Appreciations and Overvaluations

Macroeconomics IV

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Introduction

- Real exchange rate appreciations often reflect boom conditions, but they also stress important parts of the economy
- Most economies experience episodes of this sort. Today, this is the case of commodity producing economies, emerging markets, as well as countries experiencing strong capital inflows
- In this context the question arises whether there is a need for policy intervention
- Here we present one framework to address such question (Caballero-Lorenzoni)

Motivation: Appreciations

Episodes of large and persistent appreciations of real exchange rate

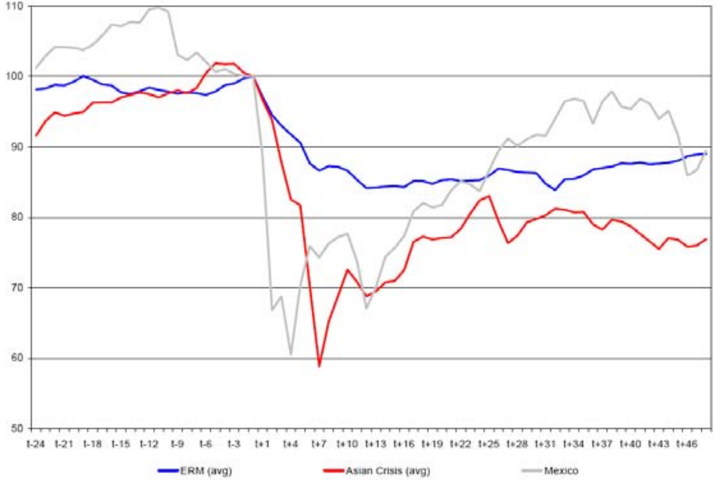
Many sources:

- Absorption of large capital inflows
- Inflation stabilization policies
- Exchange rate adjustments in trading partners
- Favorable price shock for commodity producers
- Discovery of natural resources (Dutch disease)

Slow adjustment in recoveries

- Persistent appreciations drains resources of export sector, lead to destruction/bankruptcies
- May slow down export sector recovery once things turn around
- Depressed input demand from consumers + depressed input demand from export sector
- Real exchange rate overshooting

RER overshooting



Policy question

Is there a need to intervene to protect the export sector?

Does costly ex post adjustment justify intervention ex ante?

A: no

Add extra ingredient: financial constraint

A: in some cases

Inter-temporal pecuniary externality

- Suppose consumers reduce their demand for non-tradables in appreciation
- Less destruction ex-ante and a faster recovery ex-post
- Higher wages and real exchange rates ex post
- Rational atomistic consumers ignore this effect

Related work

- 'Dutch disease' (Corden, Krugman, Wijnbergen)
  - learning-by-doing, real externality
- Broader problem: preventive measures during appreciations and current account deficits
  - inefficient current account deficits (Blanchard)
- Financial development and the negative effects of macro volatility
  - exchange rate fluctuations bad for liquidity constrained entrepreneurs (Aghion-Bacchetta-Ranciere-Rogoff, Aghion-Angeletos-Banerjee-Manova)

Model

- two goods: tradable T, non-tradable N
- price of N (RER): p_t
- two countries: home, foreign
- two groups in home country: consumers, entrepreneurs

Preferences

Consumers:

$$\mathrm{E}\sum \beta^t \theta_t \left(\log c_t^T + \log c_t^N\right)$$

preference shock θ_t

Entrepreneurs and ROW:

$$\mathrm{E}\sum \beta^t c_t^T$$

Shocks

First shift to θ_A, then shift to θ_D w.p. δ

$$\theta_A > \theta_D$$

D absorbing state

complete markets

Endowments

Consumers sell 1 unit of labor inelastically

Entrepreneurs, period 0:

$$a_0 \text{ tradable goods}$$
$$n_{-1} \text{ production units}$$

Technology

Tradable sector

- f of tradable good to create one production unit
- (*Leontief*) 1 production unit produces 1 tradable using 1 labor
- (*No mothballing*) if production unit inactive $\longrightarrow$ destroyed

Non-tradable sector

- 1 unit of labor produces 1 unit of NT
- $\longrightarrow$ wages are equal to p_t

Financial constraint

No commitment on entrepreneurs' side

Portfolio of entrepreneurs:

$$a(s_{t+1}|s^t) \geq 0$$

Equilibrium: consumers

Consumers' optimality + complete markets

Demand for NT

$$c_t^N = \kappa \frac{\theta_t}{p_t}$$

- shock: persistent shift in demand for NT
- κ endogenous depends on NPV of wages p_t

Equilibrium: export units and NT consumption

Market clearing in labor and goods market + Leontief:

$$n_t + c_t^N = 1$$

Market clearing for used units + creation/destruction margin:

$$\begin{aligned} q_t &\in [0, f] \\ n_t &> n_{t-1} \text{ implies } q_t = f \\ n_t &< n_{t-1} \text{ implies } q_t = 0 \end{aligned}$$

- q_t price of used unit

Characterization

Proposition

Equilibrium is characterized by:

Phase A

$$p(s^t) = p_A > 1 \qquad q(s^t) = 0$$

Phase D

$$p(s^t) = p_{D,j} < 1 \qquad q(s^t) = f$$

- D, j: j-th period after reversal
- Assumptions: θ_A / θ_D and n_{-1} sufficiently large

First Best – Phase A: Operational losses and option value

Cost of holding a unit:

$$p_A - 1 > 0$$

Expected benefit:

$$\beta\delta f$$

Phase D: Recovery

Cost of holding a unit:

$$f - (1 - p_{D,j}) > 0$$

Expected benefit:

$$\beta f$$

First best (large a_0)

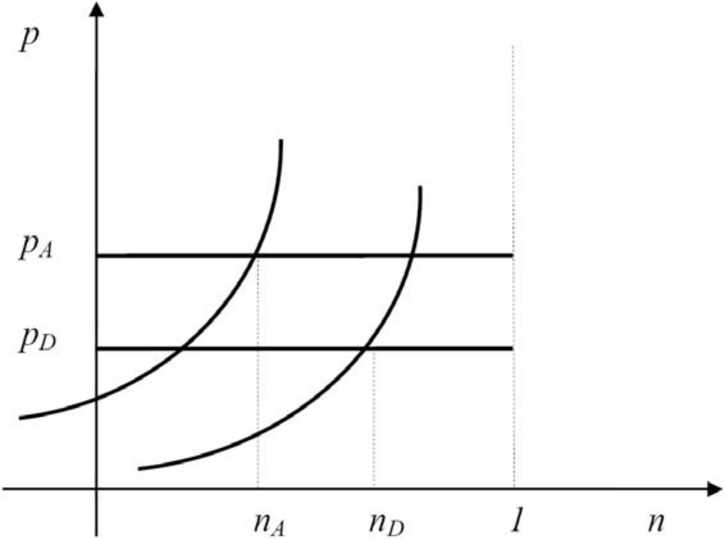
Price pinned down by intertemporal margin on the supply side

Indifference between financial assets and physical capital

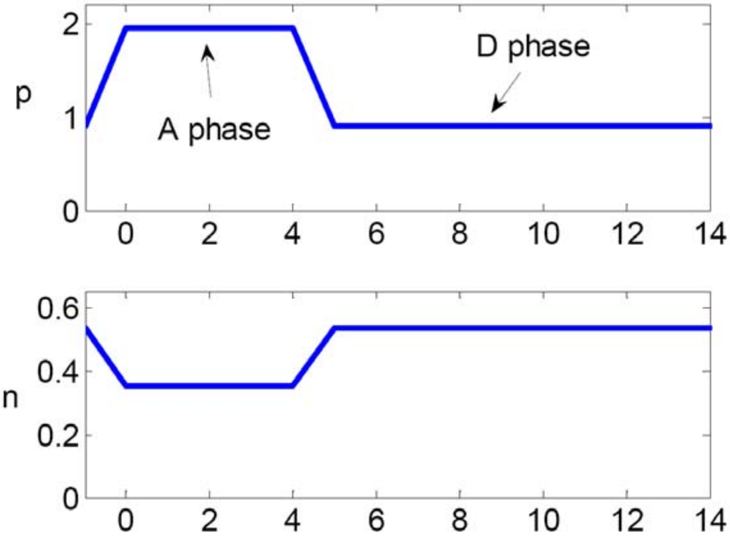
$$p_A^{fb} - 1 = \beta \delta f$$

$$f + p_D^{fb} - 1 = \beta f$$

First best



First best



First best (continued)

Cutoff $\overline{a}^{fb}$

If $a_0 \geq \overline{a}^{fb}$ financial constraint not binding

High wealth a_0 needed for two reasons:

- cover losses in A
- cover investment costs in first period of D

$$(p_A - 1)n_A + \delta\beta a_{D,0} = (1 - (1 - \delta)\beta)a_0$$

Constrained equilibrium: Low a_0

Prices no longer pinned down by intertemporal margin

Limited ability to exchange financial assets for physical capital

$$p_A - 1 \leq \beta \delta f$$

$$f + p_{D,j} - 1 \leq \beta f$$

Entrepreneur's problem: recursive setup

Equilibrium prices taken as given: $q(s^t)$ and $p(s^t)$

Individual state variables:

financial wealth	a
physical capital	n^-

Lemma

The value function $V\left(a, n^-; s^t\right)$ takes the linear form

$$V\left(a, n^-; s^t\right) = \psi(s^t) + \phi(s^t)\left(a + q(s^t)n^-\right)$$

Bellman equation

$$\phi\left(s^t\right)\left(a+q\left(s^t\right)n^-\right)=$$

$$=\max_{c^{T,e},n,a(.)} c^{T,e}+\beta\mathrm{E}\left[\phi(s^{t+1})\left(a(s_{t+1})+q(s^{t+1})n\right)\right]$$

$s.t.$

$$c^{T,e}+q(s^t)\cdot n+\beta\mathrm{E}\left[a(s_{t+1})\right]=(1-p(s^t))\cdot n+a+q(s^t)\cdot n^-$$

$$a(s_{t+1})\geq 0, n\geq 0, c^{T,e}\geq 0$$

Optimality conditions

For physical capital (production units):

$$\left(q(s^t)+p(s^t)-1\right)=\beta \mathrm{E}\left[\frac{\phi\left(s^{t+1}\right)}{\phi\left(s^t\right)}q\left(s^{t+1}\right)\right]$$

For securities:

$$\phi\left(s^t\right)\geq\phi\left(s^{t+1}\right) \qquad a\left(s_{t+1}|s^t\right)\geq 0$$

For consumption:

$$1\leq\phi\left(s^t\right) \qquad c^{T,e}\left(s^t\right)\geq 0$$

Low a_0

Limited funds a_0

$$(p_A - 1)n_A + \delta\beta a_{D,0} = (1 - (1 - \delta)\beta)a_0$$

- keep resources for A
- insure the recovery

Low a_0 can bite in A, in D, both...

Constrained appreciation

Units only pay back in state D

$$\begin{aligned} (p_A - 1)\,\phi_A &= \beta\delta f \phi_{D,0} \\ \phi_A &\geq \phi_{D,0} \end{aligned}$$

If constraint is binding then

$$p_A - 1 < \beta\delta f$$

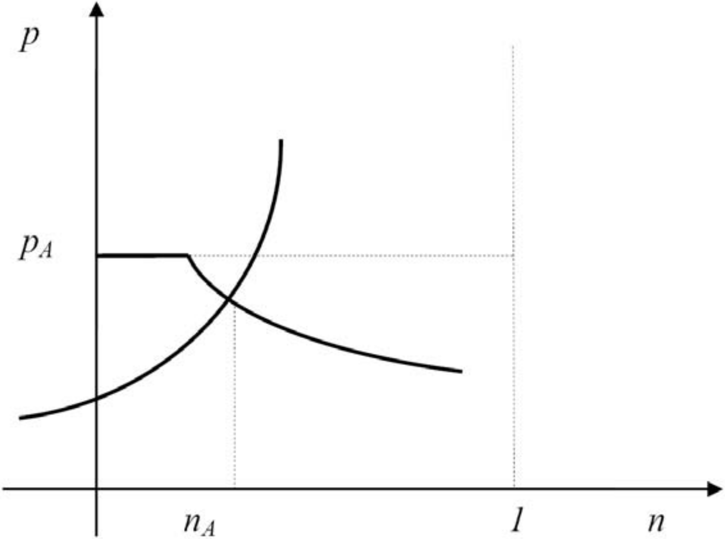
Constrained appreciation (continued)

Proposition

If $a_0 < \underline{a}^A$ *then price is depressed* $p_A < p_A^{fb}$*, destruction is bigger* $n_A < n_A^{fb}$

Smaller appreciation, symptom of financial distress

Constrained appreciation (continued)



Overshooting

Proposition

If $a_0 < \underline{a}^D$ *then overshooting:*

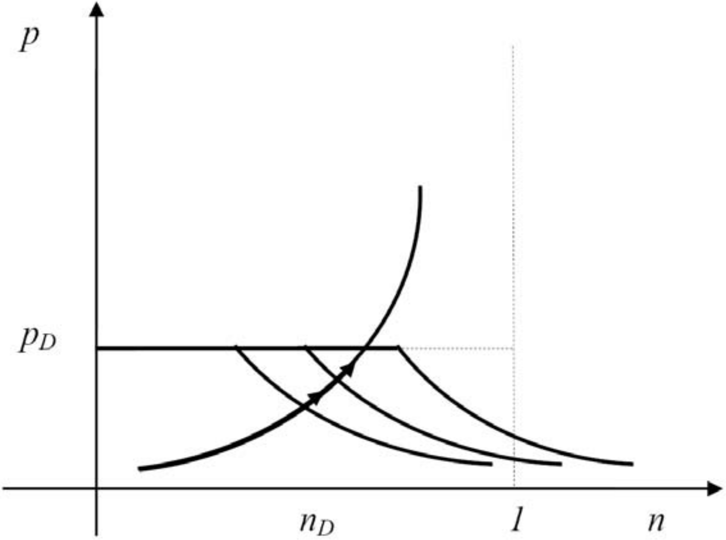
$$p_{D,0} < p_D^{fb}$$
$$p_{D,j} \rightarrow p_D^{fb}$$

- constrained recovery

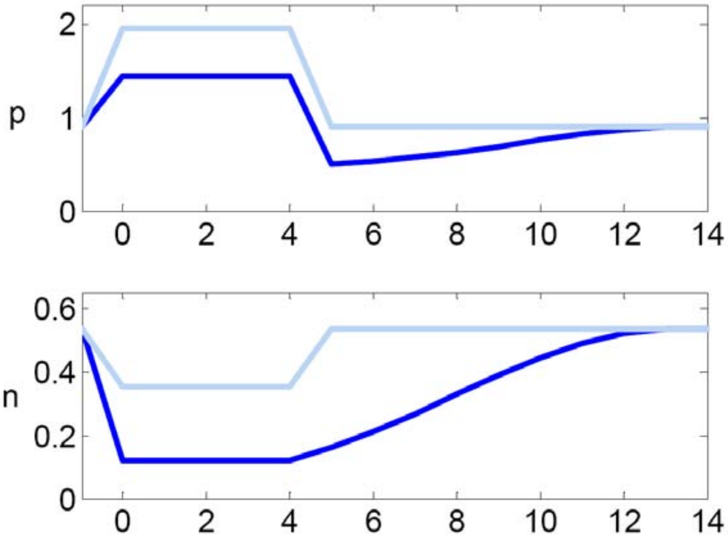
$$f + p_{D,0} - 1 \; < \; \beta f$$

$\longrightarrow$ low wages help recovery of financially constrained firms

Overshooting (continued)



Constrained equilibrium

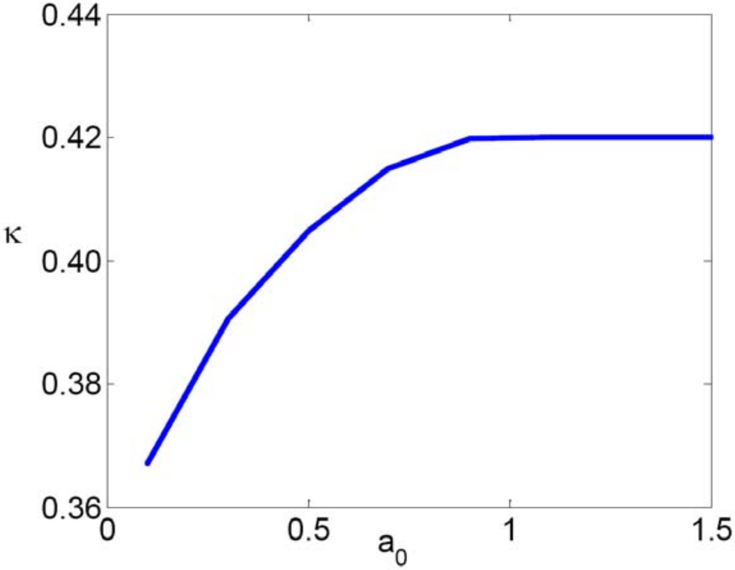


General equilibrium feedback

Back to consumers' demand

$$\kappa = \frac{\mathrm{E} \sum \beta^t p_t}{2\mathrm{E} \sum \beta^t \theta_t}$$

Now κ depends on initial wealth of entrepreneurs


0.44
0.42
0.40
0.38
0.36
κ
0
0.5
1
1.5
a_0

Exchange rate policy

Exchange rate appreciation in A leads to

$\longrightarrow$ more destruction in A

$\longrightarrow$ slower recovery in D

Policy: Relieve pressure on demand for NT, increase n_A, save units for the recovery

Q: Is this policy welfare improving?

Policy instruments

- no transfers between consumers and entrepreneurs
- taxes on consumption of T/NT, rebated lump-sum to consumers

interventions with effects in this direction:

- contractionary fiscal policy
- policies to encourage savings
- currency interventions/reserves management (?)

Planner problem

Planner chooses:

- state contingent path for $c^T(s^t), c^N(s^t)$

Takes as given:

- market clearing in labor market $n(s^t) = 1 - c^N(s^t)$
- entrepreneurs' optimality
- Map $n(.) \rightarrow p(.), a(.), c^{T,e}(.)$

- maximize consumers' utility for fixed entrepreneurs' utility

Perturbation

Increase n_A locally, around CE

Effects on consumers' welfare (leaving entrepreneurs indifferent)

Result If constrained appreciation and overshooting then:

$$dU_c > 0$$
$$dU_e = 0$$

Perturbation (continued)

Change n_A locally, around CE

$$\frac{dU_c}{dn_A} = -\theta_A u'(1-n_A) + p_A\lambda + \\ +\lambda\left(\frac{\partial p_A}{\partial n_A}n_A + \beta\delta\frac{\partial p_{D,0}}{\partial n_A}n_{D,0}\right)$$

- λ lagrange multiplier on consumers BC
- first row zero (private FOC)

Inefficient destruction

If constrained appreciation + overshooting ($p_A < p_A^{fb}$ and $p_{D,0} < p_D^{fb}$) then

$$\frac{\partial p_A}{\partial n_A} n_A + \delta\beta \frac{\partial p_{D,0}}{\partial n_A} n_{D,0} = 1 - p_A + \beta\delta f > 0$$

- total wage loss today = cost of saving an extra unit
- total wage gain tomorrow = savings in investment costs

Inefficient destruction (continued)

If $p_{D,0} < p_D^{fb}$ (overshooting) then:

$$\frac{dU_e}{dn_A} = \frac{\partial c_{D,0}^{T,e}}{\partial n_A} = 0$$

- all extra funds tomorrow go to investment

Constrained efficiency

If no overshooting optimal policy is no intervention

$$\frac{\partial p_A}{\partial n_A} n_A + \delta\beta \frac{\partial p_{D,0}}{\partial n_A} n_{D,0} = 1 - p_A < 0$$

- only wage losses today
- then reduce n_A?
- no, the entrepreneur PC binding now

Optimal policy

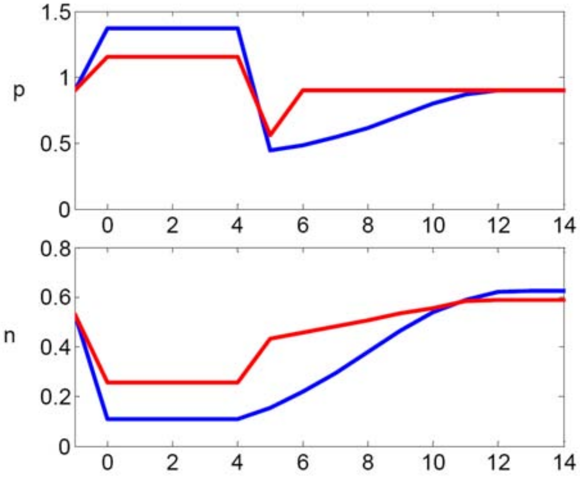
Optimal policy if no constrained appreciation? Intervention during *recovery* phase still good

In general optimal to combine intervention in A and D

Hindrances:

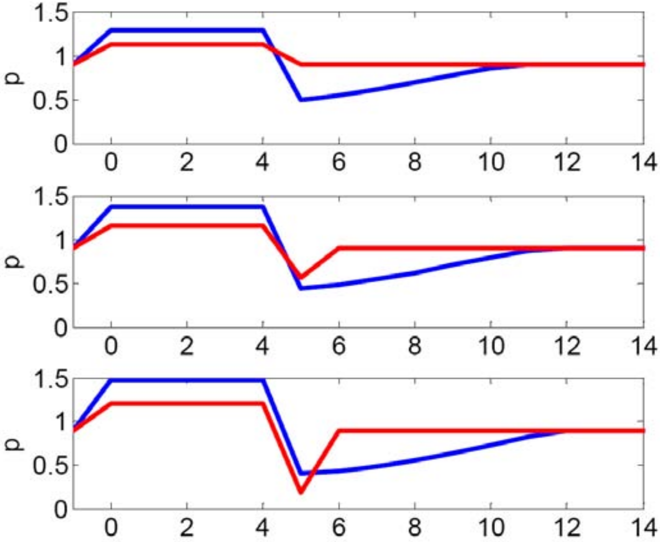
- real wage rigidities in recovery
- nominal wage rigidities + peg

Optimal policy (continued)



blue - CE, red - optimal policy

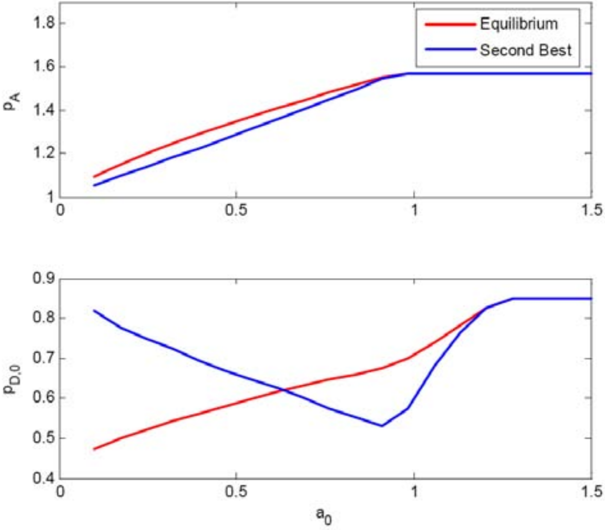
Ex ante vs ex post: Three cases



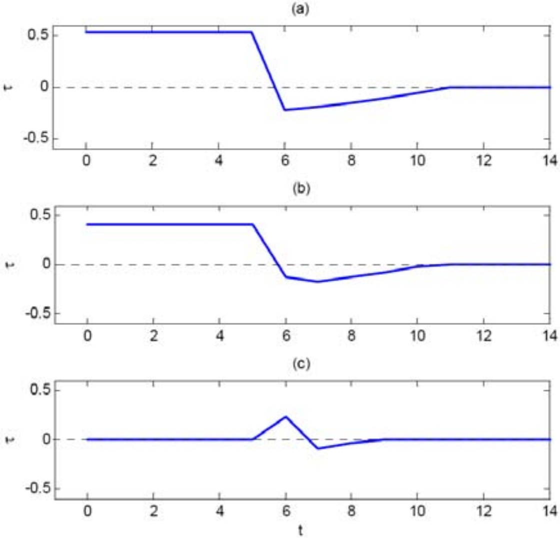
Three cases (continued)

- First case, low a_0
  - intervention in A is very effective
  - tax NT in A and subsidy in D
  - subsidy eventually vanishes
- Second case, middle a_0
  - intervention in A is effective but also leave some for D
  - all intervention in D frontloaded
- Third case, high a_0
  - intervention more effective in D
  - over-overshooting

a_0 and intervention (against CE)



Implementation: tax on nontradable



Persistence

How does δ affect the equilibrium, the incentive to intervene?

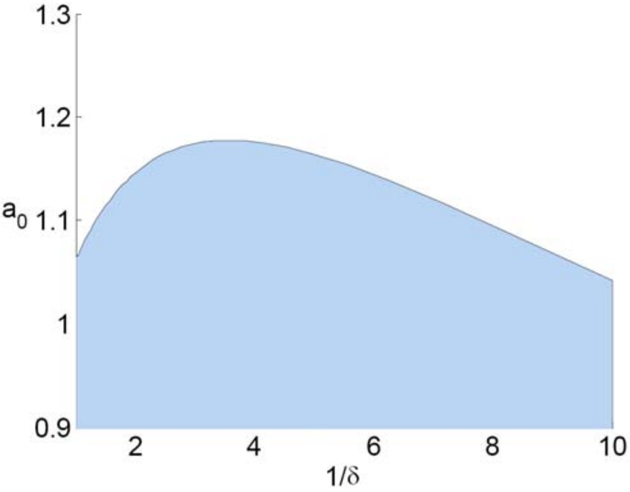
- High δ: switch is very likely

  small losses, easy to hedge

- Low δ: switch is very unlikely

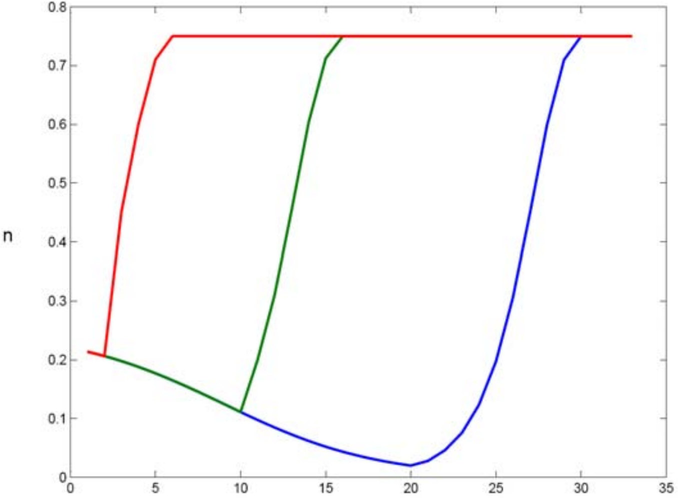
  optimal to destroy many units also in first best, easy to hedge

Persistence (continued)



shaded region - positive taxes

Incomplete markets



Conclusions

- Appreciation can generate excessive destruction
- For inefficiency, it is crucial that there is a constrained recovery
- Trade-off wage cut in A v. faster recovery in D
- Menu of intervention depends on initial conditions: more constrained entrepreneurs, more preventive policy