Asset Bubbles and Global Imbalances

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American Economic Journal - Macroeconomics

2019

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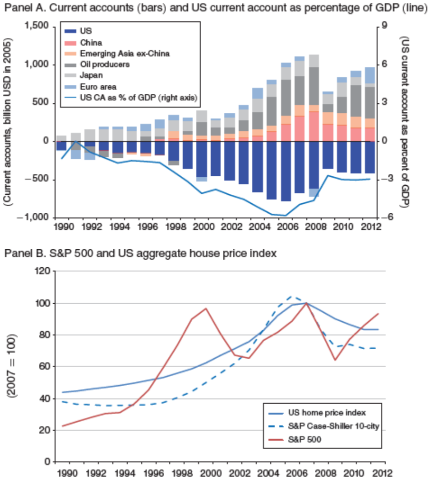
February 2020

Empirical Motivation



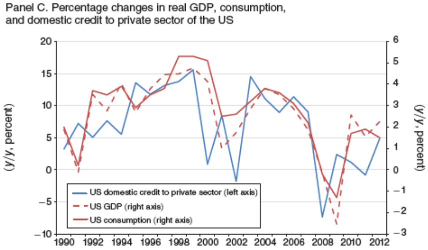


FIGURE 6. GLOBAL IMBALANCES, US ASSET PRICES, AND US ECONOMIC ACTIVITIES

Empirical regularities about bubble episodes: *Upstream capital flows and credit expansion during the boom phase, but sharp economic contractions and current account readjustment during the bust phase.*

Objective

In the context of an open economy overlapping generation model with rational bubbles (Samuelson, 1958; Diamond, 1965; Tirole, 1985) and:

- Heterogenous productivity,
- Credit Frictions,
- and asymmetric financial development.

Explain:

1. How financial integration between North and South increase upstream capital flows, reduce the interest rate and facilitate the emergence of bubbles in the north.
2. Bubbles in the North facilitate South-to-North capital flows creating a reinforcing relationship between global imbalances and bubbles.
3. How the boom-bust bubble episode explain the fluctuations in consumption, investment and output.

In other words: formalization of the saving-glut hypothesis.

Bubbleless South - The Model

Households: OLG with 2 generations (continuum of mass 1). Each young is born with a probabilistic production of capital skill $a \sim F(a)$ ($a \in \mathcal{A}$) and faces:

$$\underset{\{C_{t+1}(a), K_{t+1}(a), D_t(a)\}}{Max} C_{t+1}(a)$$

s.t.

$$K_{t+1}(a) = a\left[W_t + D_t(a)\right] \text{ where } I_t(a) = W_t + D_t(a)$$

$$C_{t+1}(a) = R^k_{t+1}(a) K_{t+1}(a) - R_{t+1} D_t(a)$$

$$D_t(a) \leq \lambda_t(a) W_t$$

$$K_{t+1}(a) \geq 0$$

Firms: $Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha}$ with $A_t = (1+g)^t$. Detrended variables will be $x_t = X_t / (1+g)^t$. $w_t = (1-\alpha) k_t^{\alpha}$ and $R_t^k = \alpha k_t^{\alpha - 1}$.

Equilibrium: $L_t = 1$ and $\int D_t(a) \, dF(a) = 0$.

Bubleless South - Solution

Endogenous segmentation of types into borrowers and lenders:

$$\frac{K_{t+1}(a)}{W_t}\begin{cases} = 0 \text{ if } a < \bar{a}_{nb,t} \\ [0, (1+\lambda_t(a))\, a] \text{ if } a = \bar{a}_{nb,t} \\ (1+\lambda_t(a))\, a \text{ if } a > \bar{a}_{nb,t} \end{cases} ; \frac{D_t(a)}{W_t} = \begin{cases} -1 \text{ if } a < \bar{a}_{nb,t} \\ [-1, \lambda_t(a)] \text{ if } a = \bar{a}_{nb,t} \\ \lambda_t(a) \text{ if } a > \bar{a}_{nb,t} \end{cases}$$

No arbitrage condition for marginal investor is given by
$R_{t+1} = \bar{a}_{nb,t} R^k_{t+1} = \bar{a}_{nb,t} \alpha k^{\alpha-1}_{t+1}$.
From here the aggregate capital stock and the excess saving over net worth ratio:

$$\frac{K_{t+1}}{W_t} = \frac{(1+g)k_{t+1}}{(1-\alpha)k_t^{\alpha}} = \int_{a>\bar{a}_{nb,t}} [1+\lambda_t(a)]\, a dF(a) = \mathcal{K}_t(\bar{a}_{nb,t})$$

$$\mathcal{SI}_t(\bar{a}_{nb,t}) = 1 - \mathcal{I}_t(\bar{a}_{nb,t}) = 1 - \int_{a>\bar{a}_{nb,t}} [1+\lambda(a)]\, dF(a) = 0$$

This last equation determines the solution for $\bar{a}_{nb,t}$.

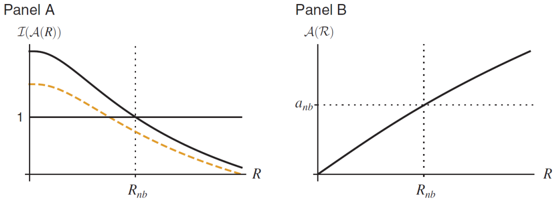
Bubleless South - Balanced Growth Path (BGP)

The BGP of this economy is given by:

$$k_{nb} = \left[\frac{1-\alpha}{1+g}\mathcal{K}\left(\bar{a}_{nb}\right)\right]^{\frac{1}{1-\alpha}}$$

$$\mathcal{SI}\left(\bar{a}_{nb}\right) = 1 - I\left(\bar{a}_{nb}\right) = 0$$

$$R_{nb} = \mathcal{R}\left(\bar{a}_{nb}\right) \equiv \frac{(1+g)\alpha}{1-\alpha}\frac{\bar{a}_{nb}}{\mathcal{K}\left(\bar{a}_{nb}\right)} \text{ or } \bar{a}_{nb} = \mathcal{A}_{nb}\left(R_{nb}\right) = \mathcal{R}^{-1}\left(R_{nb}\right)$$



Under certain assumptions about $F(a)$ $\bar{a}_{nb}$, R_{nb} and K_{nb} are increasing on $\lambda_t(a)$ and $F(A)$.

Bubbly North - The Model

Households: exogenous ability to create one unit of an asset that pays no divided (no fundamental value), has positive price, and burst to zero with an exogenous probability $p \in [0,1]$. Bubble equilibria with relative size of new bubble given by $B_t^N = nB_t$ with $n \in [0,1)$, and bubble-over-net-worth ratio $\beta_t = \frac{B_t}{W_t + nB_t}$:

$$\underset{\{K_{t+1}(a), D_t(a), B_t(a)\}}{Max} R_{t+1}^k(a) K_{t+1}(a) + (1-p) \frac{B_{t+1}^O}{B_t} B_t(a) - R_{t+1} D_t(a)$$

s.t.

$$K_{t+1}(a) = aI_t(a)$$

$$I_t(a) + B_t(a) = W_t + nB_t + D_t(a)$$

$$D_t(a) \leq \lambda_t(a)(W_t + nB_t)$$

$$K_{t+1}(a) \geq 0; \; B_t(a) \geq 0$$

Firms: Same environment

Equilibrium: we add $\int B_t(a)\, dF(a) = B_t$

Bubbly North - Solution

Again:

$$\frac{K_{t+1}(a)}{W_t + nB_t} \begin{cases} = 0 \text{ if } a < \bar{a}_{b,t} \\ [0, (1+\lambda_t(a))\, a] \text{ if } a = \bar{a}_{b,t} \\ (1+\lambda_t(a))\, a \text{ if } a > \bar{a}_{b,t} \end{cases} ; \frac{D_t(a)}{W_t + nB_t} = \begin{cases} -1 \text{ if } a < \bar{a}_{b,t} \\ [-1, \lambda_t(a)] \text{ if } a = \bar{a}_{b,t} \\ \lambda_t(a) \text{ if } a > \bar{a}_{b,t} \end{cases}$$

No arbitrage condition for marginal investor is given by

$$R_{t+1} = \bar{a}_{b,t} R^k_{t+1} = (1-p)(1-n)(1+g)\frac{b_{t+1}}{b_t}$$

From here the aggregate capital stock and the excess saving over net worth ratio:

$$\frac{K_{t+1}}{W_t + nB_t} = \frac{(1-n\beta_t)(1+g))k_{t+1}}{(1-\alpha)k_t^\alpha} = \int_{a>\bar{a}_{b,t}} [1+\lambda_t(a)]\, a dF(a) = \mathcal{K}_t(\bar{a}_{b,t})$$

$$\mathcal{SI}_t(\bar{a}_{b,t}) = 1 - \mathcal{I}_t(\bar{a}_{b,t}) = 1 - \int_{a>\bar{a}_{b,t}} [1+\lambda(a)]\, dF(a) = \beta_t$$

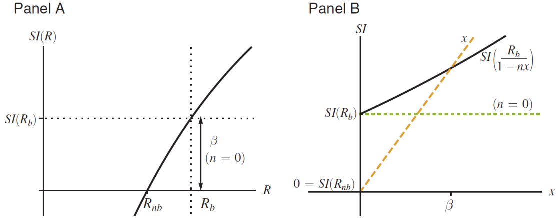
This last equation determines $\bar{a}_{b,t}$. Interestingly $\bar{a}_{b,t} > \bar{a}_{nb,t}$.

Bubbly North - BGP

$$k_b = \left[\frac{1-\alpha}{1+g}\frac{\mathcal{K}\left(\bar{a}_b\right)}{1-n\beta}\right]^{\frac{1}{1-\alpha}}$$

$$\mathcal{SI}\left(\bar{a}_b\right) = 1 - \mathcal{I}\left(\bar{a}_b\right) = \beta$$

$$R_b = (1-p)(1-n)(1+g) \text{ or } \bar{a}_b = \mathcal{A}_b\left(\frac{R_b}{1-n\beta}\right)$$



Bubbles exists if and only if $R_{nb} < R_b = (1-p)(1-n)(1+g)$

Open Economy - Bubbleless

New equilibrium conditions:

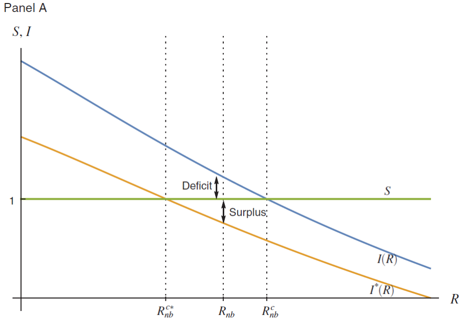
$$R_{t+1} = R^*_{t+1} \text{ and } \int D_t(a)\, dF(a) + \int D^*_t(a)\, dF(a) = 0$$

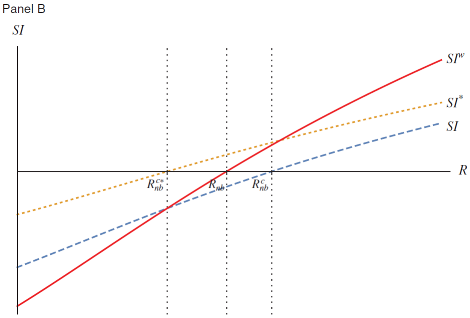
In the BGP the equilibrium equation for R_{nb} is given by:

$$\mathcal{SI}^w(R_{nb}) = \underbrace{(1 - \mathcal{I}(\mathcal{A}(R_{nb})))}_{\mathcal{SI}(R_{nb})} + \underbrace{\left(\frac{\mathcal{A}^*(R_{nb})}{\mathcal{A}(R_{nb})}\right)^{\frac{\alpha}{1-\alpha}}}_{\mu^*(R_{nb})} \underbrace{(1 - \mathcal{I}^*(\mathcal{A}^*(R_{nb})))}_{\mathcal{SI}^*(R_{nb})} = 0$$

Open Economy - Bubbleless - Metzler Diagram

With $F(a) < F^*(a)\ \forall a \in \mathcal{A}$ and $\lambda > \lambda^*$





$$R^{c*}_{nb} < R_{nb} < R^{c}_{nb}$$

$$tb_t = \frac{TB_t}{W_t} = \mathcal{SI}\left(R_{nb}\right) < \mathcal{SI}\left(R^c_{nb}\right) = 0 = \mathcal{SI}^*\left(R^c_{nb}\right) < \mathcal{SI}^*\left(R_{nb}\right) = \frac{TB^*_t}{W^*_t} = tb^*_t$$

Open Economy - Bubbly North and Bubbleless South

New equilibrium conditions:

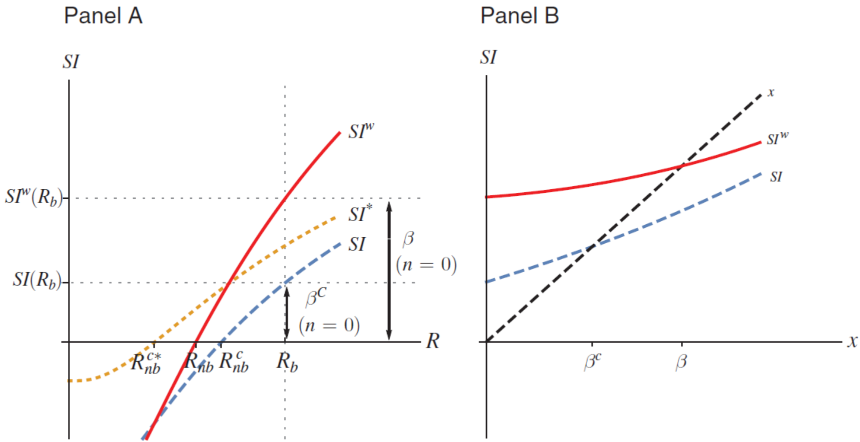
$$R_{t+1} = \bar{a}_{b,t} R^k_{t+1} = \bar{a}^*_{b,t} R^{k*}_{t+1}$$

In the BGP the equilibrium equation for R_{nb} is given by:

$$\mathcal{SI}^w\left(R_b\right) = \underbrace{\left(1 - \mathcal{I}\left(\mathcal{A}\left(\frac{R_b}{1-n\beta}\right)\right)\right)}_{\mathcal{SI}\left(\frac{R_b}{1-n\beta}\right)} + \underbrace{\left(\frac{\mathcal{A}^*\left(R_b\right)}{\mathcal{A}\left(\frac{R_b}{1-n\beta}\right)}\right)^{\frac{\alpha}{1-\alpha}}\left(1-n\beta\right)}_{\mu^*\left(R_b\right)} \underbrace{\left(1 - \mathcal{I}\left(\mathcal{A}\left(R_b\right)\right)\right)}_{\mathcal{SI}^*\left(R_b\right)} = \beta$$

Open Economy - Feedback Mechanism

$F = F^* \sim U$ and $\lambda > \lambda^*$



Feedback mechanism between bubbles and trade deficit.

Bubbles and Business Cycle