Discussion of

"Managing Credit Booms and Busts: A Pigouvian Taxation Approach," by Jeanne and Korinek

Timothy S. Fuerst

Senior Economic Advisor, FRB Cleveland

October 15, 2010

<u>Background:</u>

1. Debt/savings helps transform bumpy income into smoother consumption.

2. Debt constraint linked to value of assets. **Financial accelerator** comes from this interaction.

These two ideas are non-controversial.

Current Paper:

My debt holdings impose an **external effect** on others.

"A borrower who has one more dollar of liquid net worth when the economy experiences a bust not only relaxes his private borrowing constraint, but also relaxes the borrowing constraints of all other insiders."

This is not so obvious. I am skeptical.

Financial Accelerator.

Decline in asset price tightens credit constraint.

Tighter credit constraint lowers consumption.

Lower consumption lowers asset price.

Etc.

But, the tighter credit constraint should also have a positive effect on asset prices because assets help relax the credit constraint. This positive effect should moderate the decline in asset prices coming from the decline in consumption. This effect is missing from their analysis.

Why is CE not Pareto Efficient in model?

1. Missing market? Nope. This is RA setting.

2. Value of endowment is unbounded? Nope.

3. Large agents? Nope.

4. Explicit "pollution" effect. Nope.

I suspected the laissez-faire problem is off the mark.

Laissez Faire

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t)$$

$$(1-\alpha)y_t + a_t(p_t + \alpha y_t) + w_t \geq c_t + a_{t+1}p_t + \frac{w_{t+1}}{R}$$

$$\frac{w_{t+1}}{R} + \psi + \phi p_t a_t \geq 0$$

FONC:

$$U'(c_t) = \lambda_t + \beta R U'(c_{t+1})$$

$$U'(c_t)p_t = \beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1}) + \lambda_{t+1}\phi p_{t+1}$$

But in the paper, equilibrium behavior ($a_t = 1$) is imposed in the credit constraint <u>BEFORE FONC</u>.

$$\frac{w_{t+1}}{R} + \psi + \phi p_t \geq 0$$

<u>FONC:</u>

$$U'(c_t) = \lambda_t + \beta R U'(c_{t+1})$$

$$U'(c_t) p_t = \beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1})$$

Demand for asset should depend upon forecast of future collateral constraint….missing in their analysis.

<u>Correct price:</u>

$$p_t = \frac{\beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1}) + [U'(c_{t+1}) - \beta R U'(c_{t+2})]\phi p_{t+1}}{U'(c_t)}$$

<u>Paper's price (Lucas tree):</u>

$$p_t = \frac{\beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1})}{U'(c_t)}$$

I conjectured that the optimality of the Pigouvian tax comes from the laissez-faire problem being mis-specified.

I was wrong. But sort of right.

It depends on your definition of “wrong”.

<u>To do list:</u>

1. Examine Ramsey Problem.
2. Examine Constrained Ramsey Problem.
3. As part of #2, illustrate a simpler model of same idea.

Laissez Faire with tax on debt and subsidy on assets.

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t)$$

$$(1-\alpha)y_t + a_t(p_t + \alpha y_t + s_t) + w_t$$
$$\geq c_t + a_{t+1}p_t + \frac{w_{t+1}}{R}(1-\tau_t) + TR_t$$

$$\frac{w_{t+1}}{R} + \psi + \phi p_t a_t \geq 0$$

FONC:

$$U'(c_t)(1-\tau_t) = \lambda_t + \beta R U'(c_{t+1})$$

$$U'(c_t)p_t = \beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1} + s_{t+1}) + \lambda_{t+1} D \phi p_{t+1}$$

$$y_t + w_t = c_t + \frac{w_{t+1}}{R}$$

$$\frac{w_{t+1}}{R} + \psi + \phi p_t \geq 0$$

Ramsey Planner

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t)$$

$$\frac{w_{t+1}}{R} + \psi + \phi p_t \geq 0$$

$$y_t + w_t - c_t - \frac{w_{t+1}}{R} = 0$$

$$U'(c_t)p_t - \beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1} + s_{t+1}) - \lambda_{t+1} D\phi p_{t+1} = 0$$

$$U'(c_t)(1 - \tau_t) - \lambda_t - \beta R U'(c_{t+1}) = 0$$

(D=0 or 1 depending on asset pricing.)

$(\lambda_{1t}, \lambda_{2t}, \lambda_{3t}, \lambda_{4t}\ are\ multipliers.)$

<u>FONC:</u> (tax, subsidy, asset price, debt, multiplier, consumption.)

$$U'(c_t)\lambda_{4t} = 0$$

$$-\beta U'(c_{t+1})\lambda_{3t} = 0$$

$$[\beta U'(c_{t+1}) + \lambda_{t+1} D\phi]\lambda_{3t} = \beta\lambda_{3t+1} U'(c_{t+1}) + \beta\phi\lambda_{1t+1}$$

$$\lambda_{1t} + \beta R\lambda_{2t+1} = \lambda_{2t}$$

$$(\phi p_{t+1}\lambda_{3t} - \beta\lambda_{4t+1})\lambda_{t+1} = 0 \quad \textbf{(K-T)}$$

$$\begin{aligned}\beta U_c(t+1) - \beta\lambda_{2t+1} - \lambda_{3t}\beta U''(c_{t+1})(p_{t+1} + \alpha y_{t+1} + s_{t+1}) \\ - \beta\lambda_{4t} R U''(c_{t+1})(1 - \tau_{t+1}) + \beta\lambda_{3t+1} U''(c_{t+1}) p_{t+1} \\ + \beta\lambda_{4t+1} U''(c_{t+1})(1 - \tau_{t+1}) = 0\end{aligned}$$

And household FOC.

Simplifying the foc (assuming subsidies not possible).

$$\lambda_{4t} = 0 \tag{1}$$

$$U'(c_{t+1})\lambda_{3t} = \lambda_{3t+1}U'(c_{t+1}) + \phi\lambda_{1t+1} \tag{2}$$

$$\lambda_{1t} + \beta R\lambda_{2t+1} = \lambda_{2t} \tag{3}$$

$$\phi p_{t+1}\lambda_{3t}\lambda_{t+1} = 0 \tag{4}$$

$$\beta U_c(t+1) - \beta\lambda_{2t+1} - \lambda_{3t}\beta U''(c_{t+1})(p_{t+1} + \alpha y_{t+1}) + \beta\lambda_{3t+1}U''(c_{t+1})p_{t+1} = 0 \tag{5}$$

$$\frac{w_{t+1}}{R} + \psi + \phi p_t \geq 0 \tag{6}$$

$$y_t + w_t = c_t + \frac{w_{t+1}}{R} \tag{7}$$

$$U'(c_t)p_t - \beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1}) + \lambda_{t+1}D\phi p_{t+1} = 0 \tag{8}$$

$$U'(c_t)(1-\tau_t) - \lambda_t - \beta R U'(c_{t+1}) = 0 \tag{9}$$

<u>These are satisfied for</u>

τ_t = 0,

$$\lambda_{1t} = \lambda_t$$

$$\lambda_{2t} = U'(c_t)$$

$$\lambda_{3t} = \frac{\phi[\beta R U'(c_{t+2}) - U'(c_{t+1})]}{U'(c_{t+1})\alpha y_{t+1}} p_{t+1}$$

$$\lambda_{4t} = 0$$

<u>No tax on debt is Ramsey solution!</u>

<u>But you get same answer with “wrong” asset pricing. O my.</u>

<u>If we add subsidies:</u>

τ_t = 0,

$$\lambda_{1t} = \lambda_t = 0$$

$$\lambda_{2t} = U'(c_t)$$

$$\lambda_{3t} = 0$$

$$\lambda_{4t} = 0$$

Choose path of subsidy so that asset price always high enough to avoid constraint.

$$\frac{w_{t+1}}{R} + \psi + \phi p_t \geq 0$$

$$y_t + w_t - c_t - \frac{w_{t+1}}{R} = 0$$

$$U'(c_t)p_t - \beta U'(c_{t+1})(p_{t+1} + \alpha y_{t+1} + s_{t+1}) = 0$$

<u>What about *restricted* Ramsey?</u>

A Ramsey problem typically adds state variables to the maximization problem.

Recall Woodford's "timeless perspective".

Simpler Model and Restricted Ramsey.

Add convex transactions cost to mimic credit constraint.

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t)$$

$$(1-\alpha)y_t + a_t(p_t + \alpha y_t + s_t) + \frac{d_{t+1}(1-\tau_t)}{R} - F(x_t)$$
$$\geq c_t + a_{t+1}p_t + d_t$$

$$x_t \equiv \frac{d_{t+1}}{R} - \psi - \phi p_t a_t$$

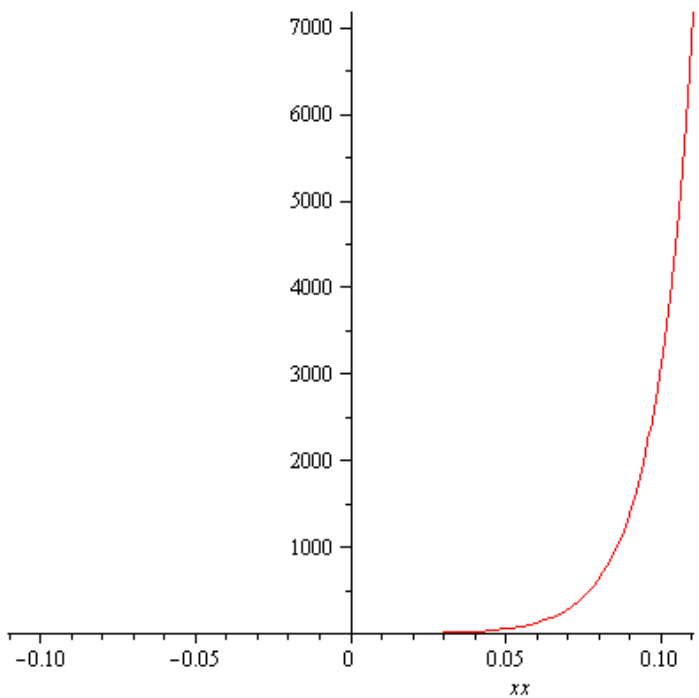
(I substituted $d_{t+1} = -w_{t+1}$).

Example:

$F(x_t) \equiv \exp(\theta x_t) - \exp(\theta x_{ss})$.

Choose θ to hit the calibrated x_{ss}.

Example: xss = -.11, θ = 80.4.



FOC of transactions cost model:

$$U'(c_t)(1-\tau_t) = U'(c_t)F'(x_t) + \beta R U'(c_{t+1})$$

$$p_t U'(c_t) = [p_{t+1} + \alpha y_{t+1} + s_{t+1} + \phi D F'(x_{t+1})]U'(c_{t+1})$$

Ramsey: optimal tax = 0, use subsidy to eliminate constraint. (same proof as before).

Restricted Ramsey:

$p_t = f(d_t; s_{t+1})$, with $f_d < 0$

Unrestricted Ramsey uses the household Euler equation and implicitly allows the price to depend on more state variables:

$$p_t = g(d_t, \lambda_{1t-1}, \lambda_{2t-1}, etc.)$$

More intuitively, asset prices a function of current debt and lagged values of debt.

Restricted Ramsey and Asset-Pricing

$p_t = f(d_t; s_{t+1})$, with $f_d < 0$

The f-function will differ depending on how assets are priced.

With "correct" pricing, slope is smaller in absolute value.

Can slope ever be positive? I don't think so, but should check.

Restricted Ramsey.

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t)$$

$$y_t + \frac{d_{t+1}}{R} - F(x_t) \geq c_t + d_t$$

$$x_t \equiv \frac{d_{t+1}}{R} - \psi - \phi f(d_t; s_{t+1})$$

Restricted Ramsey FOC:

$$U'(c_t) = U^{'}(c_t)F^{'}(x_t) + \beta R U'(c_{t+1})[1 - F'(x_{t+1})\,\phi f'(d_{t+1})] \quad (1)$$

$$U'(c_t)F'(x_t)\,\phi f_s = 0 \quad (2)$$

LF:

$$U'(c_t)(1 - \tau_t) = U'(c_t)F'(x_t) + \beta R U'(c_{t+1}) \quad (3)$$

Restricted Ramsey gives you a tax (compare 1 and 3).

But subsidy chosen to eliminate cost $F'(x_t) = 0$.

Conclusions:

1. The paper seems to price the asset incorrectly.
2. According to Ramsey, optimal debt tax = 0.
3. Asset subsidy is Ramsey-optimal.
4. This result independent of asset being priced correctly.
5. We get the paper's result only with restricted Ramsey and no subsidies.
6. Restricted Ramsey plus correct asset price gives even smaller tax than in paper.