimated using local polynomial kernel density estimation. The results square with stylized facts 1 and 2.

7.2 Details of value function

To derive T_t, I rewrite (10) for agents in the urban sector as

$$V^U(k_{it}^U, x_{it}) = \max_{k_{t+1}} \overline{U}(c_{it}^U, \overline{c_{it}}^U) - f \tag{18}$$

$$+ \beta\theta V^R(k_{it+1}^R, x_{it}) \tag{19}$$

$$+ \beta(1-\theta)\mathbb{E}V(k_{it+1}, x_{it+1}), \tag{20}$$

Combining with equation (5) and (6), the first order condition with respect to T_t^M is

$$[c_t^M]^{-\gamma} = A(n_t)[\overline{c_t}^M]^{\gamma}, \tag{21}$$

Substituting equation (7) and (8) into equation (21), I solve out

$$T_t^M = \frac{y_t^U + (1+r)k_t^U - k_{t+1}^U - A(n_t)^{-1/\gamma}[\overline{w}^R]}{1 + A(n_t)^{-1/\gamma}/n_t} \tag{22}$$

7.3 Robustness Check

In the robustness check, the income profile is given by the local polynomial kernel density. I re-calibrate the model and find very similar parameter values and targeted moments as the baseline result. The pattern is robust, see Figure 6.

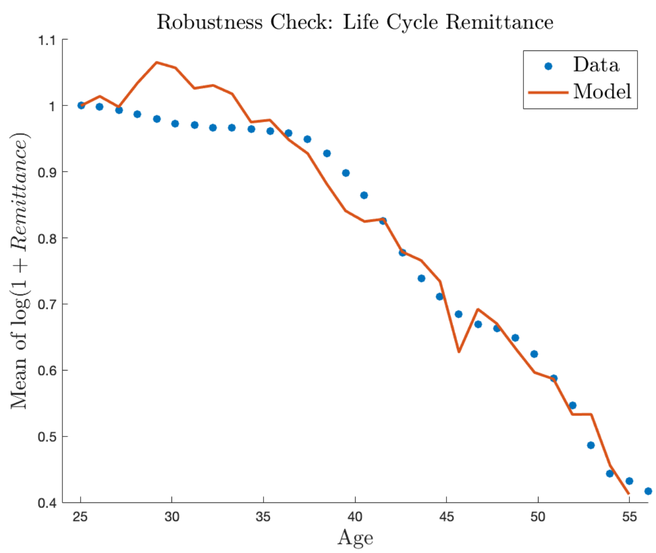


Figure 6: Robustness Check: Life Cycle of Remittance

7.4 Computational Algorithm

I firstly obtain the policy function for different types of agents and then simulate a set of agents starting from 25 years old given the initial distribution of their land endowment, idiosyncratic income shock and initial capital. I set the number of parents as 2 initially. Given the initial value of each agent's state, I simulate 30 periods thereafter given the policy function and stochastic process in subsection.