Financial Literacy, Portfolio Choice, and Wealth Inequality: A General Equilibrium Approach

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Motivation and Research Agenda

Financial Literacy SCF

- *Economic agent's "ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions"* (Lusardi and Mitchell, 2014)
- More literate individuals tend to experience higher asset returns (Clark et al., 2015; von Gaudecker, 2015)
- Little is known on aggregate relationship between financial literacy, behaviors, and outcomes

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- What are the effects of raising financial literacy in **partial vs. general equilibrium**?
  - $\Rightarrow$ *Key outcomes*: stock market participation, aggregate capital & wealth inequality
- How would such changes affect investment & equity premia of **different wealth groups**?

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Contribution

- *Framework*: dynamic GE model with portfolio choice & financial literacy accumulation
- *Findings*: aggregate and distributional implications of financial literacy

Paper In A Nutshell

I. Framework: life-cycle + incomplete market + general equilibrium model

- *Portfolio choice*: risk-free asset ("*bonds*") vs. risky asset ("*stocks*")
- *Financial literacy accumulation*: increases a household's risk-adjusted stock returns
- *Equilibrium*: aggregate capital income is distributed according to a HH's *relative* FinLit

  $\Rightarrow$ FinLit accumulation has spillover effects on *stock investment* & *equity premium*

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II. Calibration: model matches U.S. average FinLit + stock market participation in SCF

III. Policy Analysis: of subsidizing financial literacy costs

① Average FinLit $\uparrow \Rightarrow$ short-run stock investment $\uparrow \Rightarrow$ overall stock return $\downarrow$ in equilibrium

  $\Rightarrow$ Stock market participation increases by **PE** $1.92\%\text{p}$ vs. **GE** $0.22\%\text{p}$

② Redistribution of *capital incomes* from top to middle wealth quartiles

  $\Rightarrow$ Ratio of total wealth held by the top vs. other quartiles decreases by 1.9%

Related Literature

Macroeconomics

- Heterogeneity in wealth returns amplifies **wealth inequality**
  - Gabaix et al. (2016), Cao and Luo (2017), Benhabib et al. (2019), Hubmer et al. (2021), Xavier (2021), Mihet (2022)
- Sources of **return heterogeneity**: type dependence vs. scale dependence
  - Fagereng et al. (2020), Bach et al. (2020), Gaillard and Wangner (2022)

Household Finance

- **Financial literacy** is positively associated with investment outcomes
  - Calvet et al. (2007, 2009), von Gaudecker (2011), Van Rooij et al. (2011), McKay (2013), Clark et al (2015), Jappelli and Padula (2016), Lusardi et al (2017), Bianchi (2018), Gambacorta et al. (2023)
- Life cycle **portfolio choice** and equity participation puzzle
  - Merton (1969), Cocco (2005), Cocco et al. (2005), Gomes and Michaelides (2005), Yao and Zhang (2005), Yogo (2015), Fagereng et al. (2017), Catherine (2022), Athreya et al. (2023)

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This Paper

- Develop a structural model accounting for **equilibrium effects** of financial literacy accumulation
- Analyze the macroeconomic interplay: **financial literacy dispersion** $\Leftrightarrow$ **wealth inequality**

Road Map

I. **Framework**: GE with portfolio choice & FinLit

II. **Quantitative Exercise**: data, calibration & model validation

III. **Policy Analysis**: financial literacy subsidy

I. Framework

Model Overview ▸ Summary

- **Portfolio choice**: a risk-free bond vs. a stock with idiosyncratic risks
  - *Frictions*: ① borrowing & short-sale const., ② per-period stock market participation cost
- **Financial literacy**: a form of human capital $\rightarrow$ increases risk-adjusted stock return ▸ SCF
  - HH *accumulates* FinLit over time as ① FinLit depreciates; ② acquiring FinLit is costly
- **Life cycle**: a household is born at $t = 25$, retires at $t = t_R = 65$, dies at $t = T = 80$
  - *Stochastic* pre-retirement labor income + *deterministic* social security benefit formula

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- **Market clearing**: (bonds = gov't debt) & (stocks = productive capital)
- ⋆ **What's new**: ***financial literacy in general equilibrium framework***
  - Assumption ①: HH's FinLit does *not* directly impact the production process
  - Assumption ②: aggregate capital income is distributed according to a HH's *relative* FinLit

  ⇒ An individual HH's return increase from FinLit comes at the cost of others' loss

Household Choice Variables

At age $t \leq T$, a household chooses:

1. **Gross saving in financial assets**: $\mathcal{S}_{t+1} \geq 0$
   - Borrowing constraint on financial assets
2. **Share of wealth invested in stocks**: $\kappa \in [0, 1]$
   - Short-sale constraints on stocks
   - Per-period stock market participation cost: $\theta > 0$
3. **Financial literacy**: $f_{t+1} = (1 - \delta_f) f_t + e_t$
   - Depreciation rate $\delta_f \rightarrow e_t = (\text{FinLit acquired at age } t)$
   - Resource cost for FinLit acquisition $\Phi(e_t) = \phi e_t^{\iota}$ with $\iota > 1$

Financial Literacy Premium on Stock Returns

*At the beginning of $t \leq T$, a **household-specific stock return** realizes:*

$$\tilde{r}(f_t) = \underline{r}^\star + r^X(f_t) + \sigma^X \eta_t, \ \eta \sim \mathcal{N}(0,1)$$

- Idiosyncratic, non-systematic capital income shock $\eta \sim \mathcal{N}(0,1)$ with variance σ^X
- FinLit *linearly* increases a household-specific mean excess return $r^X(\cdot)$ ▸ CLM (2015)

$$r^X(\cdot) \in [r^X(f_{\min}), r^X(f_{\max})] = [0, 0.01]$$

  $\Rightarrow$ *Given σ^X fixed, FinLit increases a Sharpe ratio of stock investments*

- "*Base*" expected stock return for investors with minimum FinLit

$$\mathbb{E}[\tilde{r}(f_{\min})] = \underline{r}^\star + \underbrace{r^X(f_{\min})}_{=0} = \underline{r}^\star (\rightarrow \text{equilibrium object})$$

Labor Income and Social Security

- **Pre-retirement** $(t \leq t_R)$: Inelastic supply of *stochastic* efficiency units of labor

$$\log(l_{t+1}) = m_t + \rho \log(l_t) + \varepsilon_t$$

where $m_t = (\text{deterministic component at age t})$, $\rho \in (0,1)$, $\varepsilon_t \sim \mathcal{N}(0, \sigma_l^2)$

- **Post-retirement** $(t > t_R)$: Deterministic social security benefit function

$$\log(l_t) = \log \lambda + \log(l_{t_R}), \text{ w/ } \lambda \in (0,1)$$

- Government levies a labor income tax to fund the pension system

$\Rightarrow$ Disposable labor income net of housing cost h_t and labor income tax τ^l

$$w^\star \tilde{l}_t = \begin{cases} (1-h_t)(1-\tau^l) l_t & t \leq t_R \\ (1-h_t)\lambda l_{t_R} & t > t_R \end{cases}$$

Recursive Household Problem

$$V_t(\mathcal{X}_t, f_t; l_t, \eta_t) = \max_{c_t, \kappa_t, e_t} \left\{ (1-\beta) c_t^{1-1/\psi} + \beta \mathbb{E}_{l,\eta} \left[V_{t+1}^{1-\gamma}(\mathcal{X}_{t+1}, f_{t+1}; l_{t+1}, \eta_{t+1}) \right]^{\frac{1-1/\psi}{1-\gamma}} \right\}^{\frac{1}{1-1/\psi}}$$

$$\text{s.t.} \quad \mathcal{X}_{t+1} = \underbrace{\left[\kappa_t \tilde{R}(f_{t+1}) + (1-\kappa_t) R^b\right]}_{\text{gross returns to wealth}} \underbrace{\left(\mathcal{X}_t - c_t - (1-\varphi_t)\Phi(e_t) - \theta \cdot \mathbb{1}(\kappa_t > 0)\right)}_{\equiv \mathcal{S}_{t+1},\ \text{gross saving}} + \underbrace{w\tilde{l}_{t+1}}_{\text{labor inc}}$$

$$f_{t+1} = (1-\delta_f) f_t + e_t$$

$$\tilde{R}(f_{t+1}) = 1 + (1-\tau^r)\left(\underline{r} + r^X(f_{t+1}) + \sigma^X \eta_{t+1}\right), \ \eta \sim \mathcal{N}(0,1)$$

$$R^b = 1 + (1-\tau^r) r^b$$

$$\mathcal{X}_{t+1} \geq 0, \kappa_t \in [0,1]$$

- **Preferences**: Epstein–Zin with EIS ψ; risk aversion γ
- **States**: cash on hand $\mathcal{X}_t$, FinLit f_t ($+$ stochastic labor $l_{t \leq t_R}$; stock return risks η_t)
- **Choices**: consumption c_t; risky portfolio share κ_t; FinLit acquisition e_t
- **Frictions**: borrowing & short-sale constraints; stock market participation cost θ
- **Policy intervention**: government subsidizes φ_t fraction of FinLit acquisition costs $\Phi(e_t)$

Stock Market Clearing

▸ What if $A'(F) > 0$?

⋆ ***Assumption*** ①*: FinLit does not impact the fundamental production capacity*

- Perfectly competitive firm w/ a CRS production function $Y = g(K, L) = AK^{\alpha}L^{1-\alpha}$

$$r^{\star} = g_k(K, L) - \delta_K, w^{\star} = g_l(K, L)$$

- Stocks serve as productive capital

$$K^{\star} = \int (\kappa \cdot \mathcal{S}) d\Gamma(\mathcal{X}, f; l, \eta, t)$$

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⋆ ***Assumption*** ②*: Aggregate capital income is distributed according to a HH's relative FinLit*

$$r^{\star}K^{\star} = \int \left(\underline{r}^{\star} + r^{X}(f) + \sigma^{X}\eta\right) \cdot (\kappa \cdot \mathcal{S}) d\Gamma(\mathcal{X}, f; l, \eta, t)$$

- *Equilibrium objects*: marginal product of capital $r^{\star}$, "base" expected stock return $\underline{r}^{\star}$
- *Externally calibrated*: household-specific FinLit-return premium $r^{X}(f)$

Equilibrium Mechanism of Financial Literacy

⋆ *Stock market clearing conditions:*

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⋆ ***Suppose the aggregate financial literacy*** $F^\star = \int f d\Gamma$ ***increases:***

① Individual HHs expect higher risk-adjusted stock return $\tilde{r}(\cdot)$

$\Rightarrow$ short-run stock investment and aggregate capital $K^\star \uparrow$

$\Rightarrow$ long-run marginal product of capital $r^\star \downarrow$

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⇒ short-run stock investment and aggregate capital $K^\star \uparrow$

⇒ long-run marginal product of capital $r^\star \downarrow$

② Aggregate mean excess return $r^X(F^\star) \uparrow$

⇒ *base* expected stock return $\underline{r}^\star \downarrow$

⇒ FinLit accumulation has *pecuniary externalities (i.e., FinLit is a zero-sum game!)*

Government Budget Balance

Full GE DEF

- Gov't supplies a risk-free bond with return $r^{b\star}$ s.t.

$$B^\star = \int (1-\kappa)\mathcal{S}d\Gamma(\mathcal{X}, f; l, \eta, t)$$

- Gov't levies a capital income tax τ^r on both assets to finance debt payments and subsidies

$$G^\star + r^{b\star}B^\star = \tau^{r\star}\int \left(r^{b\star}(1-\kappa) + \tilde{r}(f)\kappa\right)\mathcal{S}d\Gamma(\mathcal{X}, f; l, \eta, t)$$

  where gov't expenditure for FinLit subsidy: $G^\star = \int \varphi_t \Phi(e) d\Gamma(\mathcal{X}, f; l, \eta, t)$

- Separately, gov't also levies a labor income tax τ^l to finance the social security system:

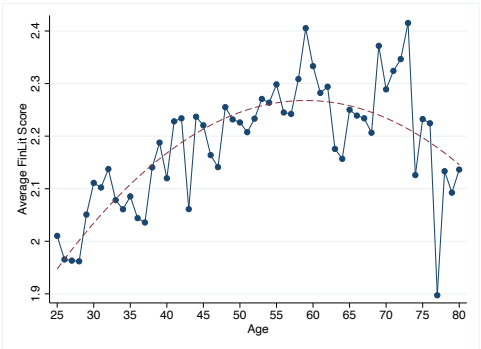
$$\tau^l w^\star \int l_t d\Gamma_{t\leq t_R} = \lambda w^\star \int l_t d\Gamma_{t>t_R}$$

II. Quantitative Exercise

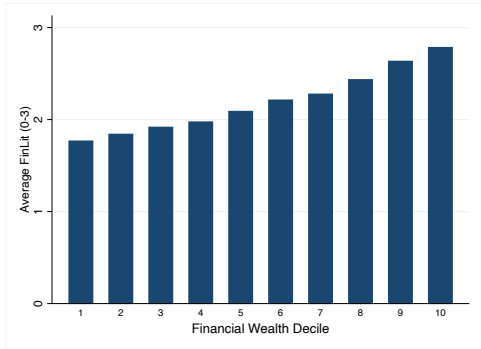
Data: Age, Wealth, and Financial Literacy in U.S.

Intro Summary Model Overview

- Financial literacy score in *Survey of Consumer Finances (SCF, 2016-2019)*
  = HH's understanding of ① risk diversification, ② inflation, ③ interest rate Big 3Q
- Life-cycle and distribution of financial literacy in the U.S.



(a) Hump-shaped life-cycle profile of FinLit



(b) Positive correlation between wealth & FinLit

Calibration Strategy

Internally calibrated:

- Average financial literacy $\rightarrow$ financial literacy investment cost coefficient ϕ
- Average participation rate $\rightarrow$ per-period fixed stock market participation cost θ

Calibration in progress:

- Std. dev. of financial literacy $\rightarrow$ financial literacy investment cost convexity ι
- $\mathbb{E}[f|71 \leq t \leq 65]/\mathbb{E}[f|75 \leq t \leq 80] \rightarrow$ financial literacy depreciation rate δ_f

Externally calibrated:

- FinLit premium on stock returns $r^X(f_{\max}) = 0.01$ from Clark et al. (2015) ▸ CLM (2015)
- Discount factor, EIS, risk aversion from Gomes and Michaelides (2005) ▸ Detail

Model Fit

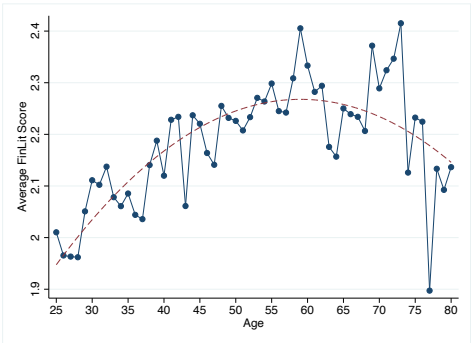
- Average financial literacy $(2.19) \rightarrow$ financial literacy investment cost coefficient ϕ
  - Increasing $r^X(\cdot)$ by 1 b.p. costs 1.8% of average pre-tax wage income
- Average participation rate $(0.54) \rightarrow$ per-period fixed stock market participation cost θ
  - Per-period participation costs 5.8% of average pre-tax wage income

	Model	Data	
Baseline Economy			
Risk-free return (%)	2.32		
Market equity premium (%)	5.38		
Equity premium for min. FinLit (%)	4.41		
Capital income tax rate (%)	9.77		
Financial literacy distribution			
Avg. FinLit age 18-25	1.98	1.98	⋆
Avg. FinLit age 26-80	2.18	2.19	⋆
S.D. FinLit age 26-80	0.93	0.86	
(Avg. FinLit 76-80)/(Avg. FinLit 71-75)	0.93	0.91	
Stock investment			
Avg. saving rate (%)	97.5	95.5	
Avg. participation rate (%)	54.1	54.1	⋆

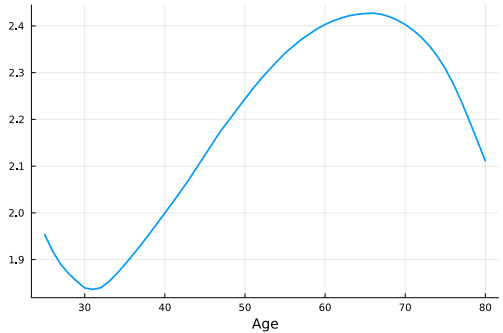
⋆ Internally calibrated. Data source: SCF 2016-2019.

Validation: Life Cycle Profile of Financial Literacy

(a) Data (Target Average: 2.19)



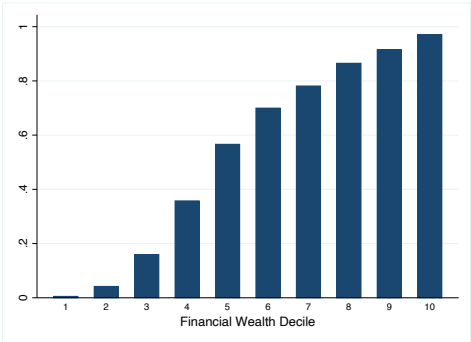
(b) Model (Simulated Average: 2.18)



- Model well replicates the hump-shaped life-cycle of financial literacy

Validation: Stock Market Participation by Wealth Group

(a) Data (Target Average: 0.54)



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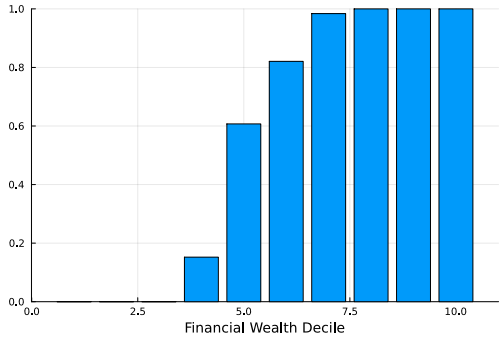


- Model well replicates the positive correlation between financial literacy and wealth

Validation: Correlation between FinLit and Stock Investment

$$(\text{Investment Outcome})_i = c + \beta \cdot \text{FinLit}_i + \Gamma X_i + \varepsilon_i \text{ for household } i$$

	Positive holdings of public equities?		Conditional wealth share in stocks	
	Data	Model	Data	Model
	(1)	(2)	(3)	(4)
Financial literacy score (0-3)	0.061***	0.089***	0.012*	0.101***
	(0.006)	(0.000)	(0.006)	(0.000)
ihs(net worth)	0.012***	0.310***	0.004***	-0.090***
	(0.001)	(0.000)	(0.001)	(0.000)
ihs(income)	0.096***	0.050***	0.007	0.141***
	(0.008)	(0.000)	(0.005)	(0.000)
Mean value	0.541	0.546	0.441	0.844
R-sq.	0.321	0.731	0.025	0.304
No. Obs	10997	2.75M	6858	1.5M

- Source: SCF 2016-2019. +p<0.10, *p<0.05, **p<0.01, ***<0.001. **Col (1), (3): Author's replication of Cupák et al. (2022)**.
- Controls: age, age sq., [Data: + business ownership, inheritance, HH size, kids, female, employed, education, race, marital status, year FE]

1 unit increase in financial literacy is associated with:

- Probability of holding public equities: $6.1\%\text{p}\uparrow$ in data, vs. $8.9\%\text{p}\uparrow$ in model
- Conditional wealth allocated into equity: $1.2\%\text{p}\uparrow$ data, vs. $10.1\%\text{p}\uparrow$ in model

III. Policy Analysis

Quantifying **Equilibrium Effects** of Financial Literacy

Summary

Recall research questions:

- What are equilibrium effects of raising FinLit on *aggregate capital* & *wealth inequality*?
- How will such changes affect *portfolio choices* & *equity premia* of different wealth groups?

$\Rightarrow$ GE framework permits quantifying the impact of policies to raise financial literacy

Consider a subsidy for FinLit acquisition costs: $\varphi = 0.75$, where $(\text{subsidized cost}) = (1-\varphi)\Phi(e_t)$

$\Rightarrow$ **Decomposing the equilibrium effects** of FinLit subsidies — on K/Y

- **PE** Partial Equilibrium — *Short-run* outcomes *without* return adjustments — $2.2\% \uparrow$
- **HE** "Hypothetical" GE — + Asset market clears & subsidy "*from heaven*" — $0.4\% \uparrow$
- **GE** General Equilibrium — + Gov't budget balance with capital income tax — $0.1\% \uparrow$

Comparative Statics: Before and After the FinLit Subsidy

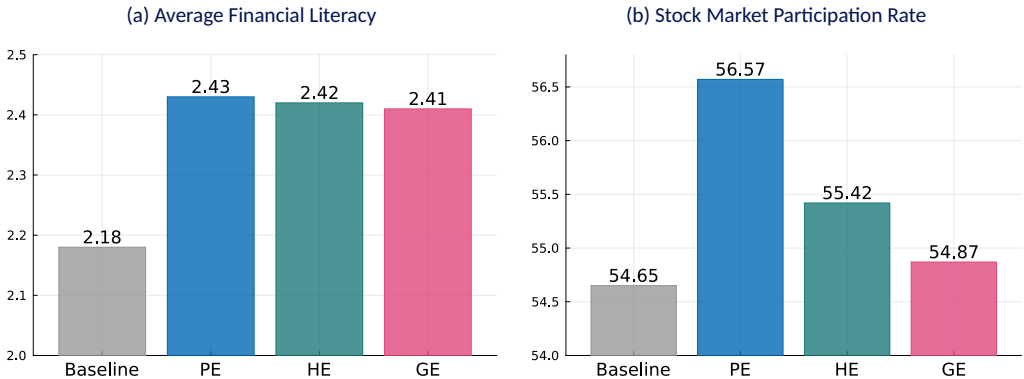
Detail

		Baseline (1)	ΔPE (2)	ΔHE (3)	ΔGE (4)
Avg. FinLit (out of 3)	$\mathbb{E}[f]$	2.18	0.25	0.23	0.22
Risk-free return (%)	r^b	2.32		-0.01	0.08
Market equity premium (%)	$r - r^b$	5.38		-0.06	-0.10
Base equity premium (%)	$\underline{r} - r^b$	4.41		-0.09	-0.13
Capital income tax rate (%)	$\tau^{r\star}$	9.77		-0.01	1.00
Agg. stock investment	$\mathbb{E}[\kappa \cdot \mathcal{S}]$	4.40	0.15	0.03	0.01
Capital-output ratio	K/Y	2.29	0.05	0.01	0.00

Note: The baseline returns and tax rate are in %. Corresponding changes (compared to the baseline) are in %p.

- The subsidy increases average FinLit by $10.16 - 11.26\%$ in all counterfactual scenarios
- **PE** Partial Equilibrium — Raising FinLit boosts short-run stock investment
- **HE** "Hypothetical" GE — As markets clear, both *market* and *base* equity premia ↓
- **GE** General equilibrium — Increase in capital income tax τ^r raises $r^b \Rightarrow$ equity premia ↓

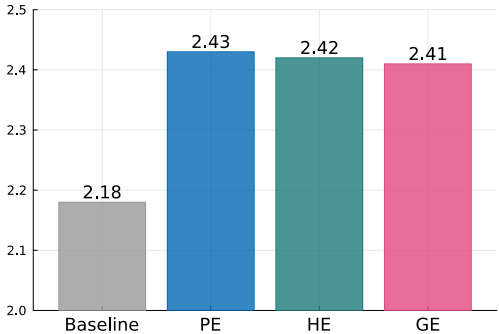
Aggregate Implication: FinLit Increases *Participation Rate* (PE vs. GE)



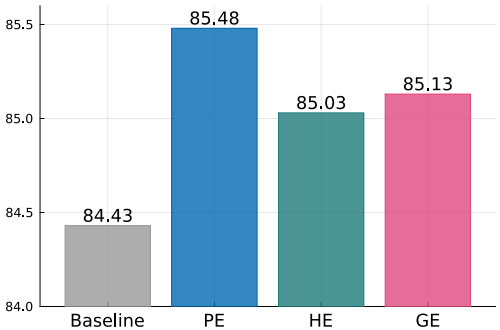
- **HE** Stock investment ↑ ⇒ aggregate capital ↑ ⇒ capital return ↓ ⇒ mkt. equity premium ↓
- **GE** To finance subsidy, capital income tax ↑ ⇒ bond return ↑ ⇒ mkt. equity premium ↓

Aggregate Implication: FinLit Increases *Risky Portfolio Share* (PE vs. GE)

(a) Average Financial Literacy



(b) Risky Portfolio Share Cond. on Participation



- **HE** mkt. equity premium $\downarrow \Rightarrow$ intensive margin of stock investment $\downarrow \Rightarrow$ portfolio share $\downarrow$
- **GE** Tax increases $r^b \Rightarrow$ marginal participants exit ($\Rightarrow$ higher portfolio share compared to HE)

Inequality Implication: Equity Premium by Wealth Inequality

Wealth Quartile	$\mathbb{E}[f]$ Average Financial Literacy			$\mathbb{E}[\tilde{r}(f)] - r^b$ Expected Equity Premium		
	Baseline	Δ PE	Δ GE	Baseline	Δ PE	Δ GE
	(1)	(2)	(3)	(4)	(5)	(6)
Q1	1.56	0.07	0.07	4.93	0.02	-0.11
Q2	1.64	0.49	0.42	4.96	0.16	0.01
Q3	2.56	0.40	0.38	5.26	0.13	-0.01
Q4	2.98	0.02	0.02	5.40	0.01	-0.12
Total	2.18	0.25	0.22	5.14	0.08	-0.06

- *Expected equity premium* $\mathbb{E}[\tilde{r}(f)] - r^b = \underline{r} + r^X(f)$ *falls for*:
  - Q1: who cannot afford FinLit accumulation even when it is subsidized
  - Q4: who attained the maximum level of FinLit prior to the subsidy

Inequality Implication: Stock Investment by Wealth Group

Wealth Quartile	$\mathbb{E}[\mathbb{1}(\kappa > 0)]$ Participation Rate			$\mathbb{E}[\kappa \mid \kappa > 0]$ Cond. Risky Portfolio Share		
	Baseline	Δ PE	Δ GE	Baseline	Δ PE	Δ GE
	(1)	(2)	(3)	(4)	(5)	(6)
Q1	**0.00**	0.00	0.00			
Q2	27.41	4.89	0.25	73.16	6.57	4.80
Q3	91.17	2.79	0.62	92.44	0.83	0.81
Q4	**100.00**	0.00	0.00	80.23	-0.21	-0.57
Total	54.65	1.92	0.22	84.43	1.05	0.70

- Q2–Q3 increase stock investments on both *extensive* & *intensive* margins
- Q4 reduces conditional risky portfolio share to compensate for the decline in equity premia
- Note: Q4 **always** vs. Q1 **never** participate in stock market $\rightarrow$ *suggests participation subsidy*

FinLit Subsidy Mitigates Wealth Inequality

Table: Share of financial assets held by each wealth group (%)

Wealth Quartile	Total Wealth		Bonds		Stocks	
	Baseline	Δ GE	Baseline	Δ GE	Baseline	Δ GE
	(1)	(2)	(3)	(4)	(5)	(6)
Q1	1.52	0.01	5.77	0.05	0.00	0.00
Q2	8.85	0.04	25.49	-0.99	2.87	0.44
Q3	23.82	0.35	13.25	-0.99	27.62	0.81
Q4	65.80	-0.40	55.49	1.93	69.51	-1.25
Total	100.00	0.00	100.00	0.00	100.00	0.00

- Middle wealth quartiles (Q2-Q3) shift toward stocks vs. top quartile (Q4) shifts toward bonds
- Share of total wealth held by the top wealth quartile (Q4) decreases by 0.4%p

$\Rightarrow$ Small improvement in wealth parity (e.g. Gini index falls from 56.3% to 55.9%)

Conclusion

- I develop a GE model accounting for the zero-sum aspect of financial literacy
  - Model is consistent with the average FinLit and stock market participation in the US
- I analyze the equilibrium effects of raising financial literacy on aggregate outcomes
- Subsidizing 75% of a household's FinLit acquisition costs increases:

  $\Rightarrow$ *Capital-to-output ratio* by **PE** 2.2% vs. **GE** 0.1%

  $\Rightarrow$ *Stock market participation* by **PE** $1.92\%\text{p}$ vs. **GE** $0.22\%\text{p}$
- Subsidy mitigates wealth gap by promoting middle wealth group's stock investment

  $\Rightarrow$ Ratio of total wealth held by the top vs. other quartiles decreases by 1.9%
- *Policy alternative*: stock market participation subsidy is suggested for low-wealth group Detail

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Potential Channels for FinLit Premium

Lit Review

Financial literacy is *positively* related to:

- **Stock market participation**
  - van Rooij et al. (2011), Yoong (2011), Jappelli and Padula (2015), Cupak et al. (2022)
- **More effective investment decisions**
  - Calvet et al. (2007, 2009): avoiding under-diversification, inertia, disposition effect
  - Guiso and Jappelli (2008), von Gaudecker (2011) : portfolio diversification
  - Bilias et al. (2010): limited resources $\rightarrow$ portfolio inertia
  - Bucher-Koenen and Ziegelmeyer (2014): selling off losing assets
  - Bhutta, Blair and Dettling (2021): higher propensity of having 3 months of liquid savings
- **Advanced retirement planning**
  - Bucher-Koenen and Lusardi (2011), van Rooij et al. (2011), Clark et al. (2015)

What if $A' > 0$? Back

- *Suppose financial literacy leads to productivity growth*
- Perfectly competitive firms w/ CRS production

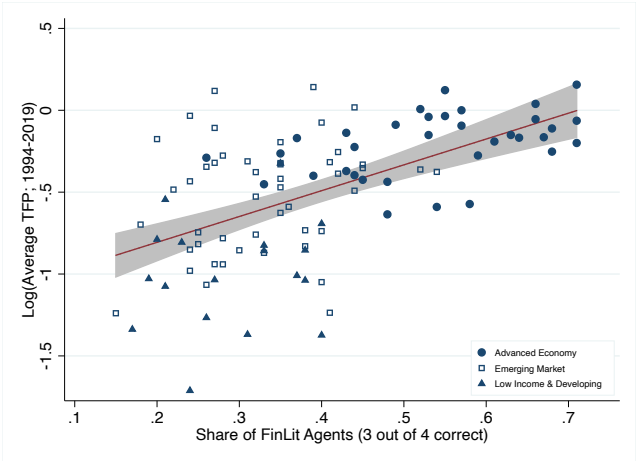
$$Y = g(F, K, L) = A(F)K^{\alpha}L^{1-\alpha} \text{ with } A'(\cdot) > 0$$
$$\Rightarrow r^{\star} = g_k(F, K, L), w^{\star} = g_l(F, K, L)$$

As average financial literacy F increases:

- Literacy-return premium increases stock demands
  $\Rightarrow$ Larger capital supply $\Rightarrow$ market returns to stocks $r^{\star} \downarrow$ ("*total demand effect*")
- Higher average financial literacy translates into more efficient capital allocation
  $\Rightarrow$ Positive externality on TFP $\Rightarrow$ market returns to stocks $r^{\star} \uparrow$ ("*productivity effect*")

Cross-Country FinLit & Log(TFP)

Back



FinLit Enhances TFP

Back

- S&P global survey of population share of FinLit adults in 150 countries Data

$$\log\left(\overline{\text{TFP}}_{2014-2019}\right) = \beta_0 + \beta_1(\text{Share FinLit}_{2014}) + \gamma X + \varepsilon$$

	All Countries			Advanced Market		
	(1)	(2)	(3)	(4)	(5)	(6)
Share of FinLit Adults	1.286***	-0.049	-0.060	0.857***	0.409**	**0.428****
	(0.201)	(0.280)	(0.267)	(0.145)	(0.144)	(0.153)
Log(GDP per capita; avg 94-13)		0.254***	0.249***		0.308***	0.275**
		(0.037)	(0.054)		(0.063)	(0.096)
Financial Development (94-13)			0.034			0.071
			(0.185)			(0.166)
R-sq.	0.237	0.513	0.513	0.317	0.618	0.620
No. Obs	100	100	100	34	34	34

- Source: S&P Global FinLit Survey (2014), Penn World Table 10.0, IMF Financial Development Index (Scale 0-1). *p<0.05, **p<0.01, ***p<0.001

⋆ Discipline $A'(F)$ s.t. 1%p ↑ in pop. share of FinLit adults → 0.5% TFP growth

Definition: General Equilibrium

Back

A steady state equilibrium consists of $(K^\star, B^\star, F^\star, r^{b\star}, r^\star, \underline{r}^\star, \tau^{r\star})$ s.t.

(1) Given $(r^{b\star}, r^\star, \underline{r}^\star, \tau^{r\star})$, household problem gives rise to $\Gamma(\mathcal{X}, f; l, \eta, t)$

(2) Firm's problem characterizes:

$$r^\star = g_K(K^\star, L^\star) - \delta_K, w^\star = g_L(K^\star, L^\star)$$

(3) Labor market clears

$$L^\star = \int l d\Gamma(\mathcal{X}, f; l, \eta, t).$$

(4) Aggregate financial literacy

$$F^\star = \int f d\Gamma(\mathcal{X}, f; l, \eta, t)$$

Definition: General Equilibrium (cont'd)

Back

A steady state equilibrium consists of $(K^\star, B^\star, F^\star, r^{b\star}, r^\star, \underline{r}^\star, \tau^{r\star})$ s.t.

(5) Gov't budget balance

$$\tau^{l\star} \int w^\star l d\Gamma(\mathcal{X}, f; l, \eta, t \leq T_R) = \lambda \int w^\star l d\Gamma(\mathcal{X}, f; l, \eta, t > T_R) \tag{1}$$

$$G^\star + r^{b\star} B^\star = \int \tau^{r\star} \left(r^{b\star}(1-\kappa) + \tilde{r}(f)\kappa \right) \mathcal{S} d\Gamma(\mathcal{X}, f; l, \eta, t) \tag{2}$$

(6) Market clearing conditions

$$B^\star = \int (1-\kappa) \cdot \mathcal{S} d\Gamma(\mathcal{X}, f, ; l, \eta, t) \tag{3}$$

$$K^\star = \int \kappa \cdot \mathcal{S} d\Gamma(\mathcal{X}, f, ; l, \eta, t) \tag{4}$$

$$r^\star K^\star = \int \left(\underline{r}^\star + r^X(f) + \sigma^X \eta \right) (\kappa \cdot \mathcal{S}) d\Gamma(\mathcal{X}, f, ; l, \eta, t) \tag{5}$$

Financial Literacy Questionnaires

Back

Survey of Consumer Finances (SCF): "Big Three" Questions

① **Risk Diversification** Buying a single company's stock usually provides a safer return than a stock mutual fund. *True, False, Do not know, Prefer not to say*

② **Inflation** Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much can you buy with the money in this account? *More than today, Exactly the same, Less than today, Do not know, Prefer not to say*

③ **Interest Rate** Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? *More than $102, Exactly $102, Less than $102, Do not know, Prefer not to say*

U.S. National Financial Capability Study (NFCS): "Big Five" Questions

④ **Mortgage** A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less. *True, False, Do not know, Prefer not to say*

⑤ **Bond Price** If interest rates rise, what will typically happen to bond prices? *They will rise, They will fall, They will stay the same, There is no relationship, Do not know, Prefer not to say*

Parameterization Detail

Back

Parameter		Value
Household Preference		
Discount factor	β	0.96
Elasticity of intertemporal substitution	ψ	0.5
Risk aversion	γ	5.0
Labor process		
Persistency	ρ^l	0.91
Variance	σ^l	0.21
Social Security replacement rate	λ	0.36
Financial literacy		
Deprecation rate in literacy	δ_f	0.02
Investment cost: coefficient	ϕ	0.22
Investment cost: convexity	ι	1.75
Stock market		
Mean excess return	$r^X(f_{\max})$	0.01
Standard deviation	σ^X	0.157
Per-period fixed participation cost	θ	0.09
Production		
Depreciation rate in capital	δ_K	0.08
Capital Intensity	α	0.36
Gov't debt to GDP ratio	B/Y	0.82

Additional Appendix

Clark, Lusardi, Mitchell (2015) ▸ Modeling: FinLit ▸ Calibration Strategy ▸ Paper

$$(\text{Investment Outcome})_i = c + \alpha \text{FinLit} + \beta X_i + \varepsilon_i$$

FinLit & Portfolio Performance *(for Fed employees)*

Compared to the least literate (FinLit 0-1), the most literate (FitLit 4-5):

- Held 11.52% points more stock
- Anticipate earning 3.5 b.p. per month more in excess returns
- Had 40% higher portfolio volatility
- Held portfolios with about 1.71%p less idiosyncratic risk

- Controls: age, sex, whether married, salary, plan balance, years at the Fed

Comparative Statics: Before and After the FinLit Subsidy (Detail)

Back

		Baseline (1)	ΔPE (2)	ΔHE (3)	ΔGE (4)
Risk-free return (%)	r^b	2.32		-0.01	0.08
Market equity premium (%)	$r - r^b$	5.38		-0.06	-0.10
Base equity premium (%)	$\underline{r} - r^b$	4.41		-0.09	-0.13
Capital income tax rate (%)	$\tau^{r\star}$	9.77	0.00	-0.01	1.00
Agg. stock investment (level)	$\mathbb{E}[\kappa\mathcal{S}]$	4.40	0.15	0.03	0.01
Capital-output ratio	K/Y	2.29	0.05	0.01	0.00
Avg. FinLit	$\mathbb{E}[f]$	2.18	0.25	0.23	0.22
S.D. FinLit	$\mathrm{S.D}[f]$	0.93	-0.10	-0.09	-0.09
Saving rate (%)	$\mathbb{E}[\mathbb{1}(\mathcal{S} > 0)]$	97.518	0.00	0.03	0.02
Participation rate (%)	$\mathbb{E}[\mathbb{1}(\kappa > 0)]$	54.65	1.92	0.77	0.22
Cond. risky portfolio share (%)	$\mathbb{E}[\kappa \vert \kappa > 0]$	84.43	1.05	0.60	0.70
Gini index (%)		56.34	-0.26	-0.31	-0.37

Policy Alternatives: Age-Specific FinLit Subsidies & Participation Subsidy

Back

- 75% FinLit subsidies ① for ages 25-80; ② for ages 61-25; ③ for ages 25-40
- + 50% stock market participation cost subsidy: ④ for ages 25-40

	Baseline (I)	Counterfactual (II)	FinLit Age 25-80 ①	FinLit Age 61-65 ②	FinLit Age 25-40 ③	+ Participation Age 25-40 ④
Risk-free return (%)	**2.32**	2.31	**2.40**	**2.39**	2.31	2.31
mkt. equity premium (%)	5.38	5.33	5.28	5.34	5.35	5.35
Base equity premium (%)	4.41	4.32	4.28	4.36	4.36	4.36
Capital income tax rate (%)	**9.77**	9.76	**10.76**	**10.27**	10.06	**10.06**
Wage	1.02	1.02	1.02	1.02	1.02	1.02
Avg. FinLit	2.18	2.42	2.41	2.26	2.32	2.42
S.D. FinLit	0.93	0.84	0.84	0.89	0.89	0.84
Participation rate (%)	**54.65**	55.42	**54.87**	54.57	**54.88**	**62.52**
Cond. risky portfolio share	84.43	85.03	85.13	84.68	84.79	86.04
Gini Index (%)	56.34	56.03	55.97	56.18	56.24	55.38