On Interest Rate Policy and Asset Bubbles

Franklin Allen Gadi Barlevy Douglas Gale

Imperial College Chicago Fed NYU

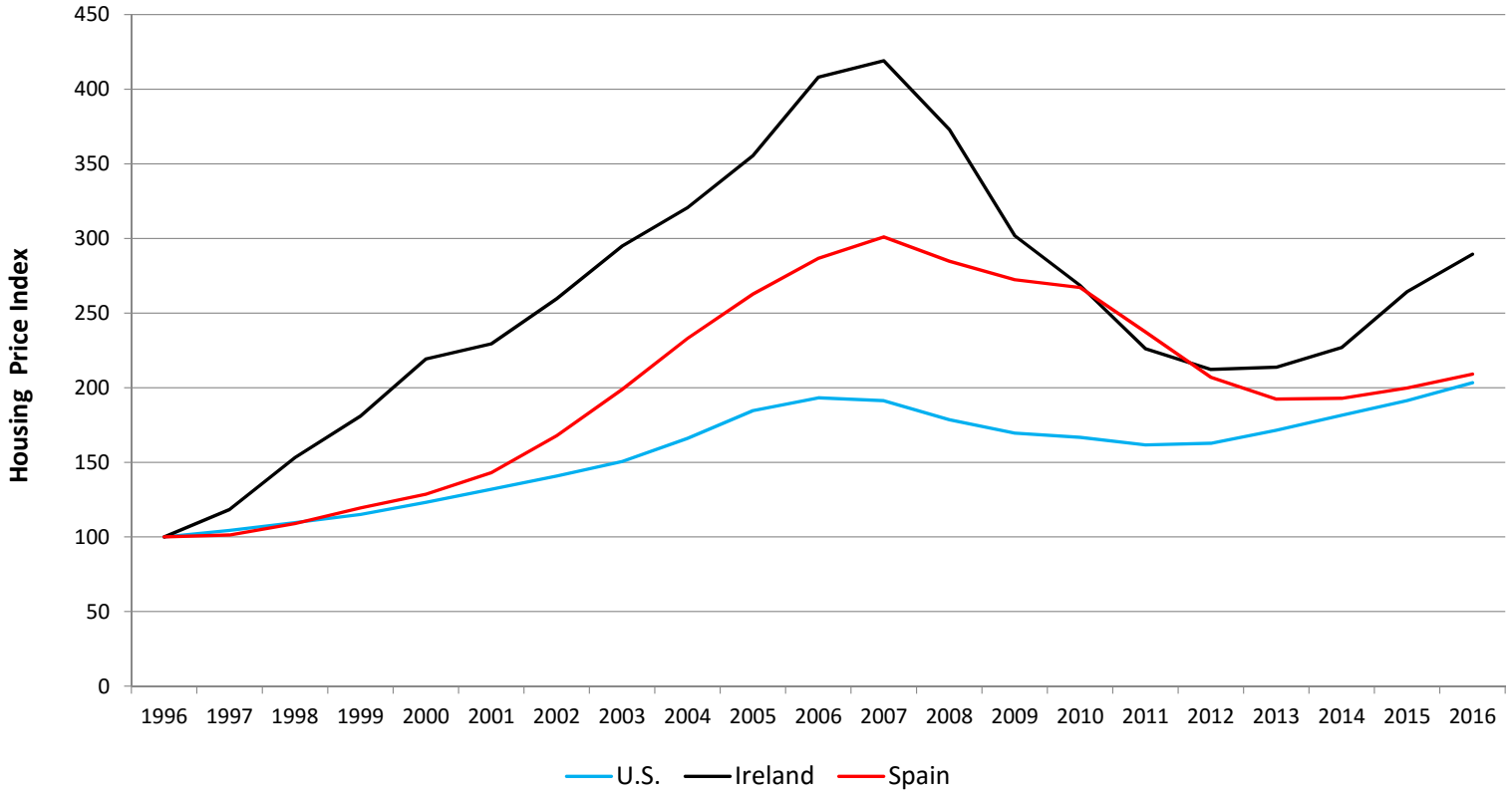
December 2017

Disclaimer: Our views need not represent those of the Federal Reserve Bank of Chicago or the Federal Reserve System

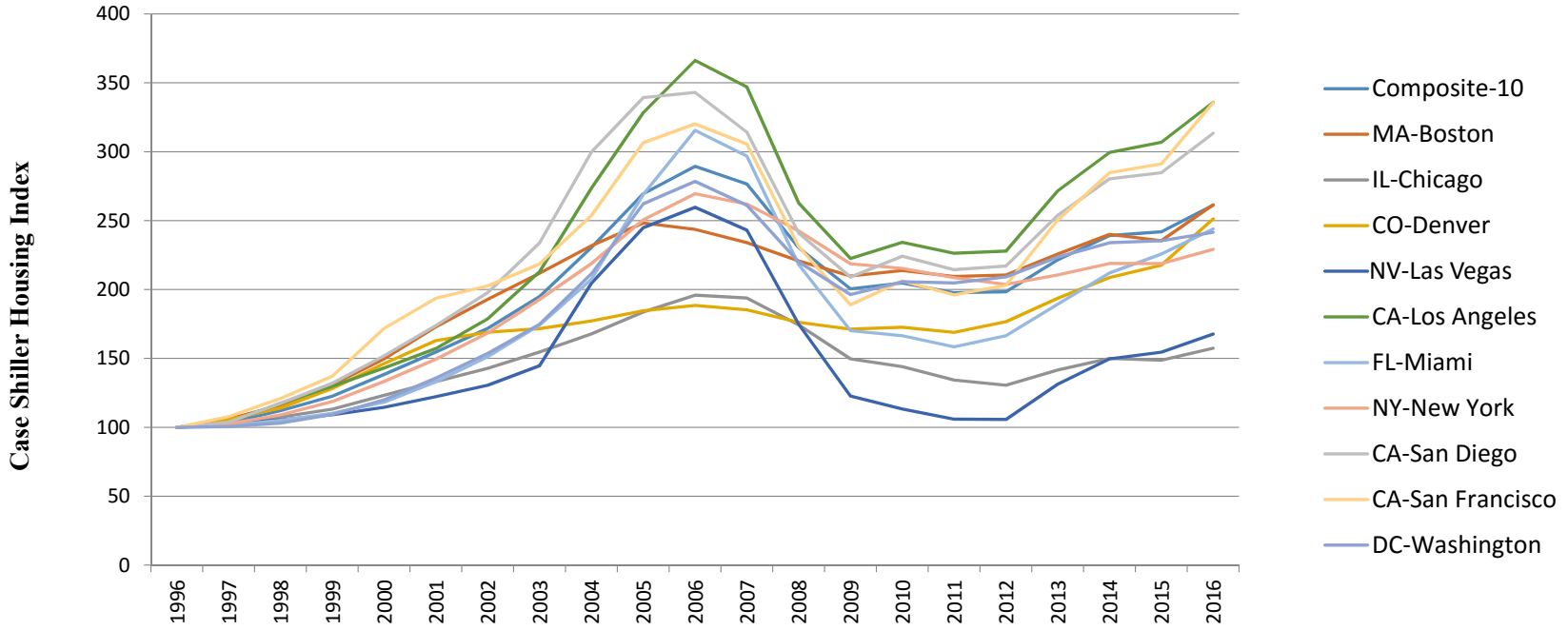
Introduction

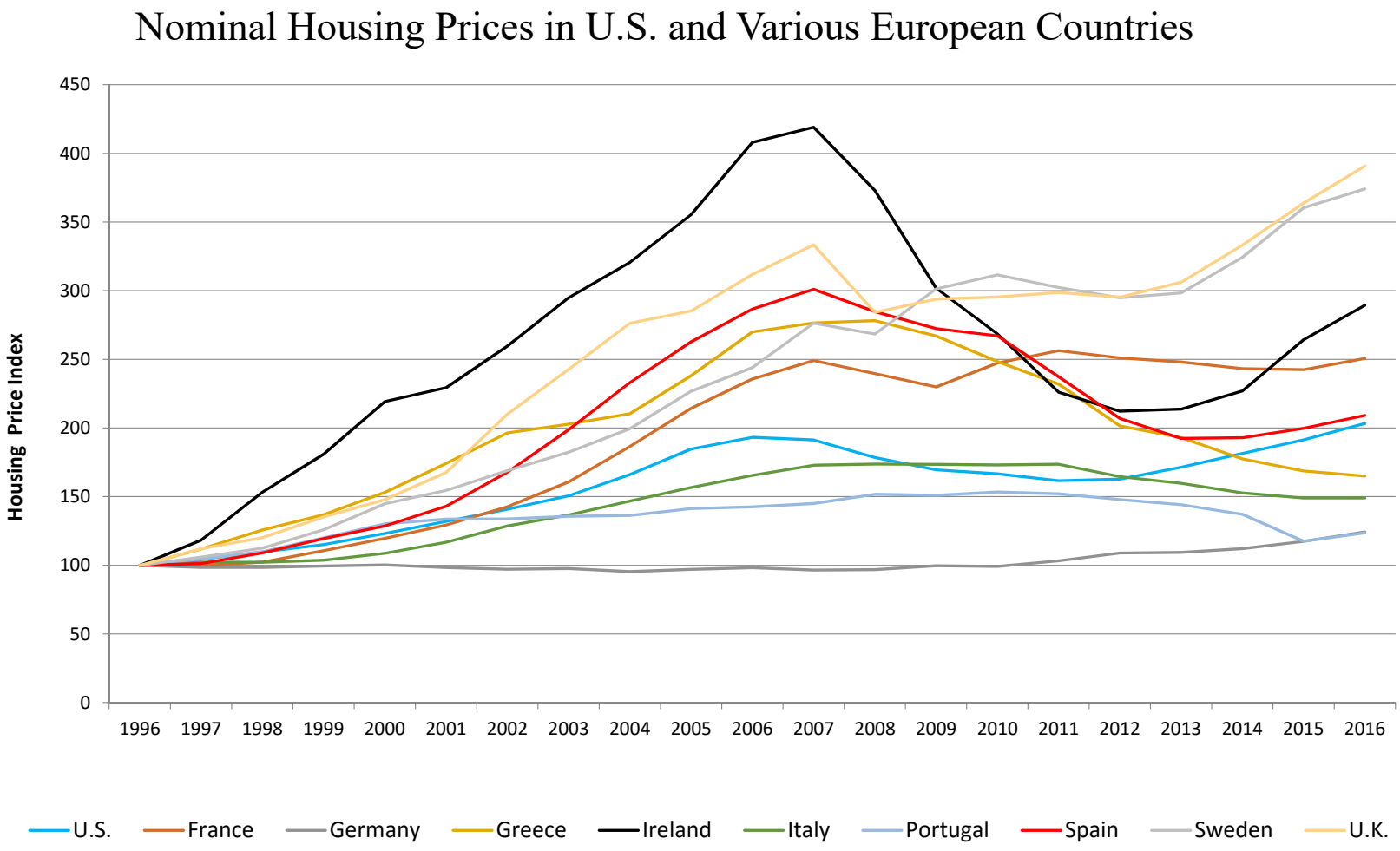
- Borio and Lowe (2002) documented a relationship between credit growth, asset price increases (bubbles) and financial instability - they argued "leaning against the wind" by raising interest rates may be desirable early on in this process to prevent the subsequent financial instability
- This policy became controversial and has only been followed in a few instances
- Greenspan orthodoxy: Clean up after bubbles have burst
- But real estate bubbles were the trigger for the U.S. and Eurozone crises

Nominal Housing Prices in Ireland, Spain and the U.S.



Nominal Housing Prices in Different U.S. Cities




Nominal Housing Prices in U.S. and Various European Countries
Housing Price Index
450
400
350
300
250
200
150
100
50
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
U.S.
France
Germany
Greece
Ireland
Italy
Portugal
Spain
Sweden
U.K.

- The issue of how to prevent real estate bubbles is back on the central bank agenda
- Macroprudential?
- Lean against the wind?
- Galí (2014) studied effect of higher interest rates in economy w/bubble
- Found that a higher rate will make bubble *larger* if one is present
- Poses a challenge to lean-against-the-wind view toward bubbles

What we do

We argue there are circumstances where lean-against-the-wind may be valid

1. Argue that raising rates can sometimes dampen bubbles
   - In Galí's setup, higher rates don't crowd out resources from bubble
   - We modify model to allow crowding out $\Rightarrow$ raising rates can dampen bubble
2. Argue that intervening to dampen bubbles may be desirable
   - Even if raising rates dampens bubble in Galí's setup, no reason to do it
   - In Galí's setup, bubble serves a beneficial role and should be preserved
   - Modify setup to get credit-driven bubble, in line w/policymaker concerns

Don't want lean-against-the-wind in Galí's setup, but might want it in others

Roadmap

1. Replicate and explain Galí's result
2. Show result overturned once we modify the model
3. Discuss monetary policy interventions
4. Show how to modify model to allow credit-driven bubbles

Replicating Galí

We use an OLG model as in Galí, although with some differences

- Agents only care about consumption when old: $u(c_t, c_{t+1}) = c_{t+1}$
- Endowed with resources only when young: $e_t = (1+g)^t e_0$ for $g > 0$

Agents can convert endowment when young into consumption when old by

- Storing goods, converting on a 1-1 basis
- Trading goods for assets, then trading back for goods

Assets available to agents

Start with Galí's two assumptions on assets (we relax both later):

- Agents effectively trade only one asset
  - Available in fixed supply that is normalized to 1
  - Yields a constant dividend d per period
- Asset intrinsically worthless, i.e. $d = 0$

Equilibria

Equilibrium $\equiv$ price p_t at which old want to sell assets, young want to buy

Let r_t denote return on investment. Assuming $d = 0$ implies $1 + r_t = \frac{p_{t+1}}{p_t}$

- If $r_t > 0$, storage dominated $\Rightarrow$ all endowment to asset, $p_t = e_t$
- If $r_t = 0$, then $p_{t+1} = p_t \leq e_t < e_{t+1}$, so some storage at $t+1$

  But if storage at $t+1$, then $r_{t+1} = 0$, i.e. zero interest is absorbing
- Any deterministic eqbm can be characterized by cutoff $0 \leq t^* \leq \infty$ s.t.

$$p_t = \begin{cases} e_t & \text{if } t < t^* \\ p_{t^*} & \text{if } t > t^* \end{cases}$$

  where p_{t^*} can be any value in $[e_{t^*-1}, e_{t^*}] \Rightarrow$ bubbles possible ▸ Figure

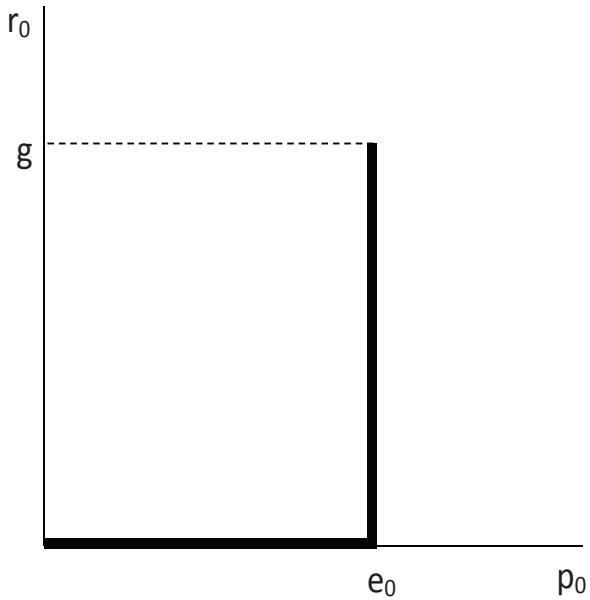
Comparative statics

How does changing interest rate path $\{r_t\}_{t=0}^{\infty}$ affect equilibrium p_t?

- Is this question even coherent?
  - Interest rates are endogenous – what does it mean to move them?
  - Can we say anything about effect given multiplicity of equilibria?
- Galí grappled with these conceptual issues in his paper
  - Begins with a "partial eqbm" analysis where $\{r_t\}_{t=0}^{\infty}$ exogenous
  - Moves to a general eqbm analysis
- We jump straight to general equilibrium analysis

Comparative statics - general equilibrium

- Think of setting rates as selecting an eqbm $\{r_t\}_{t=0}^{\infty}$ among all eqbm paths (interest rate paths also feature cutoff date t^*)
- Initial asset price and interest rate positively related across equilibria:



- Higher $r_0 \Rightarrow$ weakly higher p_0 (true for Galí and other models)
- Since p_t grows at rate r_t, higher rates $\Rightarrow$ larger bubble

Intuition

Why are higher rates associated with a larger bubble?

- If r_t higher, agents move from storage to assets
- Galí's model has similar feature, but story a little different:
  - No storage, agents value consumption while young at diminishing rate
  - A higher rate will lead to shift from consumption to buying assets
- With only one asset, more resources pour in to buy fixed supply
- Logic need not extend with more than one asset

Modifying the model

We now modify aspects of the model to show result can be overturned

- Begin by assuming $d > 0$, i.e. asset yields real dividend
- Eliminates indeterminacy
  - Can't have $r_t = 0$ since then $p_{t+1} = p_t - d$ and price turns negative
  - Storage then forces $r_t > 0$, but this implies $p_t = e_t$ so equilibrium unique
- Asset still a bubble, even w/unique eqbm (i.e. no bubbleless eqbm)
  - Fundamental value is $f_t = \sum_{j=1}^{\infty} \left(\prod_{i=0}^{j-1} \frac{1}{1+r_{t+i}} \right) d$ where $r_t = g + \frac{d}{e_t} > g$
  - Fundamental value bounded, even asymptotically: $\lim_{t\to\infty} f_t = \frac{d}{g}$
  - But price grows without bound: $\lim_{t\to\infty} p_t = \lim_{t\to\infty} e_t = \infty$

Adding more assets

- Since eqbm unique, can't think of policy as selecting eqbm interest rate
- Need some way for policymaker to affect interest rate
- Add government bonds $\Rightarrow$ now we have more than one asset
- Government raises b_t resources at t, repays $(1 + r_t)b_t$ at $t + 1$
- Asset and gov bonds must offer same return in equilibrium

Government policy and equilibrium

- Ignore money (for now) so debt depends on fiscal policy :
  1. Initial obligation $(1 + r_{-1})b_{-1}$ to old at date 0
  2. Path of lump-sum taxes on young $\{\tau_t\}_{t=0}^{\infty}$
- Given path for fiscal policy, debt evolves endogenously according to

$$b_{t+1} = (1 + r_t)b_t - \tau_{t+1} \tag{1}$$

- Storage still dominated, so asset price equal to available income:

$$p_t = e_t - \tau_t - b_t \tag{2}$$

- Equilibrium is a path $\{p_t, r_t, b_t\}_{t=0}^{\infty}$ that satisfies (1), (2), and

$$1 + r_{t+1} = \frac{d + p_{t+1}}{p_t} \tag{3}$$

Policy intervention

Consider changes in debt issuance

- Reduce policy to a single parameter b:
  - Initial debt $(1 + r_{-1})b$ where $r_{-1} > 0$
  - Constant debt over time $b_t = b$ for $t = 0, 1, 2, ...$, i.e., set $\tau_t = r_{t-1}b$
- **Key Results:** Increasing outstanding debt b at each date will lead to ...
  - ... higher interest rates r_t and taxes τ_t at all t
  - ... lower asset prices $p_t = e_t - b - \tau_t$ at all t
  - ... smaller bubbles $\Delta_t = p_t - f_t$ at all t

$\Rightarrow$ we have an example of a policy that runs counter to Galí's result

Intuition

- Maintaining a higher constant debt b requires higher taxes τ_t

  (not wlog, since here government can perpetually roll over debt)
- Higher taxes τ_t impoverish young at date $t \Rightarrow$ lower savings
  - Young can spend fewer resources on asset, so price falls
  - Young save less but consume the same, so higher return

$$1 + r_t = \frac{e_{t+1} + d}{e_t - \tau_t}$$

- Temporary monetary contraction similarly crowds out savings

Welfare

Although acting to raise rates depresses bubble, no effect on welfare

- Regardless of b, young give up endowment for old to consume
- w/o debt, young give endowment to old directly by buying their assets
- w/debt, young give endowment to gov who repay debt to old

Higher rates thus depress bubble in asset market, but no reason to do it

With more general preferences, issuing bonds may affect allocations

BUT ... bubble is dynamically efficient, so some agents must be worse off

Monetary policy

- To analyze monetary policy, need to add money as an asset
  - i.e. let agents trade endowment for assets, bonds, or money
- Capturing various effects of money requires additional modifications:
  1. Introduce money as another (somehow special) asset agents can hold
  2. Endowment not of goods but of labor (so output endogenous)
  3. Allow for nominal rigidities (sticky prices) so money matters for real side
- **Key insights:**
  - Monetary policy can reduce bubble + raise r_t by forcing more debt issuance
  - Monetary policy alone can reduce bubble and raise r_t if prices sticky

Credit-driven bubbles

- Can we generate a bubble in this model that merits intervention?
- Policymakers worry about collapsing bubbles that trigger default
- Need to modify the model to allow such a scenario
  1. Need a shock for bubble to burst (bubble persists indefinitely when $d > 0$)
     - Assume e_t growth stops at random date, can't sustain a bubble after that
  2. Need to allow private debt (only young trade, no debt when all the same)
     - Suppose some young are savers, others are entrepreneurs who can produce
  3. Need credit market frictions to get bubbles
     - Previous work emphasized borrowing constraints; we study information frictions
     - Replace too little entrepreneur borrowing with "too much" borrowing by others

Bursting bubbles

- We introduce a risk of secular stagnation:

$$e_t = \begin{cases} (1+g)^t e_0 & \text{if } t < T \\ e_{T-1} & \text{if } t \geq T \end{cases}$$

  where T has a geometric distribution

- No bubble past date T; positive interest rate but no growth
- Without private debt, no bubble before date T either
  - Result hinges on $d > 0$; bubble can arise if $d = 0$
- Can get a bubble that bursts at date T when we add credit

Credit

- Three types per cohort, not just one: savers, entrepreneurs, speculators
  - Savers collectively want to save e_t as before
  - Entrepreneurs own no resources, can deploy κ units to earn return $1 + y$
  - Speculators own no resources and don't know how to produce
- Absent any frictions, we have
  - Savers lend κ to entrepreneurs, speculators irrelevant
  - Interest rate on loans R_t same as return on government debt or asset r_t
  - Equilibrium price on the asset is not a bubble

Information frictions

Need some friction to generate a bubble; we focus on information

- Suppose savers can't distinguish entrepreneurs and speculators
- Speculators can buy asset to gamble on when growth stops

  Similar to Allen and Gorton (1993), Allen and Gale (2000), Barlevy (2014)
- There exists a pooling eqbm where all borrowers receive same contract
- Interest rate on loans R_t reflects average borrower risk
- Cross-subsidization encourages demand for the asset
- Asset price exceeds PDV of dividends until date T

  After T, no more opportunity to shift risk

Policy Intervention and welfare

- We can still find interventions that raise r_t and lower Δ_t
- Bubble no longer offers social benefit; due to information rents
- No case for intervention w/fixed supply, maybe w/variable supply

  Intervention more warranted for some types of bubbles (land vs. houses)
- Intervention helps discourage excessive creation of risky assets

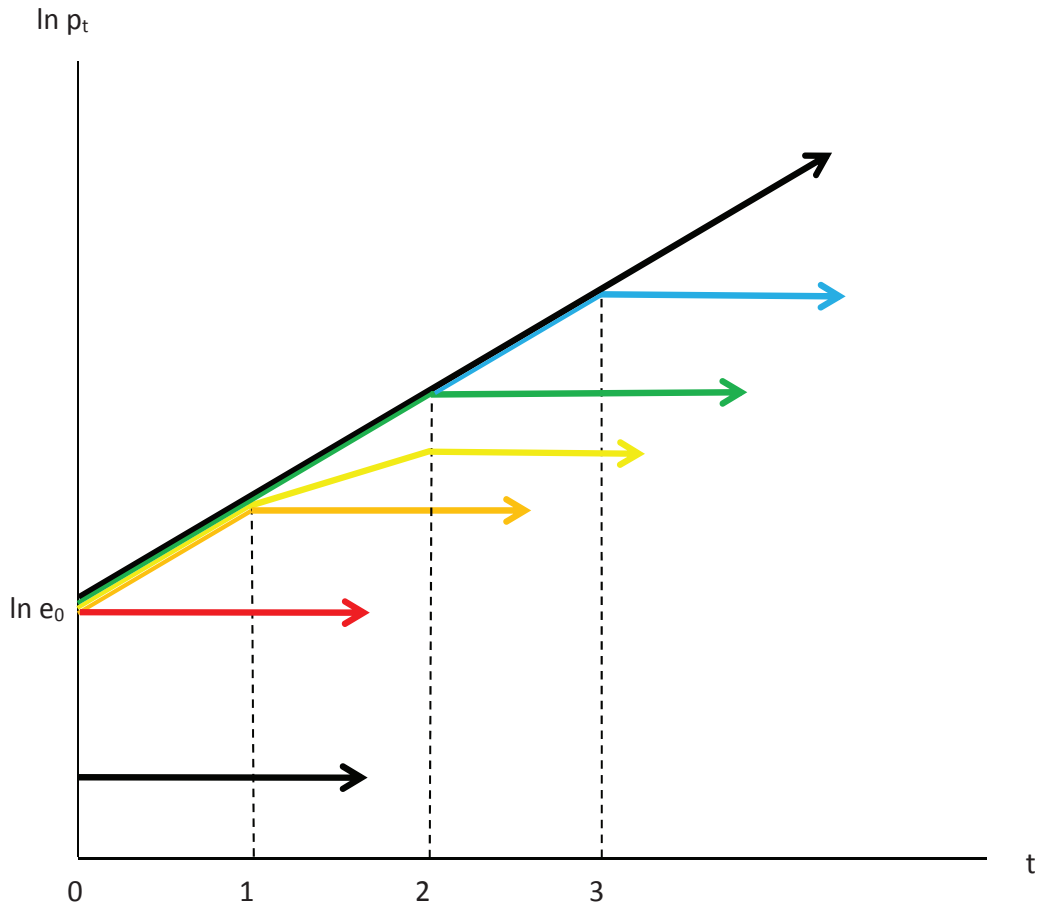
Conclusion

- We find that interventions that raise rates can depress bubbles
- Our examples not about raising rates but crowding out resources
- If policy working, should see it in savings and portfolio shares

- To justify use of policy, need different type of bubble than one Galí used

- Even if higher rates good, other policies might be better (e.g. regulatory)

Graphical illustration of equilibria



Back