The Earned Income Tax Credit and the Tax-benefit Link of Public Pensions

Dongmin Chun

Seoul National University

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Earned Income Tax Credit (EITC)

- Welfare program for the low income conditioned on working

  $\Rightarrow$ goal: to provide cash assistance & incentive to work

- EITC can raise income through...
  1. tax credit
  2. labor earnings $\uparrow$ *if labor supply responds to incentive*

Literature

- Do labor supply increase in response to EITC?
  - (seems to be) **Yes**, at the **participation** margin
    (e.g., Eissa and Liebman, 1996; Meyer and Rosenbaum, 2001)
- Is earnings ↑ important for income ↑ (tax credit + earnings)?
  - **Yes** (Hoynes and Patel, 2018)
- **Long-term impact over the life cycle?**
  - Enhance **welfare** by providing **insurance against wage risks**
    (Athreya et al., 2014; Blundell et al., 2016)
  - EITC as rainy-day fund for newborns with low lifetime income
  - precautionary savings ↓ & consumption ↑ (consumption smoothing ↑)

Motivation

- *Long-term impact* with **tax-benefit link of public pensions**?

  : $\underbrace{\textbf{earnings \& pension contribution}}_{\textbf{before retirement}} \uparrow \Rightarrow \underbrace{\textbf{pension benefit}}_{\textbf{after retirement}} \uparrow$

- Then EITC can raise *lifetime* income through...
  1. (static) tax credit
  2. (static) labor earnings
  3. (dynamic) **pension benefits** after retirement $\uparrow$

- Furthermore, if people better understand **dynamic return** when making labor supply choice (Liebman and Luttmer, 2015)
  - EITC's impact on **labor supply & earnings** $\uparrow$

$\Rightarrow$ **EITC's impact on lifetime income & welfare** $\uparrow\uparrow$

This paper

Question: How important is the pension tax-benefit link for the EITC's long-term impact over the life cycle?

1. Build a standard life-cycle model of consumption-savings with
   - EITC & labor supply choice (as in literature)
     - + *persistent wage risks* (as in literature)
       to capture EITC's consumption smoothing effect
   - tax-benefit link of public pension (new)
     - + *mortality risks* (new)
       to avoid overstating the role of pension tax-benefit link

This paper

2. Calibrate the model to the Korean economy
   - runs EITC program & supporting evidence of labor supply effect (half of UI expenditure to 10% of working-age population in 2019)
   - 70% of EITC recipients pay pension contributions (SHFLC, 2017–2020)

3. Two counterfactual experiments (in PE setting as in literature)

(1) EITC vs. NO EITC **where tax-benefit link fully active (full model)**

- importance of pension income ↑ in lifetime income ↑

(2) EITC vs. NO EITC **where tax-benefit link active only for EITC-ineligible employment (static-only model)**

- **results from (1) vs. (2)**: EITC's effects with *both static and dynamic returns* vs. *static return only*

⇒ importance of understanding about pension tax-benefit link

Brief summary

- **Question**: How important is the pension tax-benefit link for the EITC's long-term impact over the life cycle?

- **Answer**: Focusing on newborns with low lifetime income, I find *pension tax-benefit link* can explain *more than half (a quarter)* of the increase in lifetime income (welfare)

- **Contributions**:

  1. Further understand the *benefits* of the EITC: better knowledge of the pension tax-benefit link can be an important amplifying mechanism

  2. EITC to the working age as an alternative policy tool to prevent old-age poverty *in advance*

Model — EITC (million KRW ≈ thousand USD)

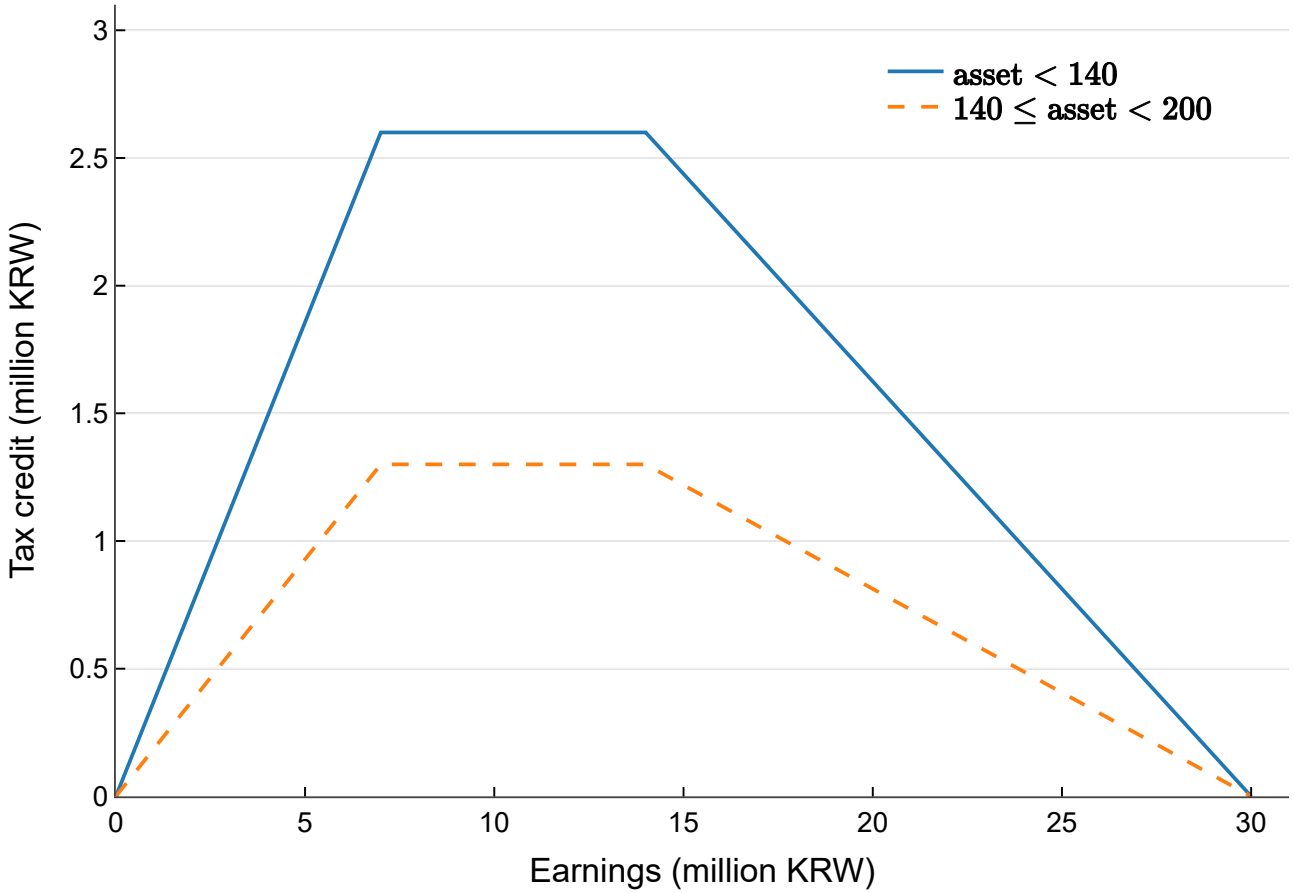

Figure: EITC schedule for single-earner families, 2019, Korea

- earnings limit & asset limit

Model — Public Pension

- Pension benefits formula:

$$\xi(e, n) = \kappa(E + e)\mathbf{n}$$

  - e: career average taxable earnings
  - **n: contribution periods (cumulative years of employment)**
    - κ: scale parameter (avg. replacement rate of 40%)
    - E: economy-wide average taxable earnings

- Note that $\partial\xi/\partial n > 0$

  $\Rightarrow$ **employment response to EITC $\Rightarrow$ future pension income $\uparrow$**

Earnings (static) vs. Pension benefits (dynamic)

If an EITC-eligible individual works 1 more year, he will receive tax credits and...

- (static) earns about ₩10 million
- (dynamic) **more pension income in future** by about
  - ₩0.3 million per year
  - ₩6 million in total (life expectancy at age 65 $\approx$ 20 years)
  - ₩1.3 million in PV at age 25
  - ₩4.3 million in PV at age 65

$\Rightarrow$ **quite large dynamic labor supply incentive**

Model — Tax / Transfer

$$\text{tax} = \underbrace{T(y)}_{\text{labor income tax}} + \underbrace{\tau_p \cdot \min\{y, \bar{y}\}}_{\text{pension contribution}} + \tau_k ra + \tau_c c$$

$$\text{transfer} = \underbrace{\psi(a, y) + \Omega \cdot (1 - h) + tr}_{\text{before retirement}} + \underbrace{\xi(e, n) + bp}_{\text{after retirement}}$$

where

- y: earnings; a: risk-free asset holdings; $h \in \{0, 1\}$: labor supply
- $T(y) = \max\{0, y - \lambda_l y^{1-\tau_l}\}$: progressive income tax (HSV)
- $\psi(a, y)$: EITC
- Ω: transfers to non-employed; tr: lump-sum transfer to working age
- ξ: public pension benefits; bp: basic pension (lump-sum)

back

Model — Overview of Individual's Problem

- During working age ($25 \leq$ age ≤ 65)
  - consumption-savings & labor supply choice
  - facing persistent wage risks & borrowing constraint
  - can receive EITC & pay taxes
- During retirement period ($66 \leq$ age ≤ 100)
  - consumption-savings choice
  - facing mortality risks
  - receive pension benefits
- extension of standard heterogeneous-agent (incomplete markets) OLG model of Huggett (1996)

Model — Individual

- Value function of the **working age** ($j < J_R$) :

$$V_j(a, z, n, e) = \max_{c, a', h} \log c - \nu_j h + \beta \boxed{\phi_{j+1}} E_{z'|z} V_{j+1}(a', z', n', e')$$

subject to

$$c + a' = y + ra + a - (\text{tax} - \text{transfer})$$

$$a' \geq 0, \quad c \geq 0, \quad \underbrace{\boxed{h \in \{0, 1\}}}_{\text{labor supply choice}}$$

$$\boxed{n' = n + h}; \quad e' = \frac{e \cdot n + \min\{y, \bar{y}\}}{n'}$$

$$\boxed{y = w \epsilon_j z h}$$

$$\boxed{\log z' = \rho_z \log z + \epsilon'_z, \quad \epsilon'_z \sim i.i.d\ N(0, \sigma_z^2)}$$

- ϵ_j: deterministic productivity by age
- z: idiosyncratic shock to productivity

back

Model — Individual

- Value function of the **retiree** ($j \geq J_R$) :

$$V_j(a, e, n) = \max_{c, a'} \log c + \beta \phi_{j+1} V_{j+1}(a', e, n)$$

subject to

$$c + a' = \xi(e, n) + bp + ra + a - \text{tax}$$
$$a' \geq 0, \quad c \geq 0$$

  - receive pension benefits ξ
  - consumption-savings decisions only

Calibration

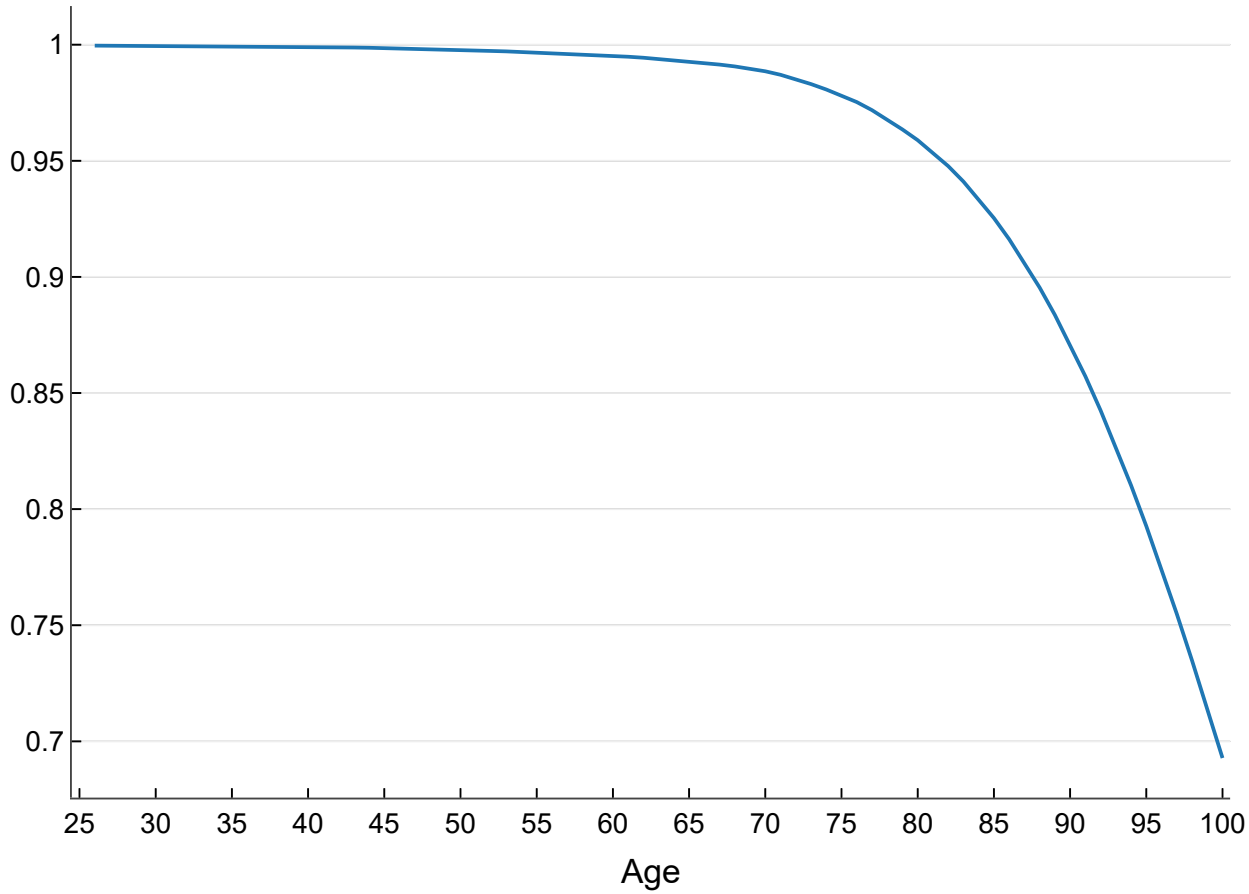

Figure: Conditional survival probability by age

Source: Life Table (2015)

- pronounced mortality risks in retirement period

Calibration

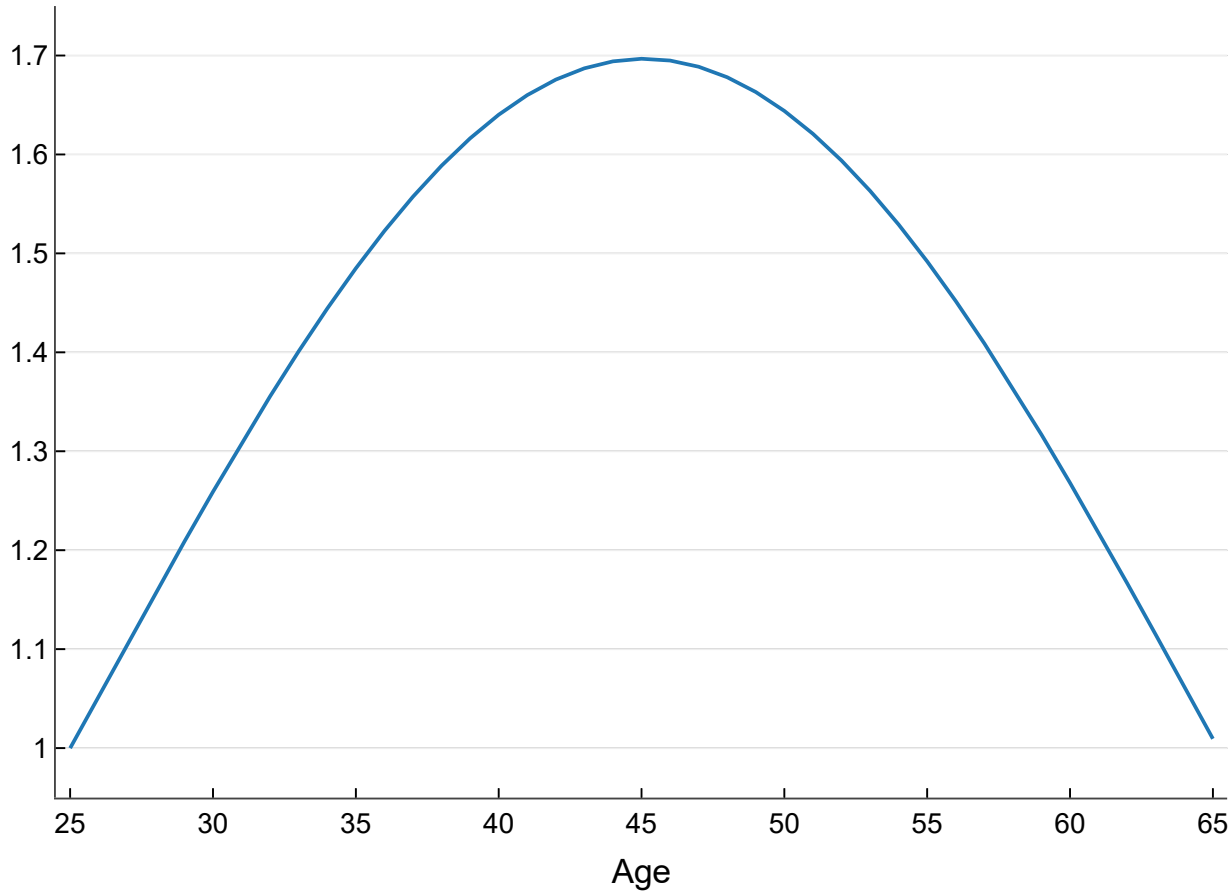

Figure: Deterministic productivity by age ϵ_j

Source: SHFLC, 2019

- standard hump-shaped age earnings profile

Model fit — Targeted

- employment rate by age

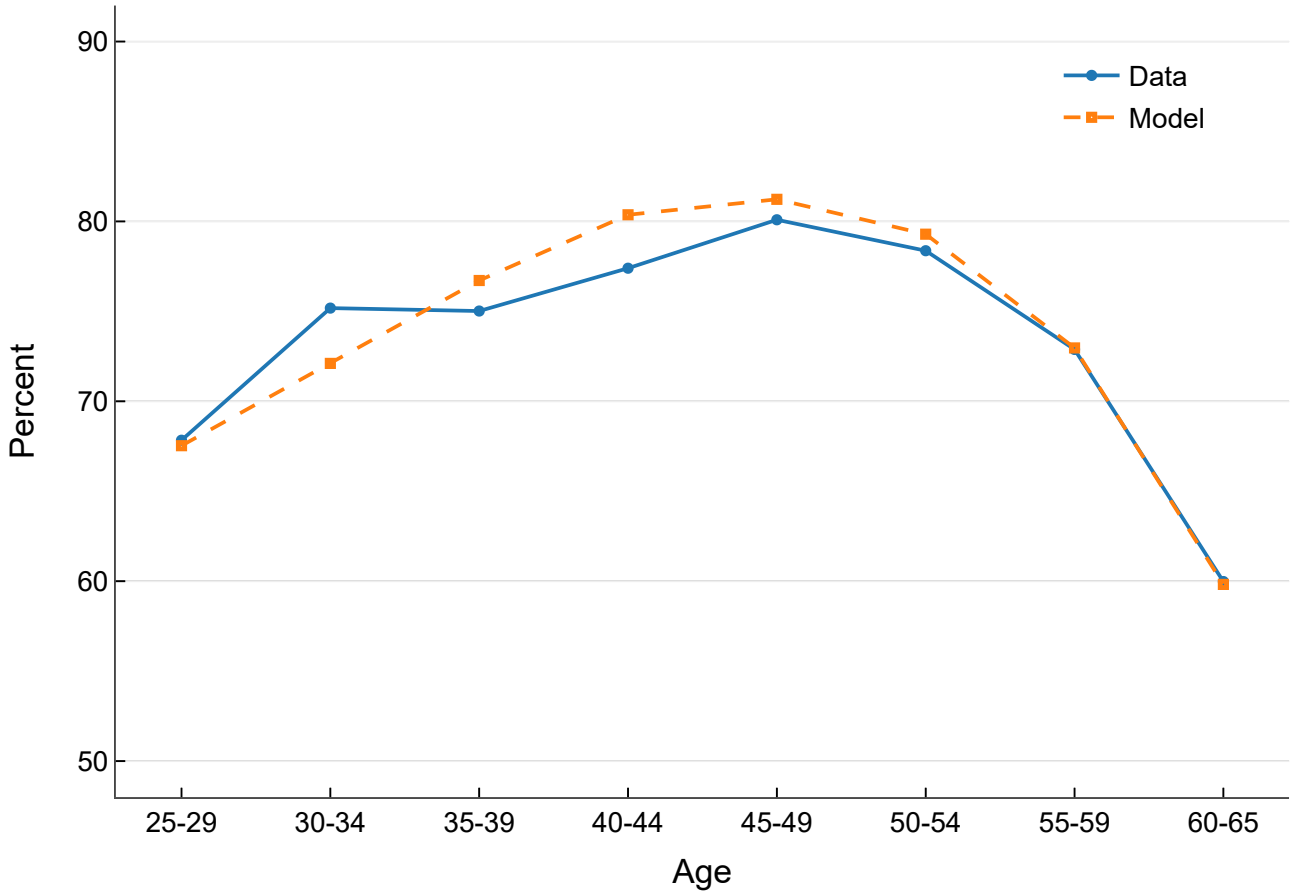

Figure: Employment rate by age

Source: Economically Active Population Survey, 2015–2019

Model fit — NOT targeted

- **moments for EITC** (2019 EITC)

	Data	Model
EITC to GDP ratio (%)	0.20	0.19
EITC recipiency rate (%)	10.4	11.4

- **labor supply elasticity** (holding wealth distribution fixed)
  - aggregate: 0.72 (Chang and Kim, 2006; Fiorito and Zanella, 2012; Erosa et al., 2016)
  - Moon and Song (2016)'s estimates: 0.23 at intensive margin & 0.93-0.99 at total margin

$\Rightarrow$ **model-implied labor supply effect of EITC would be plausible**

Effects on Lifetime Income

	Environment	
	full	static-only
Lifetime years of employment (years)	**0.86**	0.59
Tax credit (million KRW)	7.45	4.41
Post-tax earnings (million KRW)	8.52	6.01
Pension income (million KRW)	**4.55**	−0.40
Labor-related income (million KRW)	20.52	10.02

- **Results from full pension tax-benefit link setting (1st column)**
  - post-tax earnings ↑ is as large as tax credit receipts (Hoynes and Patel, 2018)
  - **pension income** ↑ amounts to 60% of tax credit receipts
  - **pension income ↑ explains more than one-fifth of (labor-related) lifetime income ↑**

Role of Pension Tax-benefit Link

- How important is the dynamic return to labor supply through the pension tax-benefit link for the result?
- This is important because...
  - people might not recognize pension tax-benefit link when making labor supply decisions (Liebman and Luttmer, 2015)
  - Liebman and Luttmer (2015): informational intervention (RCT) about pension tax-benefit link $\Rightarrow$ labor supply $\uparrow$
- **What if we can make potential EITC recipients better understand the dynamic return on labor supply?**
  - "If you work, you get EITC & your **future pension benefits** $\uparrow$"
- To this end, we shut down pension tax-benefit link for EITC-eligible employment and analyze EITC's effects (static-only model)

Individual's problem

Role of Pension Tax-benefit Link

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- **Results WITH vs. W/O dynamic return (1st vs. 2nd column)**

  fully understand future return of pension benefits
  vs. perceive pension contribution as pure tax

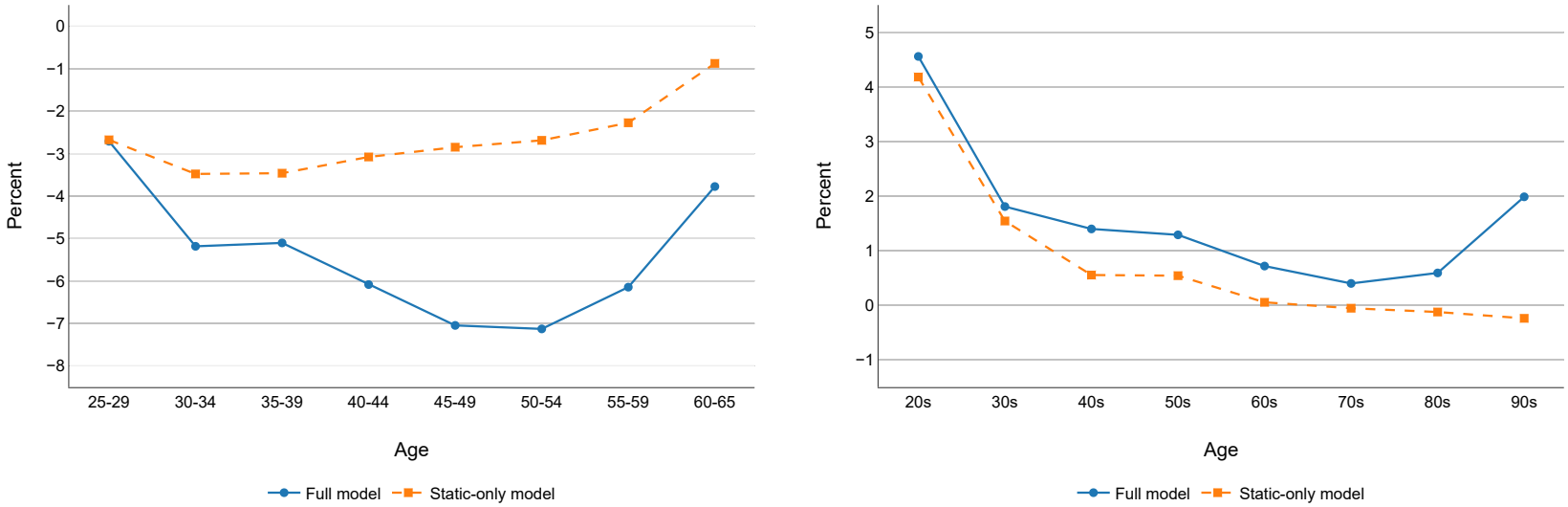
  - **labor supply & incomes ↑ greater with dynamic return**

⇒ If the true model is static-only in 2nd column,

EITC's benefits can be substantially amplified through information provisions about pension tax-benefit link

Who is mainly affected? Labor supply effect by age

Effects on Savings & Consumption



(a) Savings (b) Consumption

Figure: Proportional changes in savings & cons.: full vs. static-only model

- EITC $\Rightarrow$ precautionary savings $\downarrow$ b/c it partially insures against bad productivity in future (Athreya et al., 2014; Blundell et al., 2016)
- **With dynamic return, EITC's impacts on dis-savings & consumption at middle age $\uparrow\uparrow$ as well as retirement period**
- because EITC-eligible employment near retirement...
  - **insures against retirement through tax-benefit link**

  $\Rightarrow$ retirement motive savings $\downarrow$ & consumption $\uparrow$ at middle age

Welfare Consequences

	Environment	
	full	static-only
Changes in PV of	Unit: million KRW	
Lifetime disposable income, (a)	8.01	5.43
Lifetime consumption, (b)	9.55	5.91
Consumption smoothing, (b)/(a)−1	19%	9%

Table: Effects on consumption smoothing

	Environment	
Consumption equivalence (%)	full	static-only
Consumption component	2.33	1.78
Consumption-Leisure	0.73	0.54

Table: Effects on welfare

- **dynamic return amplifies consumption smoothing effect**
  $\Rightarrow$ **explains a quarter of consumption component welfare gain**

Conclusion

- Examine the **EITC**'s **long-term impact over the life cycle** and emphasize the role of **pension tax-benefit link**

- Policy implications
  - informational intervention about tax-benefit link ↑
    ⇒ EITC's benefits ↑
  - such interventions also can help reduce old-age poverty *in advance*

- CAVEATS
  - results from comparing two extreme cases: w/ perfect knowledge vs. w/ no knowledge
  - NOT directly applicable to other countries b/c how pension contributions and benefits are linked would be different across countries

Appendix

Model — Government

- Govt balances tax/transfer & public pension systems, *respectively*:

$$\textbf{(Tax/Tr)}\ G + EITC + Welfare + BP = \sum_{j=1}^{J_R-1} \theta_j \int T(y)\, d\mu_j(x) + \tau_c C + \tau_k r K + Beq$$

$$\textbf{(Pension)}\ \sum_{j=J_R}^{J} \theta_j \int \xi(e,n)\, d\mu_j(x) = \tau_p \sum_{j=1}^{J_R-1} \theta_j \int \min\{y, \bar{y}\}\, d\mu_j(x)$$

  - Expenditures (revenues) are on LHS (RHS) for each system
  - Assume PAYG system for public pension as in literature

Model — Firm

- Representative firm has access to CRS technology:

$$Y = AK^{\alpha}L^{1-\alpha}$$

- L is labor input in efficiency unit:

$$L = \sum_{j} \theta_j \int \epsilon_j \cdot z \cdot h(x)\, d\mu_j(x)$$

  where $x = (a, z, e, n)$ and θ_j is population share.

- Aggregate capital K depreciates at rate δ
- Markets are competitive.

Model — Equilibrium

Equilibrium consists of prices $\{w, r\}$, tax-transfer policies $\{\tau_c, \lambda_l, \tau_l, \tau_k, \Omega, tr, bp\}$, EITC $\{\beta_{in}, \beta_{out}, \alpha_{out}, \bar{\psi}, \bar{a_1}, \bar{a_2}\}$, public pension system $\{\tau_p, \bar{y}, \kappa, E\}$, government consumption G, and individual's policy functions $\{c(x), h(x), a'(x)\}$ such that,

- Given prices and government policies, the policy functions of the individual are solutions to optimization problems,
- Given prices, firms determines their demand for capital and labor to maximize profit: $w = AF_L(K, L)$ and $r = AF_K(K, L) - \delta$,
- G and τ_p satisfy each government budget,
- Markets are cleared,
- The measure of individuals is consistent.

Calibration

Parameter	Value	Description	Target/source
Labor productivity			
ρ_z	0.773	persistence of shock	Han et al. (2019)
σ_z^2	0.04	variance of shock	Han et al. (2019)
Preference			
$\{\nu_j\}_{j=1}^{J_R-1}$	-	disutility of work by age	employment rate by age
β	0.9767	discount rate	$r = 4\%$
Tax and Transfer			
τ_l	0.02	progressivity of income tax	estimated
λ_l	0.913	scale parameter of income tax	$T_l/Y = 4.6\%$
Ω	0.039	transfer to non-employed	estimated
tr	0.026	lump-sum transfer	$Welfare/Y = 7.4\%$
Public Pension			
τ_p	12.9%	contribution rate	balanced budget
$\bar{y}$	0.5880	maximum taxable earnings	current system
κ	0.005	scale parameter (replacement rate)	current system (40%)
E	0.4146	economy-wide average earnings	equilibrium

Table: Parameter values

Calibration

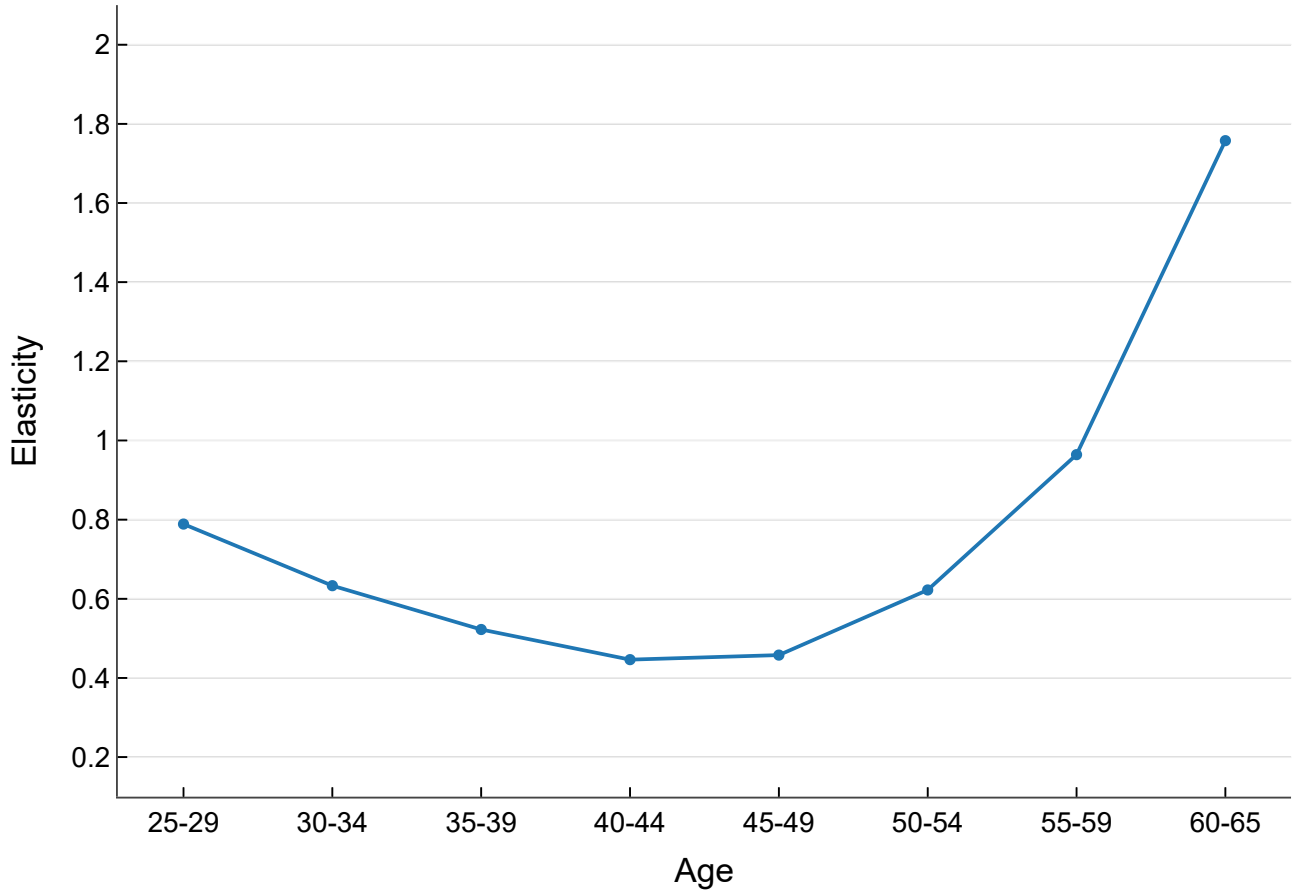


Figure: Labor supply elasticity by age

Calibration

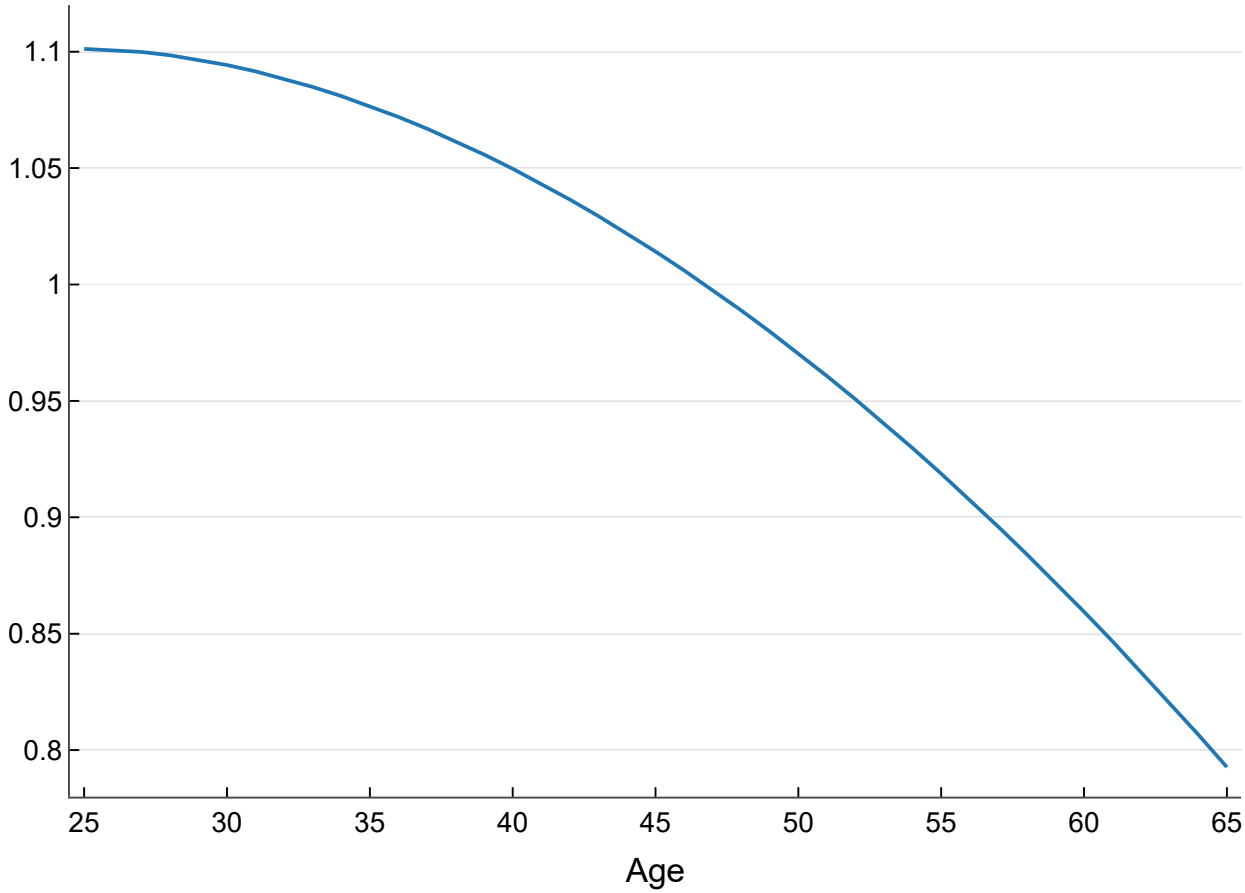
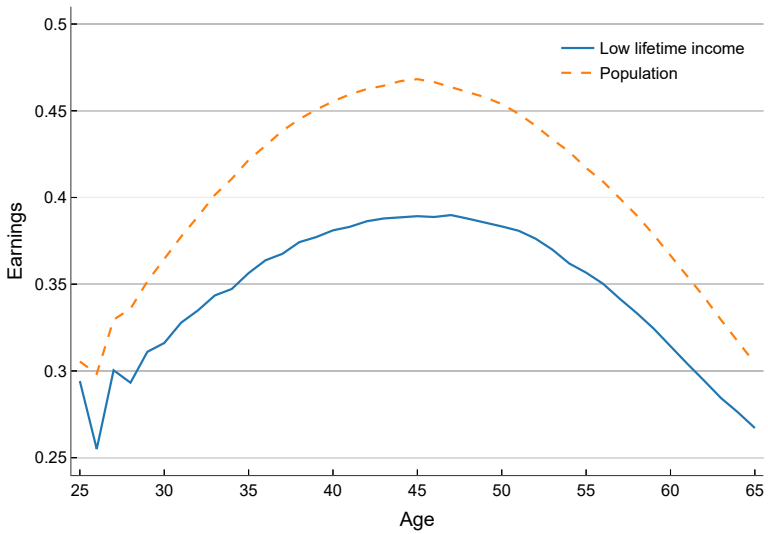


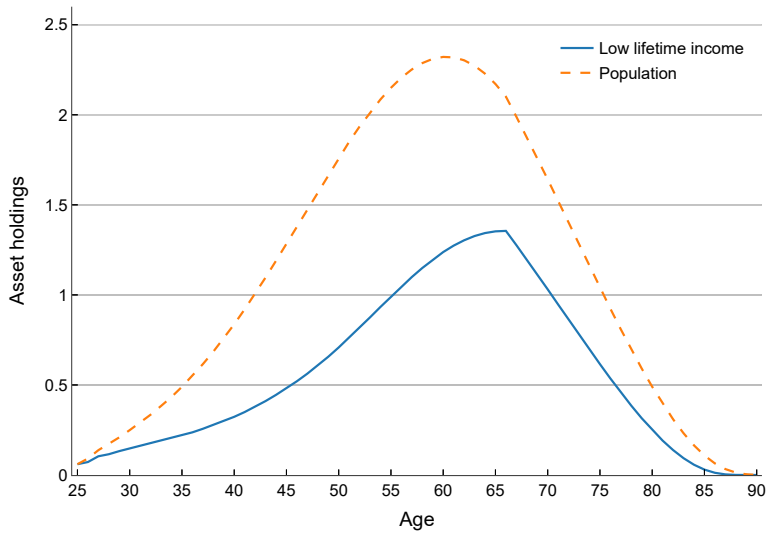
Figure: Fixed cost of work by age

Who is mainly affected?

Figure: Median age profiles for low lifetime income and population



(a) Labor earnings

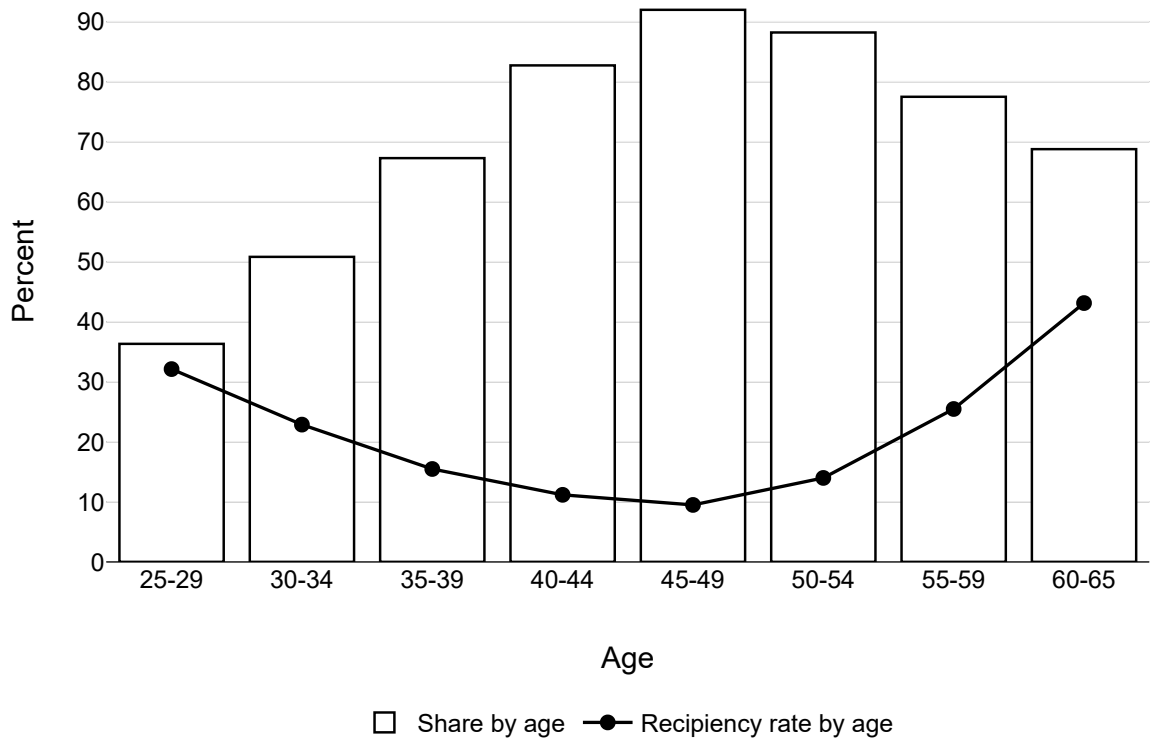


(b) Asset holdings

- 'low lifetime income': newborns whose PV of lifetime income belongs to lowest 30%
- earnings & assets are persistently low compared to population
- seems to be plausible candidate

Who is mainly affected?

Figure: Low lifetime income's share of EITC recipients and recipiency rate



- **large share of EITC recipients (bar graph)**

⇒ **We will focus on *average effects* for newborns whose PV of lifetime income belongs to lowest 30% (low lifetime income)**

back to lifetime income

Effects on Labor Supply

	By age		
	25–39	40–49	50–65
Employment rate (pp)	1.91	0.53	3.22
	(1.82)	(0.24)	(1.81)

- stronger response at younger and older age due to
  - high recipiency rate at those ages
  - high labor supply elasticity especially nearing retirement (French, 2005; Erosa et al., 2016; Fan et al., 2022)
- consistent with empirical findings of Park and Lee (2018) & suggest possible mechanisms for it
  - Korean EITC $\Rightarrow$ labor supply at extensive margin
  - find larger labor supply response of those aged 60–65
- **Parentheses** report the results from **partial model**
  - **difference b/w full model gets larger near retirement**

  $\Rightarrow$ role of dynamic return gets larger near retirement

back to pension income | back to lifetime income | Recipiency by age | static vs. dynamic