

Investing or Gambling? The Government's Trade-Off

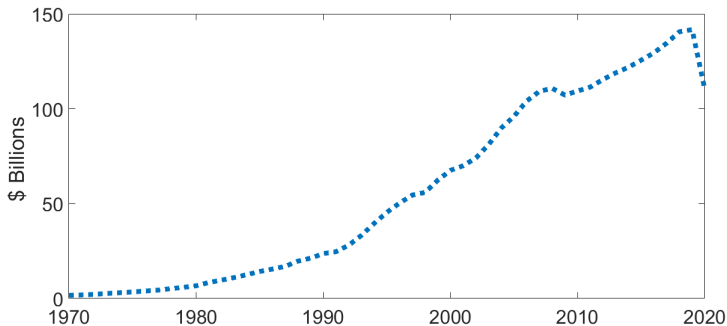
Raffaele Corvino and Francesco Ruggiero

University of Torino & CeRP and Bank of Italy

CeRP Workshop - 29th October 2021

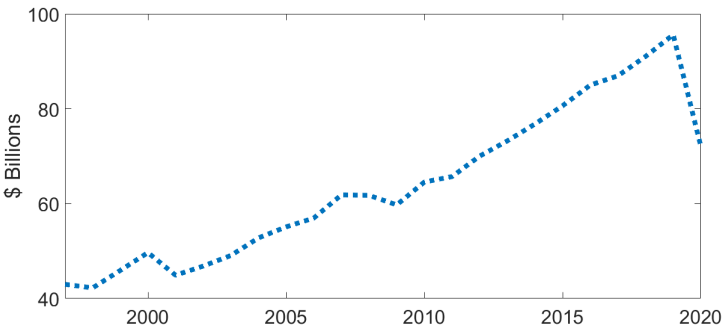
Gambling Boom (PCE)

Personal Expenditures in Gambling (US)
(141 billions in 2019)



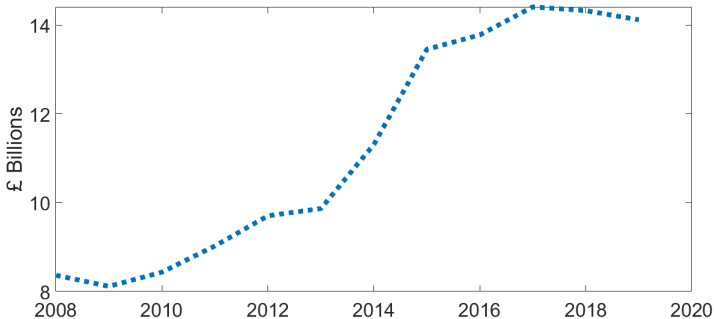
Gambling Boom (GDP)

GDP generated by **Gambling Industry (US)**
(0.5% of US GDP)



Gambling Boom (UK)

Gambling yield in UK
(Jackpot - Prize)

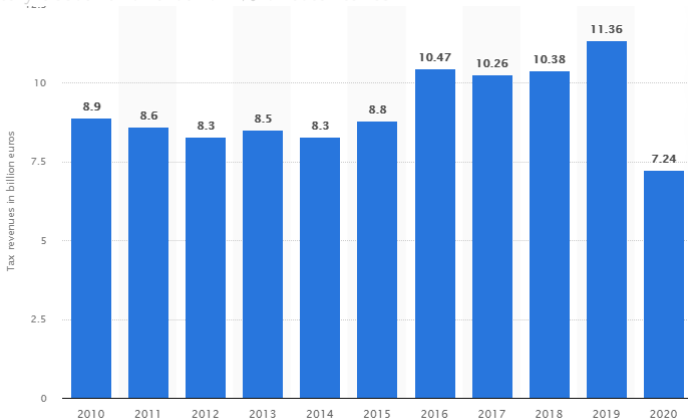


Drivers (1/2)

1 Liberalization

- During very last decades in EU/UK/US
- To fight against illegal gambling
- To improve public revenues (Implicit/Explicit taxes)

→ In Italy account for around 2% of total taxes

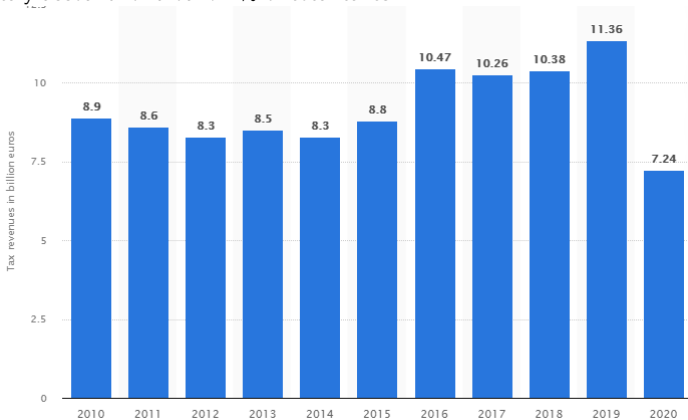


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Drivers (2/2)

2 Simplicity

- No knowledge required
- Technology expansion (Internet, on-line gambling)
- **Effortless risky opportunity** (huge gain and small loss)

In contrast with investments in financial markets

- (Belief that) Some financial literacy is needed
- Fear, skepticism, transaction costs
- **Barriers-to-Entry** (pecuniary and not pecuniary)

⇒ Limited participation rate stylized fact in Asset Pricing/Household Finance

→ Despite crucial social value

- Provide funds to finance productive capital
- Enhance job opportunities
- **Improve tax revenue** (taxes on profits)

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Government's Trade-Off(s)

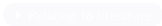
The government sets the **corporate tax rate**...

- + Improves public income to finance public expenditure
- Reduces (after-tax) earnings
 - Lower dividend/firm value to shareholders
 - Depress motivation to invest (to provide capital/job/taxes)

...and the tax on gambling

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This paper studies the (two-fold) Government's trade-off
⇒ Optimal policy of the Welfare planner



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Static Model

Agents:

- N **Education-Heterogeneous** individuals (**investors/employees/consumers**)
 - **Invest** initial wealth (stock/lottery/deposit)
 - **Work** for the firm and produce output
 - **Consume** final wealth (payoff + salary + public good)
- Heterogeneity in **Education** affects
 - Costs to access the financial markets
 - Understanding of the lottery probabilities
- Firm
 - Raises capital by stocks issuance
 - Hires individuals as workers
 - Produces output
 - Distributes (after-tax) profits to shareholders
 - Productivity = business cycle + workers' quality
- Bank
 - Offers deposits at the risk-free rate
- Social Planner (Government)
 - Sets and collects taxes on profits and gambling
 - Produces and distributes a public good
 - Efficiency
 - Maximizes total welfare (sum of individuals' utility)

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Preliminary Evidence: Data

Dutch Household Survey (DNB) [Wave 1993]

Variable	Mean	Standard Deviation	p1	Median	p99	N
Stock	0.18	0.38	0	0	1	5091
Lottery	0.36	0.88	0	0	1	3953
Both	0.04	0.20	0	0	0	3953
Bank	0.30	0.46	0	0	1	5091
PropStock	0.05	0.23	0	0	0.14	3469
PropLottery	0.04	6.67	0	0.01	0.18	1870
Ln(NetWorth)	11.78	1.78	9.10	12.38	13.29	2244
Ln(NetIncome)	10.40	1.08	9.08	10.59	11.42	3223
HH Size	2.85	1.31	1	2	5	4799
Age	42.74	15.21	23	42	65	4799
College	0.15	0.36	0	0	1	5091
Education	2.31	1.49	1	2	5	5091
Male	0.52	0.50	0	1	1	4799
Unemployed	0.08	0.28	0	0	0	5091
Retired	0.10	0.30	0	0	0	4799
Health	4.08	0.77	3	4	5	4796
Fin. Literacy	2.27	2.69	0	2	6	4810
Risk Aversion	5.08	1.68	3	5	7	3037

Preliminary Evidence: Probit

	Stock		Lottery	
Costant	-6.865*** (0.792)	-7.085*** (0.781)	0.872 (0.557)	1.117 (0.548)
Ln(NetWorth)	0.270*** (0.045)	0.273*** (0.045)	-0.046 (0.025)	-0.048 (0.025)
Ln(NetIncome)	0.138* (0.067)	0.143* (0.066)	-0.038 (0.051)	-0.049 (0.051)
HH Size	-0.040 (0.037)	-0.037 (0.037)	-0.017 (0.029)	-0.021 (0.029)
Age	0.011* (0.005)	0.011* (0.004)	-0.003 (0.004)	-0.003 (0.004)
College	0.297** (0.097)		-0.299** (0.086)	
Education		0.071** (0.025)		-0.048* (0.021)
Male	-0.006 (0.131)	-0.010 (0.131)	0.192 (0.096)	0.189 (0.096)
Unemployed	-0.799 (0.590)	-0.816 (0.583)	0.116 (0.281)	0.134 (0.279)
Retired	0.326* (0.149)	0.321 (0.149)	-0.091 (0.126)	-0.080 (0.126)
Health	0.011 (0.058)	0.014 (0.058)	-0.034 (0.046)	-0.039 (0.046)
Fin. Literacy	0.243*** (0.023)	0.242*** (0.023)	0.012 (0.017)	0.011 (0.017)
Risk Aversion	-0.084*** (0.027)	-0.083*** (0.027)	0.022 (0.021)	0.021 (0.021)
Pseudo R2	0.218	0.217	0.014	0.011
N	1,498	1,498	1,459	1,459

Timeline: Time 0

▶ Set-Up

- The government sets the lottery prize α and the corporate tax rate τ
- Investors observe α and τ and allocate their initial endowment
- The government gathers the jackpot lottery H
- The firm raises capital K from stock issuance
- The firm hires L individuals and uses K and L to produce the good Y
- The bank stores individuals' wealth into risk-less deposits

Timeline: Time 1

- The bank returns the deposit plus a risk-less interest rate to the depositors
- The government collects taxes on corporate profits $\tau\pi$
- The firm pays the wage ω to the L workers
- The firm is liquidated and the liquidation value D is distributed
- A fraction α of the jackpot H is awarded to the winner as a prize
- The government retains $(1 - \alpha)H$ from the lottery jackpot
- The government uses $(1 - \alpha)H$ and $\tau\pi$ to produce the public good
- Individuals receive the payoff from their investment, the public good from the government and consume the final wealth

Model Solution

(Two-Stage)-Backward Induction

1. Optimal α and τ
2. Optimal individual allocation (given α^* , τ^* , θ , γ , ...)

→ Equilibrium: $\{\mathbf{m}^*(\alpha^*, \tau^*), \mathbf{l}^*(\alpha^*, \tau^*), \mathbf{b}^*(\alpha^*, \tau^*)\}$.

Task: $m(K, L, A) \Leftrightarrow \left\{ \begin{array}{l} A(L) \\ L(K, A) \\ K(m) \end{array} \right\}$

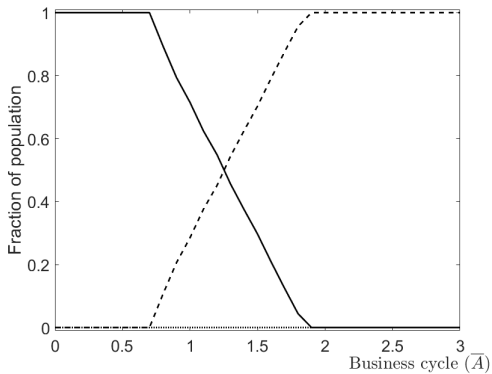
Numerical Algorithm....

Variable	Parameter	Value
Number of individuals	N	1000
Initial endowment	W_0	1
Interest rate	r	0.1%
Upper bound for θ_i	$\bar{\theta}$	0.99
Consumption good price	P	1
Capital share of output	β	0.75

Allocation (Correct Beliefs)

(In)Efficient Government

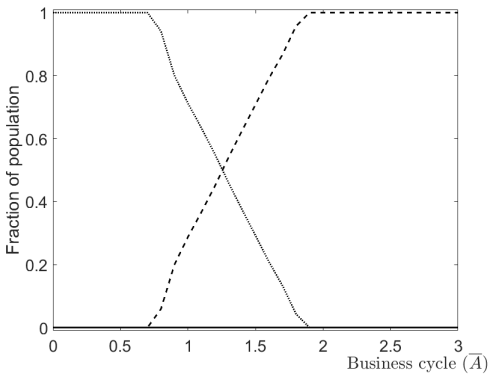
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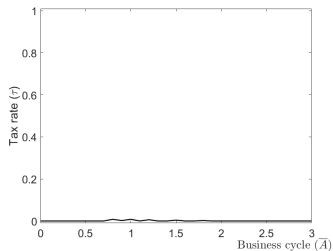
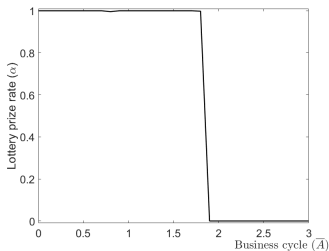
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Optimal Policy (Correct Beliefs)

Inefficient Government ($\lambda < 1$)

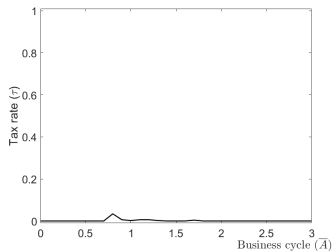
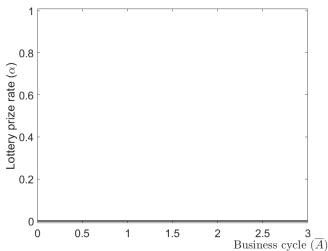
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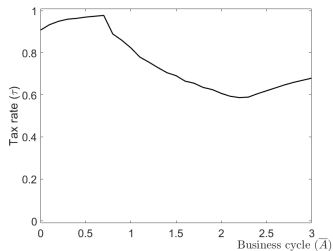
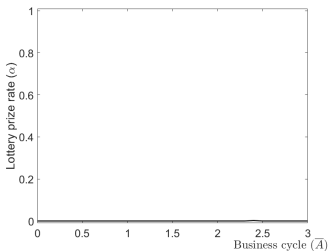
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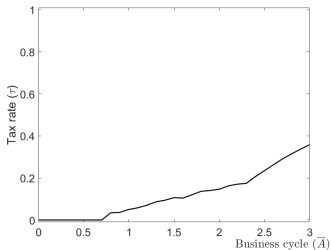
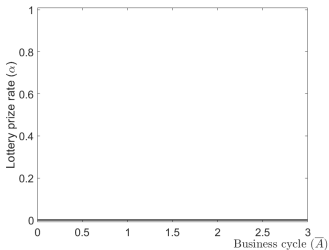
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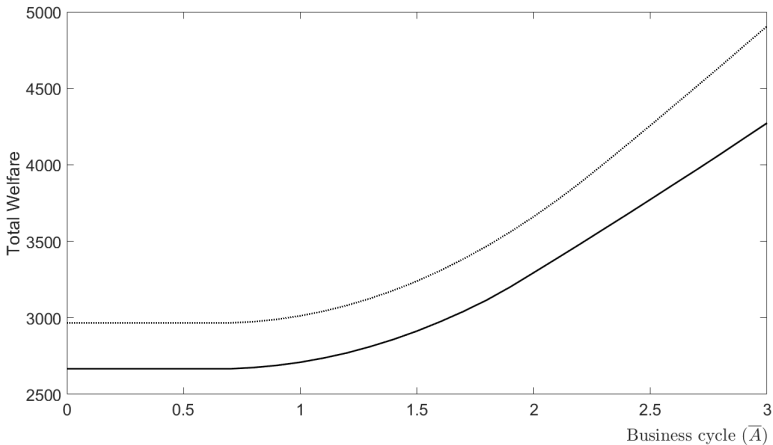
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Total Welfare (Correct Beliefs)

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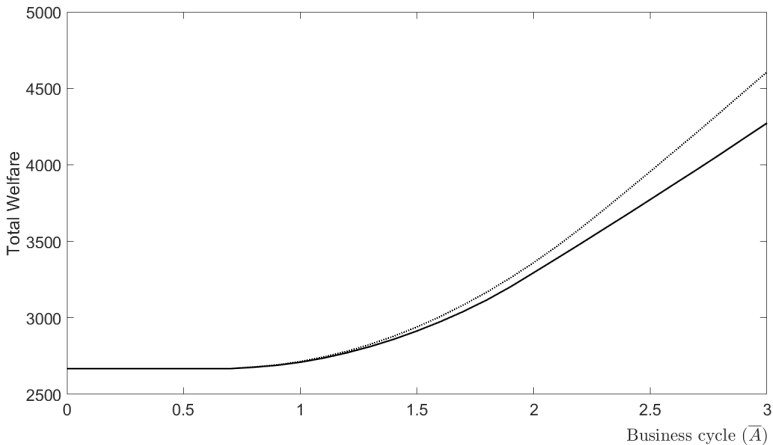
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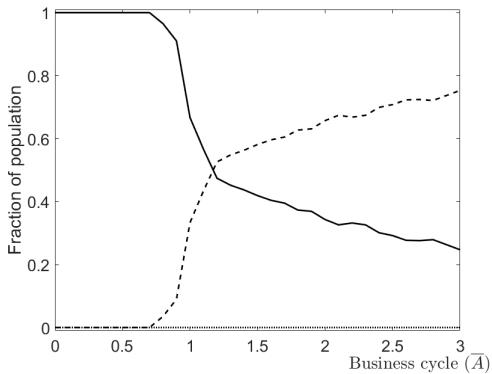
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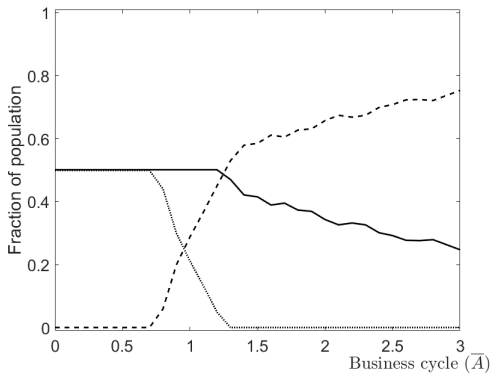
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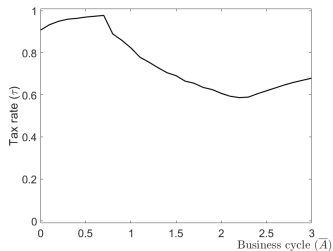
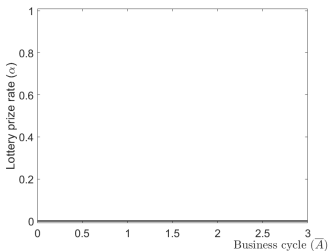
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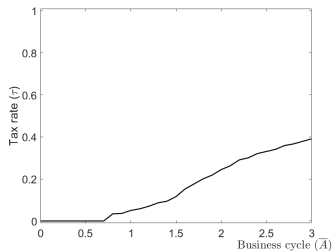
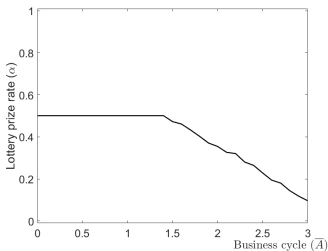
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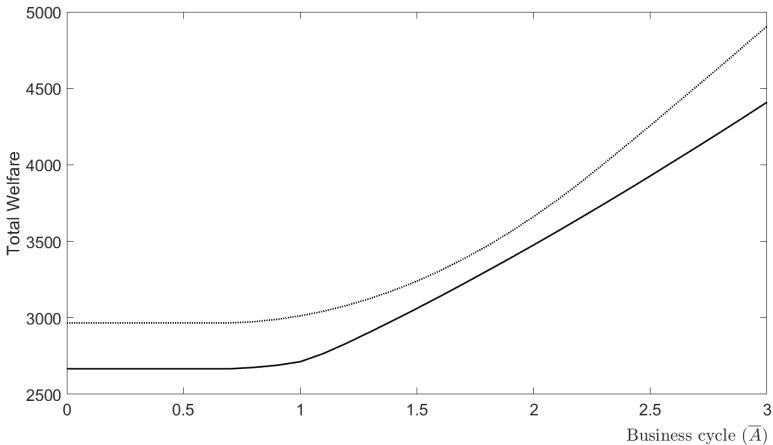
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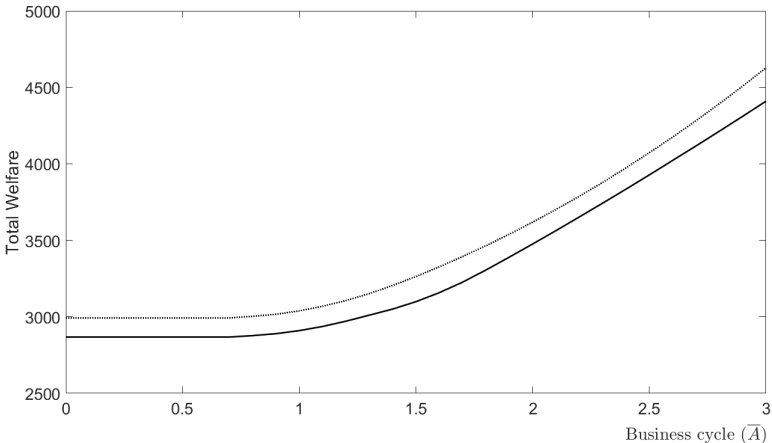
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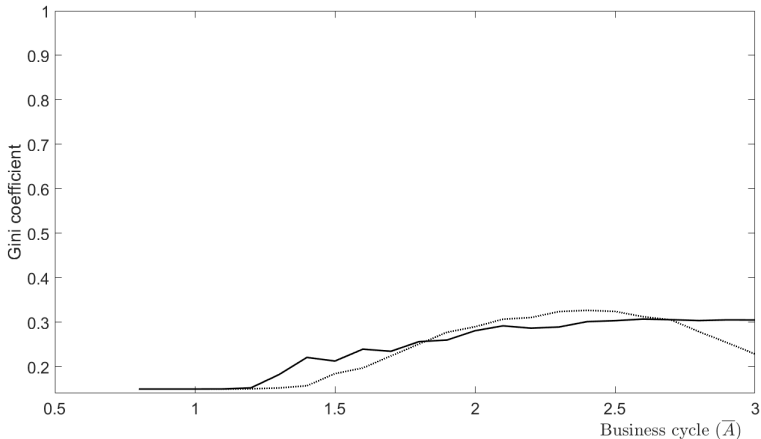
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Inequality

Inefficient → **Efficient**

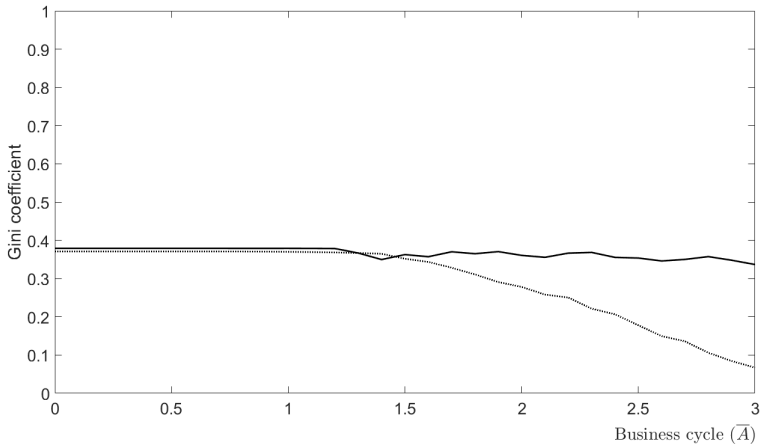
Personal Wealth



Inequality

Inefficient → Efficient

Total Utility



Main Results

- τ and α as drivers of individual choices
- *Progressive* tax rate/ *regressive* lottery prize
- Redistribution effect (cross-subsidization across education)
- Distortionary effect of (unproductive) income

Additional results

- Labour market participation
- Total firm productivity
- Stock market return

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Further Extensions

- Endogenous Education
- Endogenous Salary/Good price
- Heterogeneous Endowment
- Tax Evasion
- Debt market (defaultable firm)
-

Related Literature

- Lottery-like stocks vs Normal stocks
→ Kumar (JF 2009), Eraker and Ready (JFE 2015)
(Background of investors in LL-stocks)
- (k/l)-Returns to education
→ Fagereng et al. (WP 2021), Halac et al. (AER 2019)
(Welfare returns: capital/labour/taxes)
- Taxation schemes
→ Fahri and Gabaix (AER 2020)
(Optimal taxation with behavioral biases)
- Social value of gambling
→ Di Bella (WP 2015)
(Impact of gambling on public revenues)

Set-Up (1/2)

Individuals

$$\max u_i = E_0[U(C_{i,T})] = E_0[d_i] - \theta_i \cdot I_i^m + (q_i h) + (W_{i,0}(1+r)) \cdot I_i^b$$

$$d_i = \frac{k_i}{K} D,$$

$$q_i = \gamma_i p_i,$$

$$\gamma_i = \frac{1}{1-\theta_i},$$

$$h = \alpha H.$$

Set Up (2/2)

Firm

$$D = (1 - \tau) \max(\pi, 0),$$

$$\pi = AK^\beta L^{1-\beta},$$

$$A = \bar{A} + \sum_{i=1}^{\bar{L}} \frac{1 - \theta_i}{\bar{L}}$$

$$L = .$$

Lottery Expected Payoff

$$q_i \cdot h + (1 - q_i) \cdot 0 = q_i H \alpha$$

Government

$$\{\alpha^*, \tau^*\} = \arg \max J(\alpha, \tau) = E_0 \sum_{i=1}^N U(C_{i,T}(\alpha, \tau) + \lambda G(\alpha, \tau)/N),$$

$$G = \tau \max(0, \pi) + (1 - \alpha)H.$$