RESEARCH ON BUBBLES: STILL (OR) SPARKLING?

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I. WHAT (WE THINK) WE KNOW

Warnings:

(a) focus on rational bubbles: $p_t = F_t + B_t$ where

$$\begin{cases} F_t \equiv \Sigma_{\tau=1}^{\infty} \dfrac{d_{t+\tau}}{(1+r_{t+1})\cdots(1+r_{t+\tau})} \\ B_{t+1} \equiv (1+r_{t+1})B_t \end{cases}$$

in risk-neutral, safe-bubble version.

Assets that can support a bubble

- durability
- scarcity
- limited short sales

Therefore leave aside many interesting models of overvaluation or more generally mispricing, e.g.

- heterogeneous beliefs/agreeing to disagree, models of overpricing with limits on short sales (price driven by (i) current ownership by most optimistic group and (ii) resale option) , starting with Harrison-Kreps (1978)

  [e.g., Allen et al 1993, Scheinkman-Xiong 2013, Hong-Scheinkman-Xiong 2006, Hong-Sraer 2011]

- agency-based models

  [Allen-Gale 2000 on overvaluation due to risk shifting; Allen-Gorton 1993 on churning bubbles...]

- rational agents combined with behavioral/noise/liquidity

  [Abreu-Brunnermeier 2003; Albagli-Hellwig-Tsyvinski 2011; Doblas-Madrid 2012]

- outright irrationality models of overconfidence or investor sentiments

  [Shleifer, Stein, behavioral finance ...]

- transaction services

  [Scheinkman-Weiss 1986, Kocherlakota 1992.]

(b) mostly ignore empirical issues (e.g., are conditions for dynamic inefficiency met?)

(c) will be a bit critical. Nonetheless, bubble theory is attractive; can account for

- value of gold, jewels, paintings, scarce real estate,
- volatility, "bubble substitution", "bubble crashes".

  [e.g., Internet bubble: rapid 70 % loss from peak.]

Necessary or facilitating factors

(1) *Overlapping generations*

[Infinitely-lived agents – or operative bequests – preclude bubbles. Tirole 1982, Weil *Journal of Monetary Economics* 1987: bequests="reverse bubbles" (require $r > n$), Santos-Woodford 1997]

(2) *Dynamic inefficiency prior to inception of bubble (facilitates or necessary)*

Allais 1947, Samuelson 1958; Cass 1972:

Inefficient path iff $\Sigma_{t=1}^{\infty}\left[\Pi_{\tau=1}^{\infty}\left(\frac{f'(k_\tau)}{1+n}\right)\right] < +\infty$

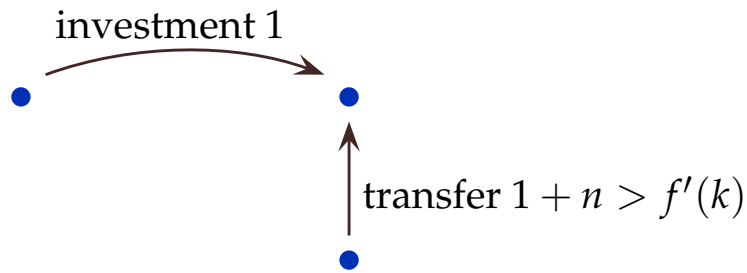
If $1 + r_\tau = f'(k_\tau)$:

Dynamic inefficiency $\Longrightarrow$ bubble per capita: $b_t = \Pi_{\tau=1}^{\infty}\left(\frac{f'(k_\tau)}{1+n}\right) b_0$

$\longrightarrow 0$ (asymptotically bubbleless)

Conversely: asymptotically bubbly $\Longrightarrow$ consumption efficiency.

Clear intuition: if $f'(k) < 1 + n$:



Intergenerational transfer economizes on costly store of value.

Basic effect of alternative stores of values: raise interest rates/crowd out bubbles.

- public debt
- rents

More generally: bubbles fill a void, a shortage of stores of value

(3) *Rents*

Result #1 (Scheinkman 1980): Suppose $n = 0$ and existence of a consol that delivers, say, 1 in each period. Finite value requires $r > 0$. No bubble.

Result #2: more generally, $r \leq n$ impossible if a consol pays "dividends" $\{d_t\} = (1, 1+n, \cdots, (1+n)^t, \cdots)$: still no bubble.

Fundamental: $f_t = \Sigma_{\tau \geq 1} \dfrac{d_{t+\tau}}{(1+r_{t+1}) \cdots (1+r_{t+\tau})}$

Result #3 (non-capitalized rents):

Rents are created proportionally to population (at date t $(1+n)^t$ consols paying off $(1,1,...)$.)

$\Longrightarrow$ bubbles are feasible despite rents that do not become small relative to the economy.

[Tirole 1985]

Result #4 (Geerolf 2013): back to result #2 (capitalized rents), but introduce capital taxation (on value + dividend, or capital gain + dividend); price of rent:

$$p_t = \left[p_{t+1} + (1+n)^{t+1}\right]\left(\frac{1-\tau}{1+r}\right)$$

remains finite as long as:

$$\frac{(1+n)(1-\tau)}{1+r} < 1 \iff r > n(1-\tau) - \tau$$

(4) *Is dynamic inefficiency required for the existence of bubbles?*

No. Multiple rates of interest: which is relevant?

(a) *Imperfect capital markets*
Market rate of interest demanded by investors (r) $<$ Marginal productivity of capital (ρ).
Can easily have $r \leq n < \rho$.

(b) *Aggregate externalities*
Again social yield ρ exceeds private yield r

[Saint-Paul 1992, 2005. (1992) paper: public debt reduces growth rate.
Grossman-Yanagawa (1993)'s model of endogenous growth: capital accumulation raises labor productivity. Spillovers imply that there is too little capital accumulation. All generations made worse off by bubble, except generation that creates bubble.]

(c) *Bubbles attached to productive assets*

(5) *Efficiency properties of bubbles?*

Would one want to prick bubbles if it were easy /cheap to do so?

How to measure efficiency?

- Dynamic efficiency/inefficiency, but fair amount of indeterminacy
- SWF

[Heterogeneous beliefs add a layer of complexity. See, however, recent work of Brunnermeier-Simsek-Xiong (2012).]

Benefits

- Dynamic efficiency.
- Crowding in (see later).
- Eliminate inefficient investments and boost efficient ones

  [Ventura 2003/2012 on bubbles as substitutes for capital flows. Arise in low-productivity countries, and through changes in prices increase investment in high-productivity countries.]

But potentially other means to achieve these benefits.

Costs (of overvaluation in general)

- Costly bubble creation: gold-digging.
- Non-exhaustion of a market fundamental: contrast gold and paintings

  [although if painting stored in a vault because it is expensive...]
- Stochastic bubbles

  [risk of crash, followed by either fire sales or bailouts.

  Not specific to bubbles: risky assets more generally: Allen-Gale 2000: debt-financed intermediaries buy risky asset, that becomes overvalued.

  Weil *QJE* 1987: probability of continuation of bubble $x < 1$. Needs x sufficiently large, though. Mistrust is bad.]
- Firms with overvalued stocks overinvest rather than buy stores of value, so as not to put financial investors on edge and prick the bubble

  [Blanchard 2000].

(6) *Crowding in*

(a) *Attached bubbles*

- Subsidy to *investment*

  [Olivier 2000: bubbles are growth-enhancing, by contrast with Saint-Paul where they have nefarious effects.]

- Attached to *entrepreneurship*: net worth effect

  [e.g., Ventura 2012, Martin-Ventura 2012. Financial frictions; young entrepreneurs create bubble.]

- Attached to *stock price*

  [Miao-Wang 2012: borrowing constrained by market value of firm.]

(b) *Provision of liquidity when shortage thereof*

[Farhi-Tirole *REStud* 2012. See also Arce-Lopez Salido 2011 on housing bubbles.]

Asynchronicity between firms' access to and need for cash. Inside and outside liquidity.

(i) Two effects of outside liquidity:
- leverage effect (competes for savings with productive investment)
- liquidity effect.

[Bubbles affect firms differently. Liquidity effect dominant for firms with low pledgeability/low recourse to leverage.]

(ii) Bubbles more likely to exist/larger when firms need liquidity:
- agency costs more severe (high demand for liquidity)
- outside liquidity is scarce and firms' net worth is high.

(iii) Crash of bubble $\Longrightarrow$ low interest rates, high leverage $\Longrightarrow$ bubble carries liquidity premium even in risk neutral environment.

Crowding in or crowding out? Evidence from US housing bubble before financial crisis.

- Adelino-Schoar-Severino (WP2013): crowding in; in areas with strong home-price increases, collateral lending channel contributed to strong employment gains in small businesses (smaller gains in large firms in same industries).

  [Landier-Sraer-Thesmar (*AER* 2012): impact of wealth effects – collapse of land prices or interest rate risk exposure of banks – on lending. More generally bank lending channel literature.]

- Chakraborty-Goldstein-Mac Kinley (WP2013): crowding out; negative relationship between housing price index and borrowing firms' investment (for regional banks).

(7) *Globalization (for financially developed countries)*

Countries with underdeveloped financial systems create excess demand for assets when capital mobility is introduced and so bubbles in countries with developed financial systems may emerge

[Basco 2011. Inspired by Ventura 2003/2012, but focus on capital mobility, rather than bubbles as substitute for capital mobility.]

(8) *Bailouts*

[Hirano-Inaba-Yanagawa 2012, Martin-Ventura 2012.]

Impact of (exogenous) bailouts: for example, bailouts

- relax condition for existence of bubbles
- initially crowd in most productive investments (good for workers); but if too generous, crowding-out effects (bad for workers, who furthermore must pay for the bailouts). Partial bailouts best for workers.

  [Hirano et al.]

II. WHAT WE DON'T KNOW

(1) *Sufficient conditions?*
Institutional backing of asset (however *small*)

- Government guarantees a price floor above fundamental (above 0 for a dividend-free asset), or
- Reserve requirement

  [say, value of gold held $\geq \xi \cdot$savings. Then asymptotically bubbly path only, and no bubble feasible on other assets.]

(2) *Detection* (both by participants and by authorities)

(a) *Ex post vs ex ante*

- 20/20 insight
- price-earning, price-rental ratios.

(b) *Good vs. bad bubbles.*

(3) *Policy.*

(a) *One of the weak points of the economics of bubbles: policy*

- policymakers: prudential, fiscal and monetary policies
- economic theorists: dynamic efficiency, intergenerational transfers and public debt.

Talk at cross purposes!

(b) *Why is one wary of bubbles?*
Explain why one is wary of bubbles; after all,

- eliminate dynamic inefficiency
- provide liquidity if shortage.

Answer below: bailouts when (stochastic) bubbles burst.
Could alternatively be fire sales.

[As in Caballero-Krishnamurthy 2006. Both are consistent with difference between Internet bubble and housing bubble, latter being held by strategic, levered institutions.]

(c) *Policy prescriptions: Leaning against the wind?*

- old Jackson Hole consensus (e.g., Bernanke, Bernanke-Gertler, Greenspan; but see Bordo-Jeanne 2002): bubbles (i) are hard to detect and (ii) monetary policy is wrong instrument (unless bubbles signal inflation);
- consensus is being revisited (Stein).

(d) *Policy prescriptions: National debt glut?*

Wouldn't public debt be a safer store of value (can easily be rolled over when interest rate does not exceed rate of growth of economy)?

- large literature on sovereign debt default, but assumes benefits from default

  [contrast Hellwig-Lorenzoni (2009)]
- the two literatures ignore each other.

III. BUBBLES AND PUBLIC POLICY
JOINT PROJECT WITH EMMANUEL FARHI

Simple model:

Infinite horizon: $t = 0, 1, \cdots$

Consumers, banking entrepreneurs, social planner.

(1) *Consumers* (passive players in this model)

- live for 1 period
- (large) endowment e
- consumption c_t.

(2) *Banking entrepreneurs*

- live for 2 periods. Generation G_t born at $t-1$ with endowment y
- utility $E_{t-1}(c_t)$.

Generation t

Invest at $t-1$ endowment in illiquid assets i_t and liquid assets ℓ_t:

$$y = i_t + \ell_t \qquad \text{for generation } t.$$

1 unit of investment at $t-1$ requires R_0 units of reinvestment at t, hence the need for liquidity $R_0 j_t$ if productive capacity is $j_t \leq i_t$.

Produces ρj_t, non-pledgeable.

[could make some of ρ pledgeable so as to capture "mop up after crash" strategy. As in Farhi-Tirole *AER* 2012, lowering interest rates in case of negative macro-shock would then help refinancing.]

Assets

$$\ell_t = a_t + b_t$$

- *Safe store of value*: a_t ; yields R_0 per unit at t

  [same R_0 so that 1 unit of i_t requires 1 unit of a_t.]

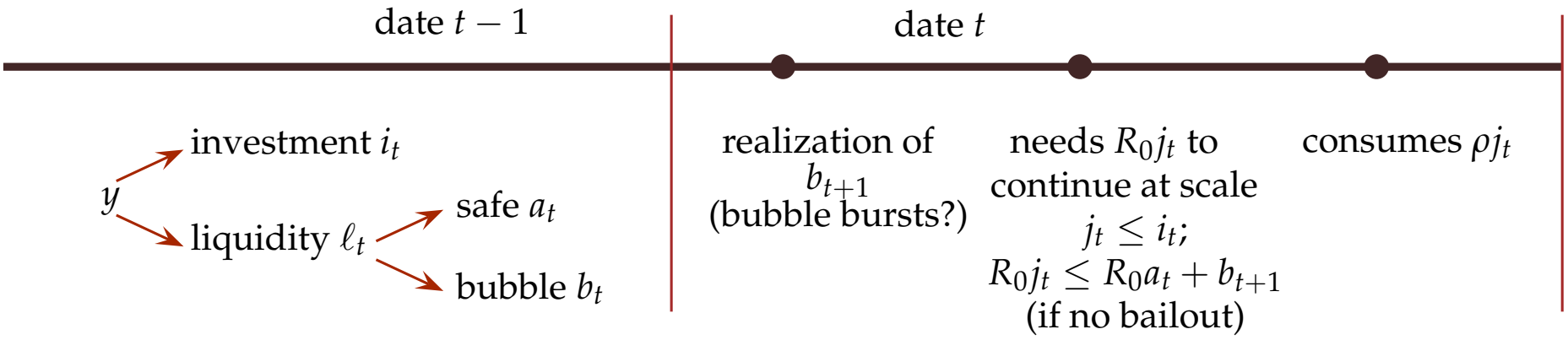
  Assume $R_0 < 1$

- *Bubble*: b_t. Stochastic: bursts with probability $1 - x$

  [one interpretation: becomes reproducible].

  Unit supply (w. l. o. g.)

Summing up



Generation-t banking entrepreneurs

(3) *Social planner/state*

$$W = \sum_{t \geq 0} \delta^t [c_t + \beta j_t].$$

- δ reflect short-termism, etc.
- foundations of β: see Farhi-Tirole *AER* 2012
  - loanable funds and spillovers on industry
  - employment rents in banking industry
  - internalization of bankers' welfare

  [slightly different expressions in latter interpretation.]

Assumption $R_0 < \beta < 2R_0$

implies

- incentives for bailouts if banking entrepreneur short of money:
$$\beta > R_0$$
- state prefers covered to naked investment
$$\beta \frac{y}{2} > (\beta - R_0)y \iff \beta < 2R_0.$$

Also implies willingness to subsidize ex post (fait accompli) but not ex ante:

$$\Longrightarrow \qquad \beta < R_0 + \frac{1}{\delta}.$$

▸ Optimum

Regulation: crude assumptions

- can tax/subsidize in lump sum way
- cannot measure individual allocation of ℓ_t, i.e., (direct or indirect) exposure to bubble
- but learns when bubble crashes (macroeconomic data).

First implication: *collective moral hazard*

> better off investing in bubble if others do as well, as this induces a bailout.

LAISSEZ-FAIRE (NO BAILOUT)

In absence of bubble, $i = \ell = a = \dfrac{y}{2}$

Dynamically inefficient as $R_0 < 1$.

Social welfare: $e + \delta W_0$, where

$$W_0 = \frac{1}{1-\delta}\left(e + \beta\frac{y}{2}\right)$$

Stochastic bubble

Resource constraint: $i + b = y$

Liquidity coverage: $R_0 i = b$

$$i = \frac{y}{1+R_0} > \frac{y}{2} \quad \text{and } b = \frac{R_0 y}{1+R_0}$$

Stochastic bubble (continued): requires

$$x\rho\left[\frac{y}{1+R_0}\right] \geq \rho\left[\frac{y}{2}\right]$$

or

$$x \geq \frac{1+R_0}{2}.$$

Feasibility (Weil 1987):

- low probability of bursting
- extent of dynamic inefficiency.

Welfare: $e + \delta W_1$, where

$$W_1 - W_0 = \frac{\beta y}{(1-\delta x)(1+R_0)}\left[x - \frac{1+R_0}{2}\right],$$

State congruent with banks as to investment/allocation of liquidity

BAILOUTS

Suppose all banking entrepreneurs invest $i = y/(1+R_0)$ in illiquid assets and

$$\ell = b = R_0 \left(\frac{y}{1+R_0} \right)$$

in bubble.

Bailouts with probability $1-x$.

$$W_2 = \frac{e}{1-\delta} + x \left[\beta \frac{y}{1+R_0} + \delta W_2 \right] + (1-x) \left[(\beta - R_0) \frac{y}{1+R_0} + \delta W_0 \right],$$

$$\Longrightarrow \qquad W_2 - W_0 = \frac{yR_0}{(1-\delta x)(1+R_0)} [x - x^*(\beta)]$$

where $x^*(\beta)$ is defined by

$$x^*(\beta) \equiv 1 - \left(\frac{1-R_0}{2R_0} \right) \beta,$$

Bubbles "eliminate" dynamic inefficiency, but generate (ex-ante) unwanted bailouts.

Preventing vs. pricking bubbles

Blanchard (2000): "much costlier to prick bubbles" (analogy with inflation).

Thought experiment: suppose can prick bubble, without any other cost than those induced by wealth effect ("illegal to hold the asset").

> Never optimal to prick stationary bubble, even when latter undesirable (i.e., $x < x^*(\beta)$).

PRUDENTIAL REGULATION (LIQUIDITY COVERAGE RATIO)

Suppose regulator can impose a liquidity coverage ratio ℓ_t / i_t.

Benefit: rules out naked investments

$$i = y \quad \text{and bailout} \quad R_0\, y$$

$\Longrightarrow$ welfare $e + \delta W_3$ with

$$W_3 = \frac{1}{1-\delta}\left[e + (\beta - R_0)y\right] < W_0.$$

Liquidity requirement: $\ell \geq \underline{\ell} \geq \dfrac{R_0}{1+R_0} y$.

Bubble $b = \underline{\ell}$ larger than before.

Welfare: $e + \delta W_4$, where

$$W_4 = \frac{e}{1-\delta} + x\left[\beta i + \delta W_4\right] + (1-x)\left[(\beta - R_0)i + \delta W_0\right]$$

$$W_4 > W_2 \Leftrightarrow x < x^*(\beta).$$

Controls level, but not structure of liquidity hoarding: just reduces investment.

LEANING AGAINST THE WIND

Suppose that $x < x^*(\beta)$.

(1) *Commitment to a given interest rate*
$R > R_0$

Trade-off:

- subsidy $(R - R_0)\left(\dfrac{R_0 y}{1 + \dfrac{R_0}{R}}\right)$
- gets rid of bailouts.

Lower welfare than under laissez-faire (than W_0). Want to prevent bubbles when $x < x^*(\beta)$ *and* R_0 close to 1 (small intervention) or x small enough.

(2) *Other commitments (off-the-equilibrium path)*
As usual: Strong enough interest rate response to (here) bubbles. Credible commitment to prick bubbles $\Longrightarrow$ no need to prick them.

(3) *Time-consistent interest rate policy*

[work in progress]

War of attrition:

- State gives up and returns to R_0. Bubble jumps up.
- Bubble bursts.

ISSUING PUBLIC DEBT

[work in progress as well]

Cannot assume that authorities per se less credible than bubble.

Somehow policymakers must find it difficult to roll over the public debt (despite fact that $r \leq n$).

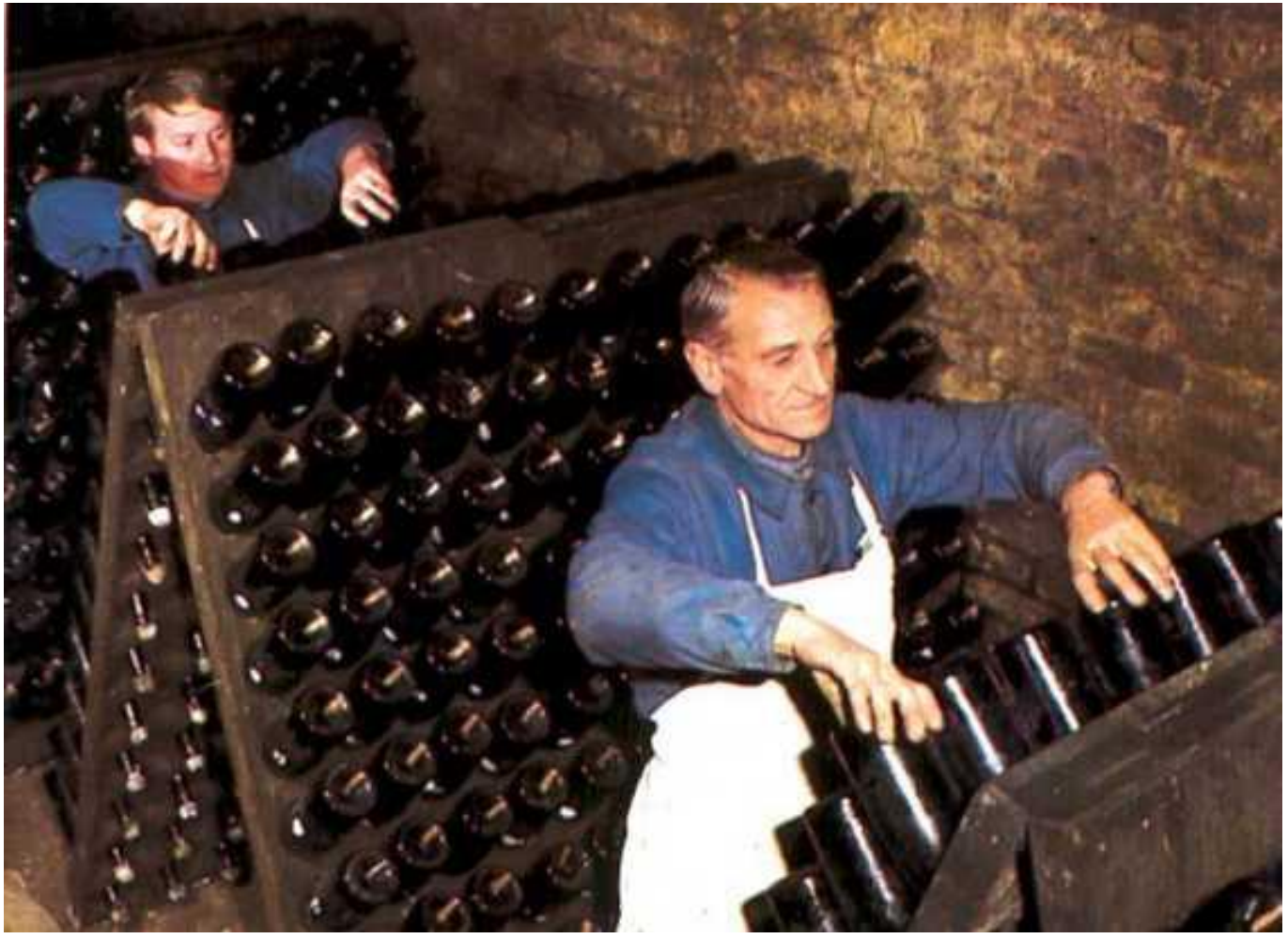
Example:

- short-sighted public decision-makers (δ small).
- random savings s_t by low-political weights savers (e.g., foreigners).

Then still scope for bubbles.

IV. STILL (OR) SPARKING?

In the making, still need some “remuage”



before...

Thank you for your attention!

TARGET SLIDE

Optimum

- Would like to expropriate banking entrepreneurs' endowment y (hence $i = 0$).
- If no expropriation constraint or, say, can invest in safe store of value abroad, optimum can be obtained through
  - tax on banking investment
  - acceptance of a SBC.

return