# Produce or Speculate?
# Asset Bubble, Occupational Choice and Efficiency

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November 2009

# Motivation

*One of the changes that I would like to see — and I'm going to be talking about in this in weeks to come — is seeing our best and our brightest commit themselves to making things — engineers, scientists, innovators. For so long, we have placed at the top of our pinnacle folks who can manipulate numbers and engage in complex financial calculations. And — and that's good. We need some of that. But you know what we can really use is some more scientists and some more engineers who are building and making things that we can export to other countries.*

President Barack Obama,
Georgetown University Washington, D.C. 14 April, 2009.

# Motivation

*What the crisis has made bluntly apparent is that all this intelligence is not employed in a particularly productive way [...]. More pragmatically, the disappearance of their exorbitant earnings may encourage younger generations to join other industries, where their creative energies would be socially more useful. The financial crisis could plunge us into a severe and prolonged recession. The only silver lining is that it could cause a more realistic allocation of talents*

Esther Duflo, "Too many bankers?", Vox, 8 October, 2008.

# Motivation

Goldin and Katz (2008) on the share of males Harvard graduates working in finance:

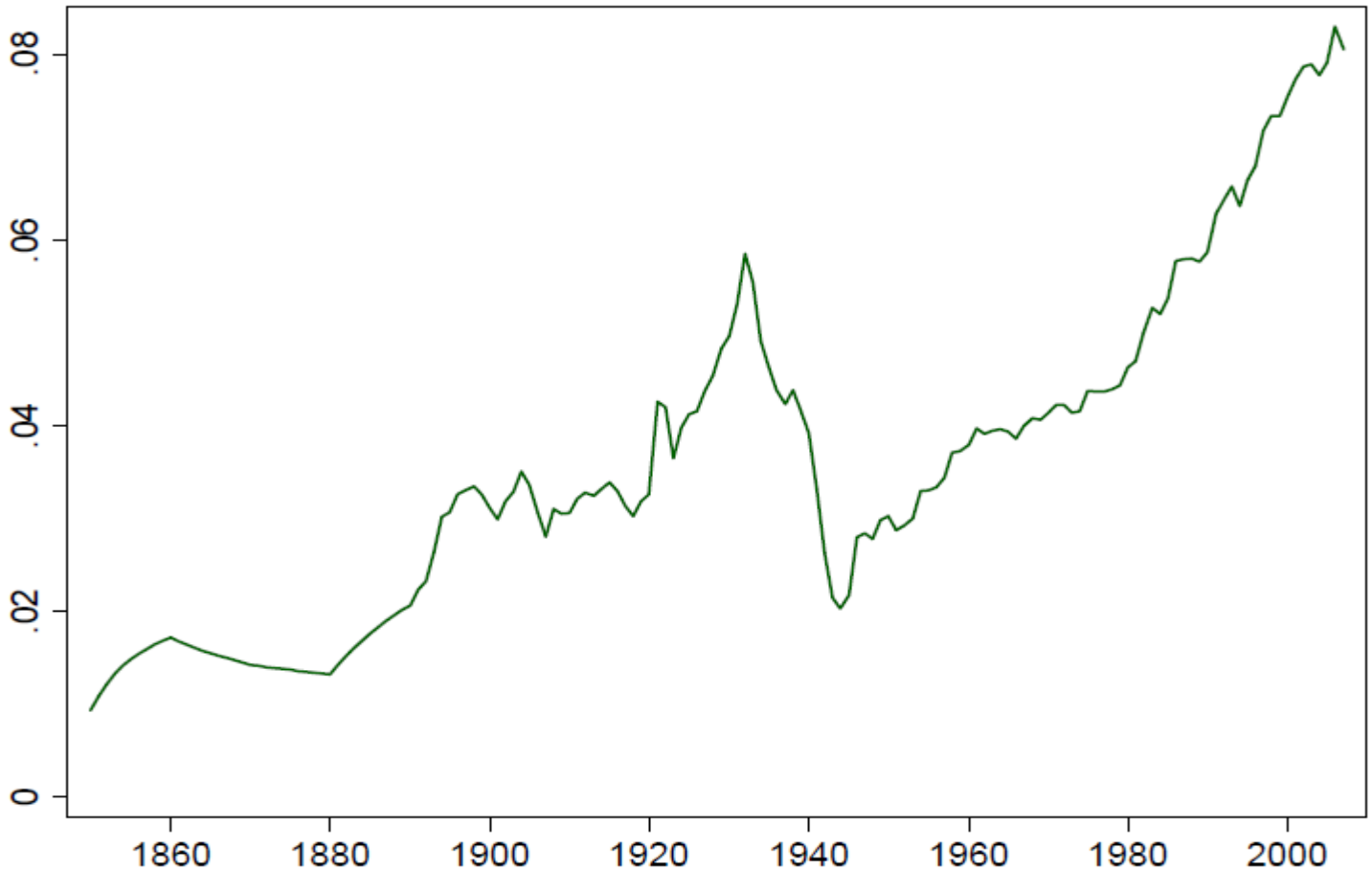
- 5% for the classes 1969-1972
- 15% for the classes 1988-1992

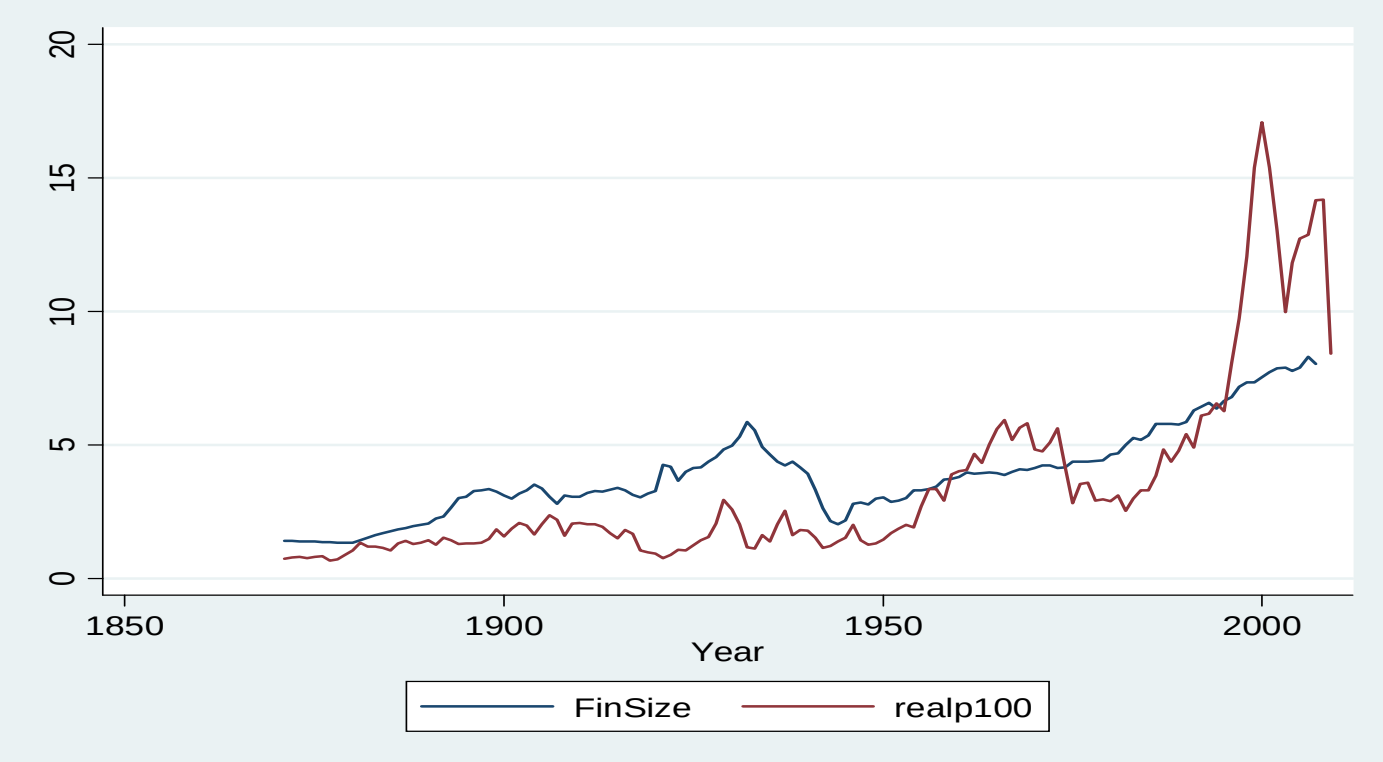
Philippon (2008): Financial sector overgrown by 2% of GDP in the 2000s

Philippon and Reshef (2008):

- Brain drain of skilled labour into finance in the 1920s and the 1980s$\rightarrow$2000s
- Income in finance higher than in other sectors by 60% (40% after accounting for unemployment risk)

Figure 1: GDP Share of U.S. Financial Industry






Stock price and share of financial industry in GDP, 1871-2007 (Source: Shiller, 2005, and Philippon, 2008)

# Motivation

The aim of this paper is to analyse the interactions between

- Asset bubbles
- Allocation of labour between financial/productive sector
- Macroeconomic performance

Framework:

- Rational asset bubbles (OLG model)
- Asset trading requires specialised financiers/speculators
- Occupational choice: production or financial sector
- Frictions in the market for deposits create rents in the financial sector

# Related Literature

Rational bubbles in OLG models

- Tirole (1985), Weil (1987)
- Saint-Paul (1992), Grossman Yanagawa (1993), Olivier (2000)
- Caballero et al. (2006), Fahri Tirole (2008)

Optimal size of the financial sector

- Philippon (2007, 2008)

Occupational choice under rent-seeking

- Baumol (1990), Murphy et al. (1991, 1993)

# Outline

1. The Model
2. The Bubbleless Equilibrium
3. The Bubbly Equilibrium
4. Dynamic Efficiency
5. Asset Bubbles and Income Inequalities

# The Model

OLG model a la Diamond (1965) and Tirole (1985)

Two period-lived, risk-neutral agents enjoying late-life consumption

$N_t$ newly born workers at date $t$, with $N_{t+1}/N_t = n > 0$.

- work in their first life period
- Choose between becoming a producer or a financier
- Producers save, financiers manage savings

Workers shares:

$$\begin{aligned} N_t &= \underbrace{L_t}_{\text{producers}} + \underbrace{(N_t - L_t)}_{\text{financiers}} \\ 1 &= \underbrace{\ell_t}_{\text{fraction of producers}} + (1 - \ell_t) \end{aligned}$$

# The Model

Neoclassical production function

$$Y_t = F(K_t, L_t)$$

Define:

$$y_t = \frac{Y_t}{N_t},\ k_t = \frac{K_t}{N_t}$$

Then,

$$\frac{y_t}{\ell_t} = \frac{Y_t}{L_t} = F\left(\frac{K_t}{N_t}.\frac{N_t}{L_t}, 1\right) = f\left(\frac{k_t}{\ell_t}\right)$$

Factor prices:

$$1 + r_t = f'\left(\frac{k_t}{\ell_t}\right) + 1 - \delta$$

$$w_t = f\left(\frac{k_t}{\ell_t}\right) - \left(\frac{k_t}{\ell_t}\right) f'\left(\frac{k_t}{\ell_t}\right) \equiv \omega\left(\frac{k_t}{\ell_t}\right)$$

# The Model

**Diamond-Tirole**: $L_t = N_t$ (no occupational choice)

**Here**: optimal choice of career, depending on expected payoffs

Workers earn wage income $w_t$, and can store at (low) return $\lambda$

Financiers earn no wage but gain exclusive access to firm financing and asset trading, i.e., to the **productive return** $1 + r_t$

If deposits market is frictionless, then financiers compete and pay out $1 + r_t \Rightarrow$ back to Diamond-Tirole

We introduce **trading frictions** that give **market power** (rents) to financers

# Matching and Bargaining Process

Workers and financers meet randomly at the end of first life period according to an **urn-ball model**

**Financiers**:

- unlimited potential number of matches
- outside option of 0 in any match
- surplus share at any bargaining round: $\tilde{\theta}$

**Producer**:

- $\tau \geq 1$ bargaining opportunities
- outside option $\lambda w_t$ in any match
- surplus shares at any bargaining round: $1 - \tilde{\theta}$

# Bargaining Outcome

Workers and financiers strike a deal at the first match

The **interest rate** accruing to the lender is:

$$1 + \rho_{t+1} = \theta\lambda + (1 - \theta)(1 + r_{t+1}), \text{ with } \theta \equiv \tilde{\theta}^{\tau}$$

Equivalently, the **unit intermediation margin** is

$$r_{t+1} - \rho_{t+1} = \theta(1 + r_{t+1} - \lambda)$$

**Rent extraction all the more severe that $\tilde{\theta}$ large and $\tau$ small**

# Occupational Choice

Producers' consumption: $c_{t+1} = w_t \left(1 + \rho_{t+1}\right)$

Financiers' (expected) consumption:

$$\mathbb{E}_t(c^f_{t+1}) = \underbrace{\frac{\ell_t}{1-\ell_t}}_{\text{mean nb of matches}} \times \underbrace{w_t}_{\text{saving collection per match}} \times \underbrace{\left(r_{t+1} - \rho_{t+1}\right)}_{\text{intermediation margin}}$$

Free entry:

$$w_t \left(1 + \rho_{t+1}\right) = \frac{\ell_t}{1-\ell_t} w_t \left(r_{t+1} - \rho_{t+1}\right)$$

Size of productive sector:

$$\ell_t = 1 - \theta + \frac{\theta\lambda}{1 + r_{t+1}}$$

(increasing in $\lambda$, decreasing in $\theta$ and $r_{t+1}$)

# Bubbleless Equilibrium

Capital accumulation equation:

$$K_{t+1} = w_t L_t \Rightarrow (1+n)\, k_{t+1} = \ell_t \omega \left( \frac{k_t}{\ell_t} \right)$$

Labour allocation equation:

$$\ell_t = 1 - \theta + \frac{\theta \lambda}{f' \left( k_{t+1} / \ell_{t+1} \right) + 1 - \delta}$$

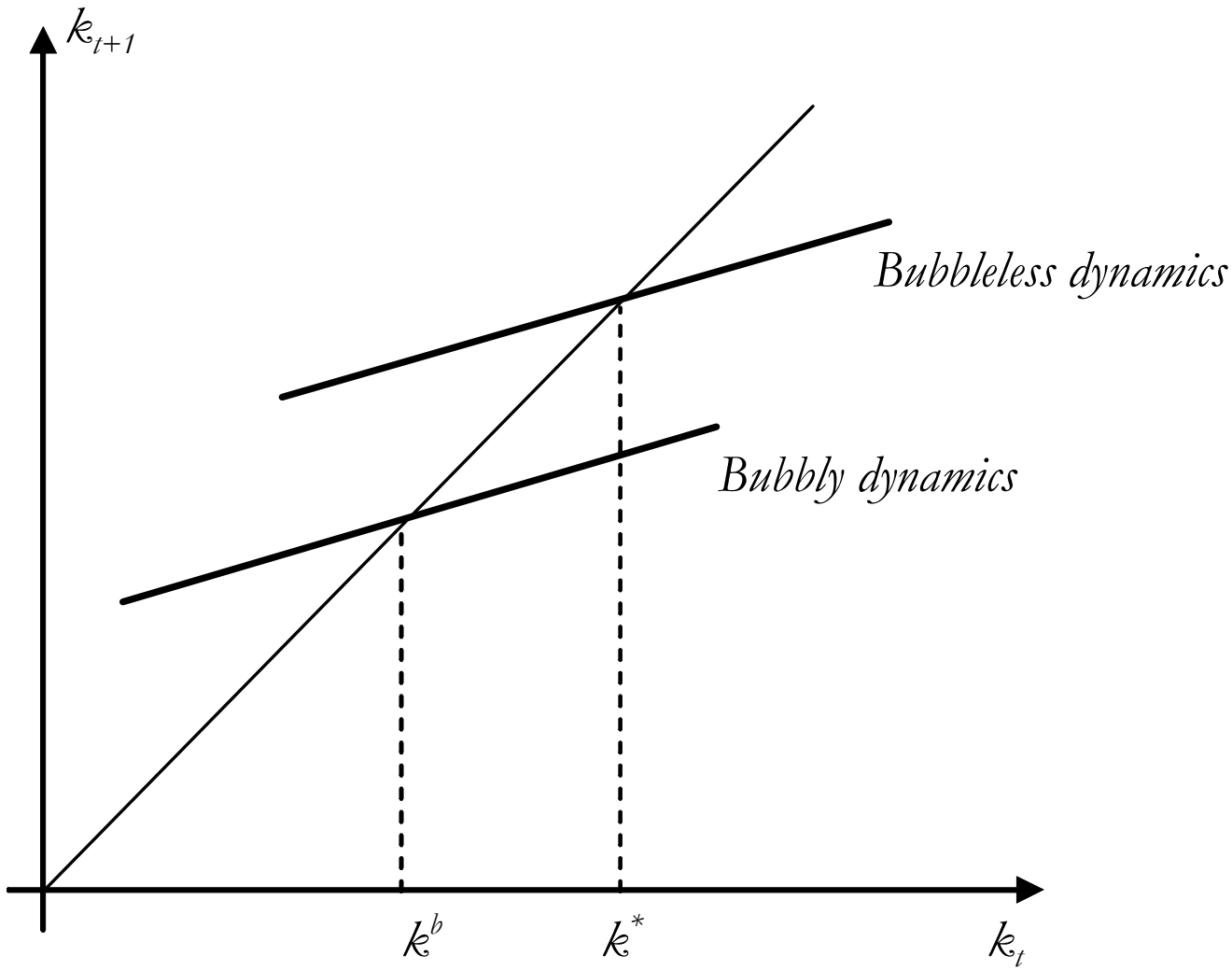
Backward/Forward dynamic system in $(k_t, \ell_t)$

Focus on local behaviour around (unique) steady state $(k^*, \ell^*)$

One predetermined $(k_t)$, one free $(\ell_t)$ variable; hence existence + uniqueness requires exactly one root inside the unit circle

Solution dynamics: $k_t = (1 - p_1)\, k^* + p_1\, k_{t-1},\ p_1 \in (0, 1)$.

# Dynamics



# Bubbly Equilibrium

Study "pure" bubbles (no underlying real asset), worth $B_t$

Focus on "asymptotically bubbly" paths: $\lim_{t\to\infty} b_t = B_t / N_t > 0$ (assume usual conditions for such paths to exist)

Bubbles are created (at $t = 0$) and traded (at $t \geq 0$) by financiers

**Basic idea**

- the productive gains generated by bubbles in the Tirole model are **partly appropriated by "speculators"**
- these rents affect workers' career choice, who **evade the productive sector**

**Implications**

- More people in the financial sector
- Lower production, and possibly lower welfare

# Bubbly Equilibrium

Capital accumulation equation:

$$b_t + (1+n)k_{t+1} = \ell_t \omega(k_t/\ell_t)$$

Labour allocation equation:

$$\ell_t = 1 - \theta + \frac{\theta\lambda}{f'\left(k_{t+1}/\ell_{t+1}\right) + 1 - \delta}$$

No-arbitrage:

$$\frac{B_{t+1}}{B_t} = 1 + r_{t+1} \Rightarrow b_{t+1} = \left(\frac{f'\left(k_{t+1}/\ell_{t+1}\right) + 1 - \delta}{1+n}\right) b_t$$

Dynamic system in $(k_t, \ell_t, b_t)$, linearised around $\left(k^b, \ell^b, b\right)$

Solution dynamics: $k_t = (1-\tilde{p}_1)\, k^b + \tilde{p}_1 \hat{k}_{t-1},\ \tilde{p}_1 \in (0,1)$

# Steady State Comparisons

Bubble crowds out capital per worker and capital per producer:

$$k^b < k^*, \ \frac{k^b}{\ell^b} < \frac{k^*}{\ell^*}$$

**Bubble crowds out productive labour**: $\ell^b < \ell^*$

What about asymptotic consumption levels?

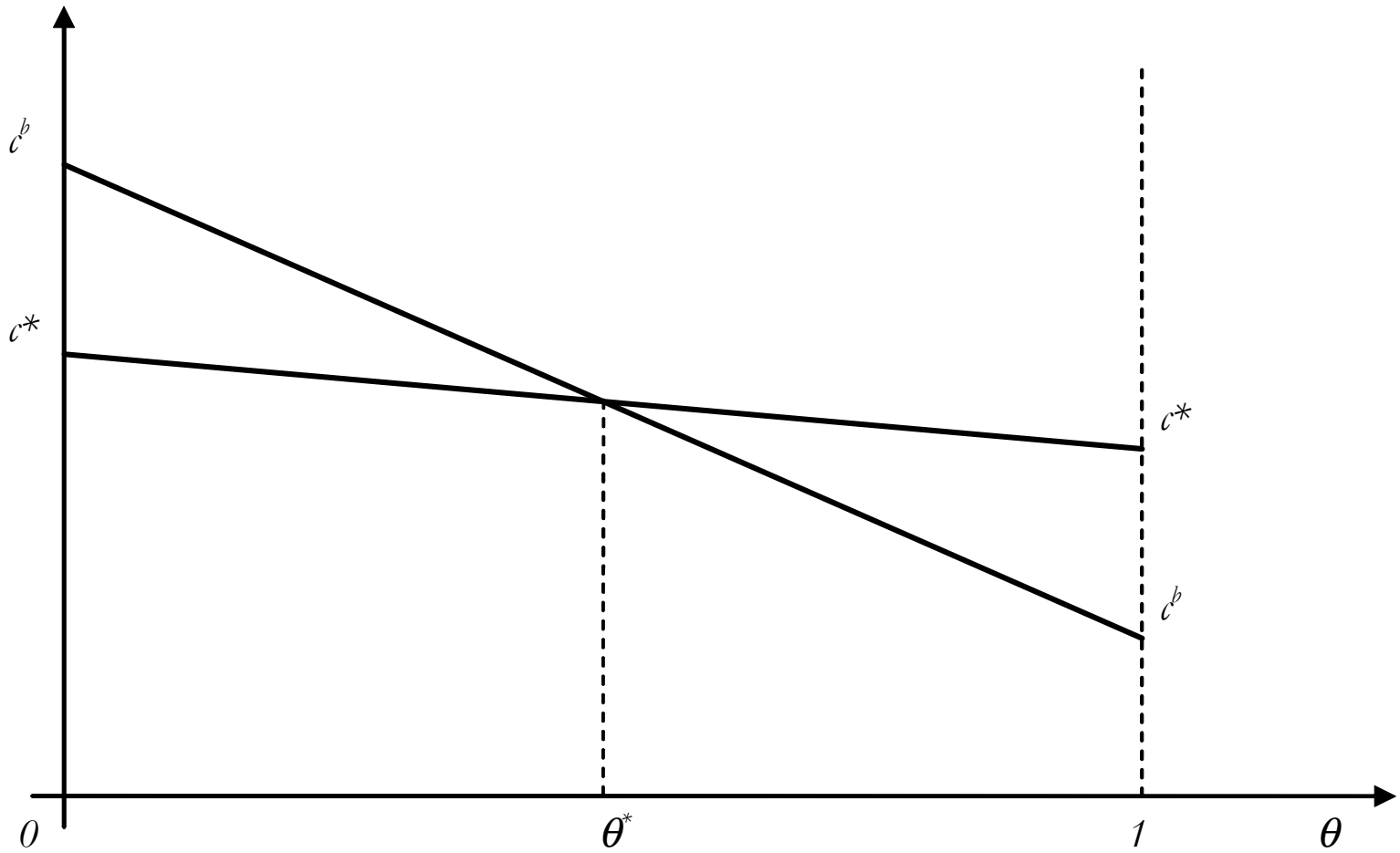
$$c(\theta) = \underbrace{\omega\left(\frac{k}{\ell}\right)}_{\text{wage}}\underbrace{\left[\theta\lambda + (1-\theta)\left(f'\left(\frac{k}{\ell}\right) + 1 - \delta\right)\right]}_{\text{interest rate}}$$

Ambiguous since $\omega\left(\frac{k^b}{\ell^b}\right) < \omega\left(\frac{k^*}{\ell^*}\right)$ whilst $f'\left(\frac{k^b}{\ell^b}\right) > f'\left(\frac{k^*}{\ell^*}\right)$

We know from Tirole (1985) that $c^b(0) > c^*(0)$

But we can see that $c^b(1) = \lambda\omega\left(\frac{k^b}{\ell^b}\right) < c^*(1) = \lambda\omega\left(\frac{k^*}{\ell^*}\right)$

# Steady State Comparisons



# Steady State Comparisons

**Proposition.** *The bubbly steady state has higher individual consumption than the bubbleless steady state iff rent extraction by the financial sector is not to serious, i.e., iff* $\theta < \theta^*$, $\theta^* \in (0, 1)$.

Bubbles lose traditional efficiency properties when rent extraction problem is too severe. Tradeoff results from two effects:

- crowds out capital efficiently (Tirole)
- crowds out productive labour inefficiently

The relative strengths of these two effects determine whether bubbles are good or bad in the long run

# Dynamic Implications

One cannot just compare steady states, must also look at transition

Assume $k^*$ and $k^b$ close, so that there are $k_0$s close to both

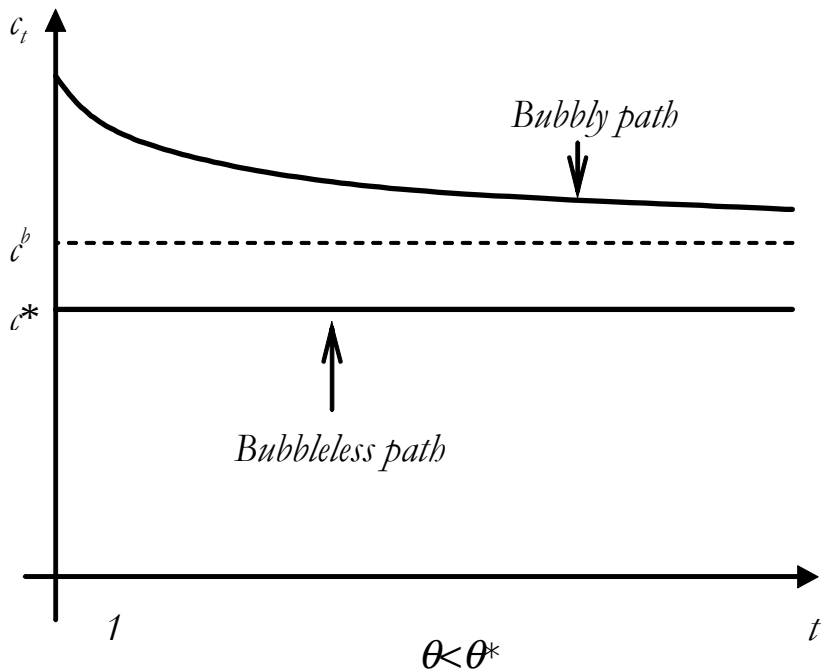
Then two possible values for $k_1$ (and hence $\ell_0$), depending on whether the economy settles on the bubbly or bubbleless path

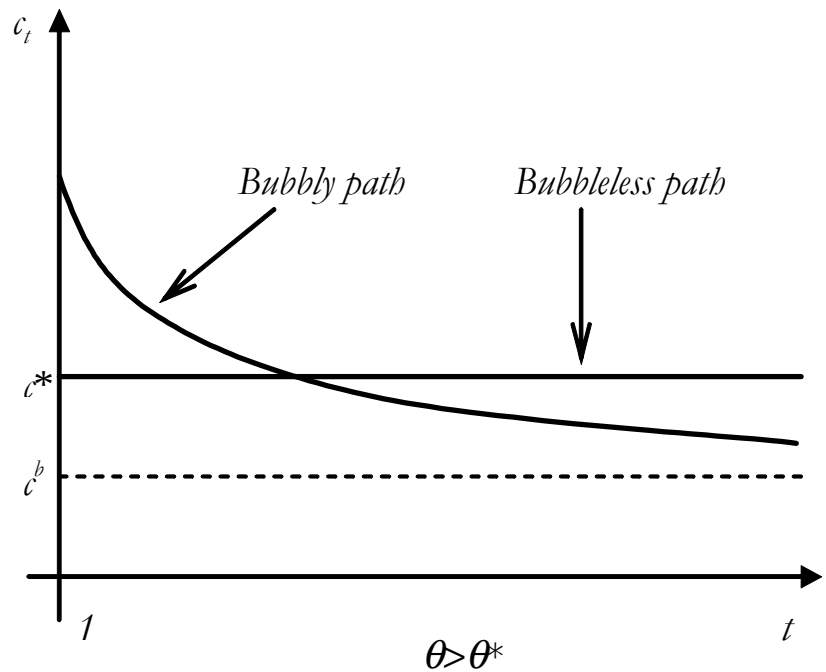
Example: suppose $k_0 = k^*$, and compare bubbleless/bubbly paths

- either $k_t$ stays flat at $k^*$
- or $k_t$ adjusts towards $k^b$

What about consumption?
jumps up and then goes down towards asymptotic value

# Consumption Dynamics



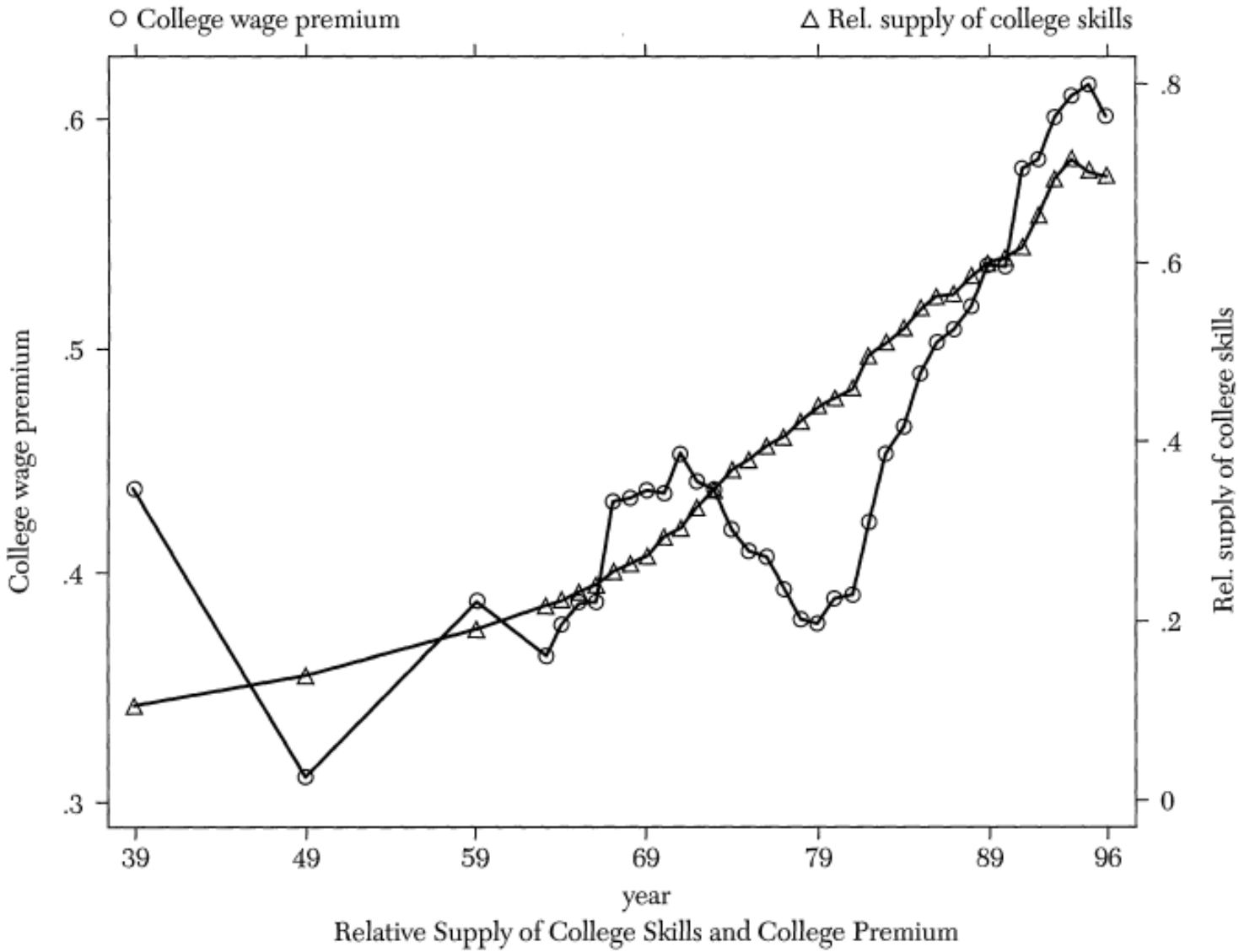



# Asset Bubbles and Inequalities

Stylised facts about incomes and labour allocation since the 80s

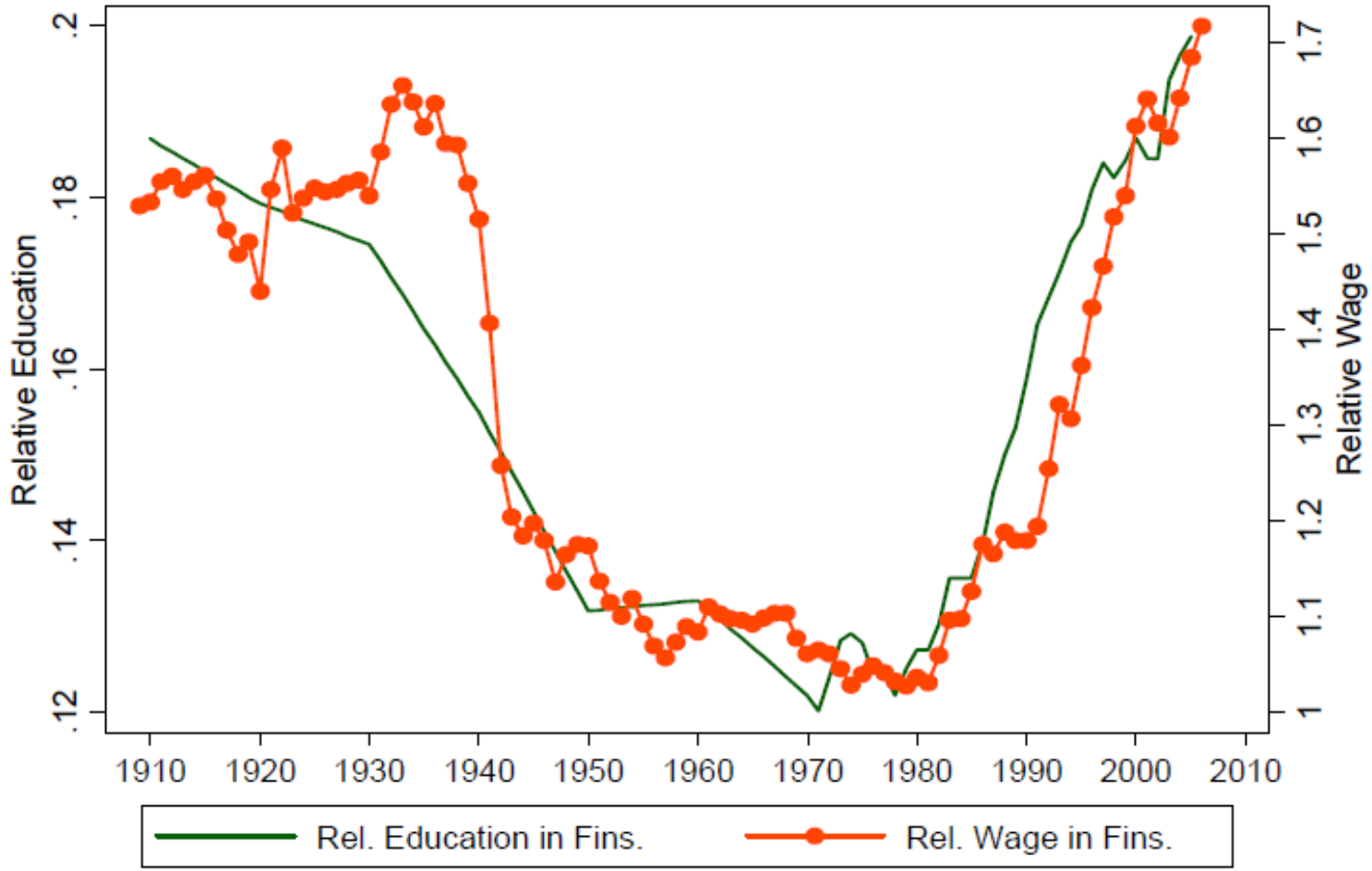
- Skill premium has increased steadily (Acemoglu, 2002)
- Top incomes have soared (Piketty Saez, 1998; Saez, 2009)
- The financial sector has mostly absorbed *skilled labour* (Philippon-Reshef, 2009)

Can our model shed light on this pattern?




Source: Acemoglu (2002)

Figure 1: Relative Wage and Education in the Financial Industry




Source: Philippon and Reshef (2008)

# Asset Bubbles and Inequalities

$N_t$ is now the number of **skilled workers**, mobile across sectors

Add a fixed share of **unskilled labour**, not mobile across sectors

$$L_{u,t} = uN_t$$

Workers shares:

$$\underbrace{(1+u)\,N_t}_{\text{nb of workers}} = \underbrace{uN_t}_{\text{unskilled in production}} + \underbrace{L_t}_{\text{skilled in production}} + \underbrace{N_t - L_t}_{\text{skilled in finance}}$$

$$1+u = u + \underbrace{\ell_t}_{\text{fraction of skilled in production}} + \underbrace{(1-\ell_t)}_{\text{fraction of skilled in finance}}$$

Production function needs both types:

$$Y_t = K_t^{\alpha} L_t^{\beta} L_{u,t}^{1-\alpha-\beta}$$

# Asset Bubbles and Inequalities

Skill premium decreases with $\ell_t$:

$$\frac{w_t}{w_{u,t}} = \left(\frac{1-\alpha-\beta}{u\beta}\right)\frac{1}{\ell_t}$$

At $K$ given, less skilled labour in the productive sector

- lowers marginal product of unskilled labour
- raises marginal product of skilled labour

Same random matching and bargaining process as before

Occupational choice made by skilled workers only

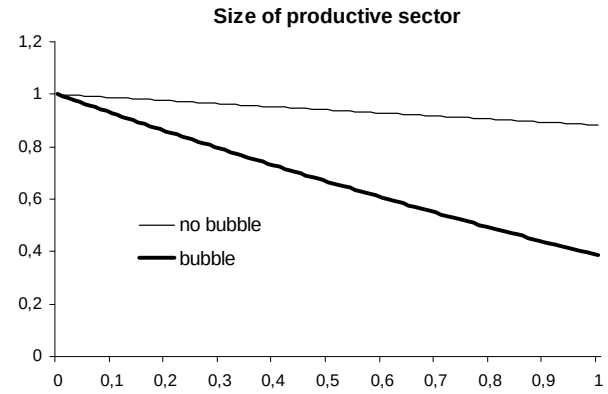
Asset bubble causes drain of skilled labour from production into speculation and raises wage and consumption inequalities. Thus, unskilled workers may suffer from bubble even though skilled workers enjoy it: **alternative breakdown of bubble efficiency**

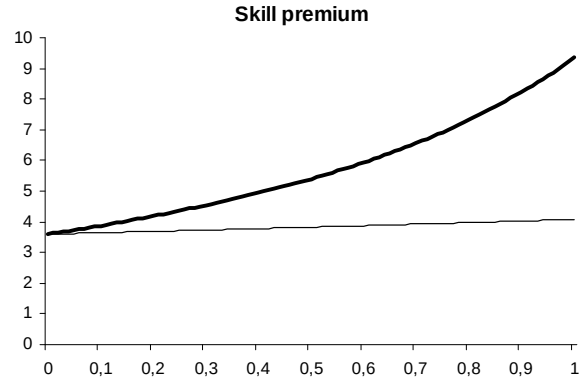
# Asset Bubbles and Inequalities

**Proposition**.Their exist $\theta_u^* \in (0,1)$ such that unskilled workers' consumption is lower in the bubbly than in the bubbly steady state whenever $\theta > \theta_u^*$. Around $\theta = \theta_u^*$ the steady state consumption level of skilled workers is higher in the bubbly steady state than in the bubbleless steady state.

**Remark**: unlike in the one labour type model with CRS, the skilled wage may decrease or **increase** with the bubble. This is because:

- bubble lowers capital stock, which **reduces** the marginal product of skilled labour
- bubble reduces number of skilled producers, which **raises** the marginal product of skilled labour
- Ultimate effect depends on the strengths of these two effects


Size of productive sector
1,2
1
0,8
0,6
0,4
0,2
0
no bubble
bubble
0 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1


Skill premium
10
9
8
7
6
5
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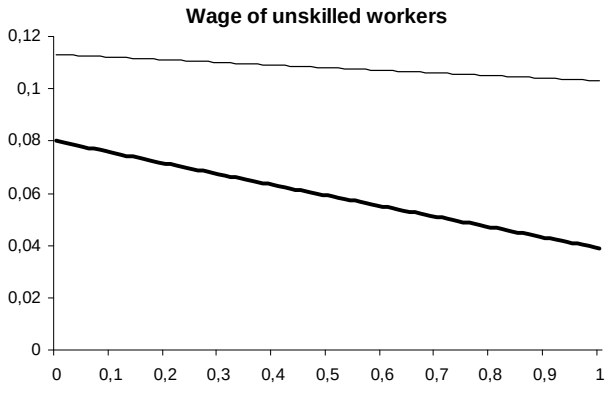
Wage of unskilled workers
0,12
0,1
0,08
0,06
0,04
0,02
0
0 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1


Wage of skilled workers
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
0 0,1 0,2 0,3 0,4 0,5 0,6 0,7 0,8 0,9 1


Consumption of unskilled workers
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0,35
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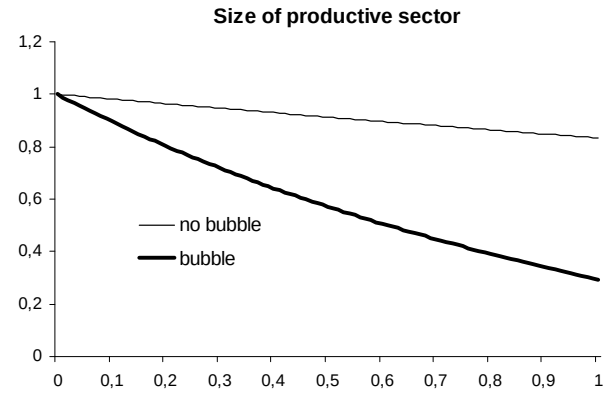
Size of productive sector
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0,4
0,2
0
no bubble
bubble
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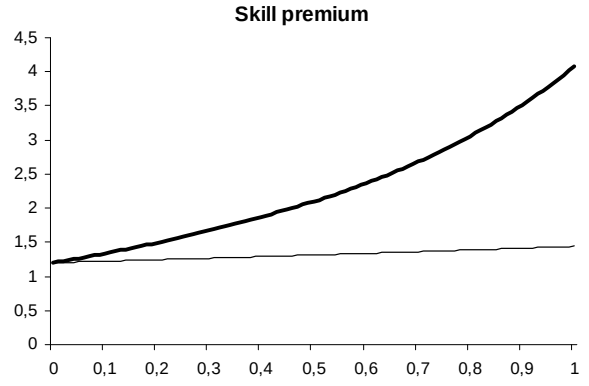
Skill premium
4,5
4
3,5
3
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2
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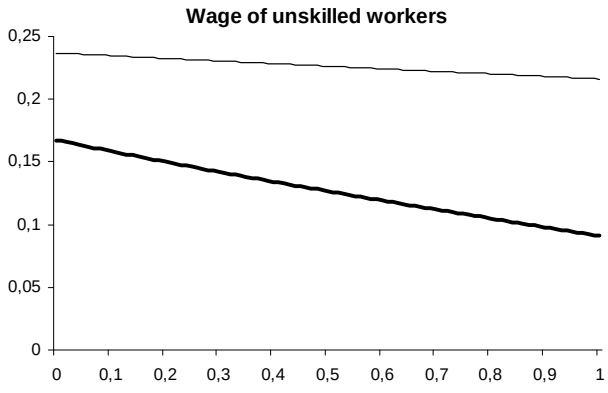
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Wage of skilled workers
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Consumption of unskilled workers
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Consumption of skilled workers
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# Conclusion

Take the standard framework and ask:

- Do bubbles affect the size of the financial sector?
- As a result, can the financial sector become inefficiently large?

Under rents and endogenous labour allocation, **yes**

Overturns traditional result on the efficiency of rational, general equilibrium bubbles

Has implications for income inequalities and the macroeconomic cost of rents