No. 855

"Dislike-for-Inflation Psychology" and Endogenous Price Fluctuations Reconsidered

by

Toshiaki Koide

March 2000

"Dislike-for-Inflation Psychology" and Endogenous Price Fluctuations Reconsidered

Toshiaki Koide*

Doctoral Program in Policy and Planning Sciences
University of Tsukuba
Tsukuba, Ibaraki 305-8573, Japan

First version: March, 2000

Abstract. This note considers two variations of Koide's (1999) monetary overlapping generations model in which agents have a kind of "dislike-for-inflation psychology." First, nominal money supply growth is introduced. It is shown that the "dislike-for-inflation psychology" may change a classical economy into a Samuelson economy, and the other way around. Second, an economy in which the agents dislike not only inflation but also deflation is analyzed. It is shown that the agents' resistance to price fluctuations strikingly affects the dynamics of the economy and causes indeterminacy of equilibrium.

Keywords: Dislike-for-inflation psychology; Endogenous price fluctuations; Indeterminacy of equilibrium

JEL classification: E31

*E-mail. tkoide@shako.sk.tsukuba.ac.jp

steady state level of real money balance depends not only on the rate of nominal money supply growth but also on the intensity of the agents' "dislike-for-inflation psychology." Therefore Koide's (1999) proposition 1, which claims that the steady state level of real balance is independent of intensity of "dislike-for-inflation psychology," does not hold under nominal money supply growth.

Next, the stability of the steady states is considered. One can show that the slope of $\phi(m_t;\alpha,\mu)$ evaluated at $m_t = 0$ and $m_t = m^*$ are

$$\phi'(0;\alpha,\mu) = \left(\frac{\beta\mu^{\alpha-1}w_1}{w_2}\right)^{1/(\alpha-1)} \begin{cases} < 1 & (\text{if } \alpha < 1) \\ > 1 & (\text{if } \alpha > 1), \end{cases}$$

$$\phi'(m^*;\alpha,\mu) = \frac{1}{1-\alpha}\left(\frac{\beta\mu^{\alpha-1}w_1}{w_2} - \alpha\right) \begin{cases} > 1 & (\text{if } \alpha < 1) \\ < 1 & (\text{if } \alpha > 1), \end{cases}$$

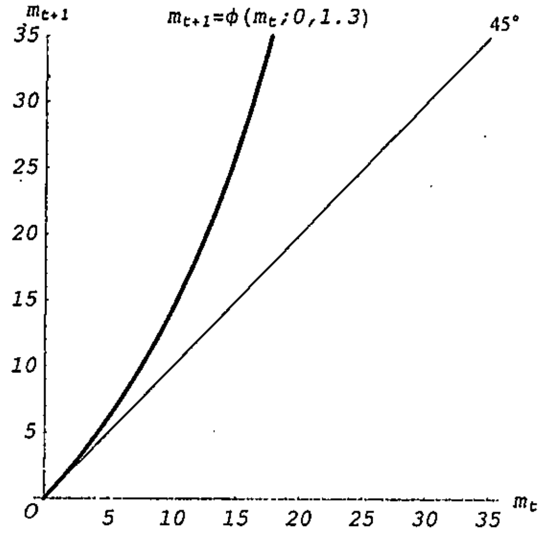
respectively. That is, proposition 2 of Koide (1999) continues to hold even though the nominal money supply grows at a constant rate. *As far as the economy is of Samuelson type,* stability of the steady states is the same as that of a standard overlapping generations model with money under weak "dislike-for-inflation psychology," while it is completely overturned when the agents' intensity of "dislike-for-inflation psychology" is strong.

Then how does "dislike-for-inflation psychology" and nominal money supply growth affect the condition to assure that the economy is of Samuelson type? Such a condition for the economy analyzed in this section is the condition (2), while that for an overlapping generations model without "dislike-for-inflation psychology" and money supply growth is $\beta w_1/w_2 > 1$. Suppose that the money supply grows at a positive rate (i.e., $\mu > 1$) since the condition is the same as that of a standard overlapping generations model under a constant money supply ($\mu = 1$). When α is in the open interval $(0, 1)$, it may fail to satisfy condition (2) even if $\beta w_1/w_2 > 1$. On the other hand, the possibility that condition (2) is met gets larger under situations in which α is greater than one. That is, the agents' "dislike-for-inflation psychology" under nominal money balance growth may affect the essential property of the economy: it may change a classical economy into a Samuelson economy if the agents' "dislike-for-inflation psychology" is comparatively strong, and vice versa if it is weak.[6] Figure 1 shows an example that a classical economy is turned into a Samuelson type due to "dislike-for-inflation psychology" with nominal money supply growth.

3 Dynamics of a case in which the agents dislike not only inflation but also deflation

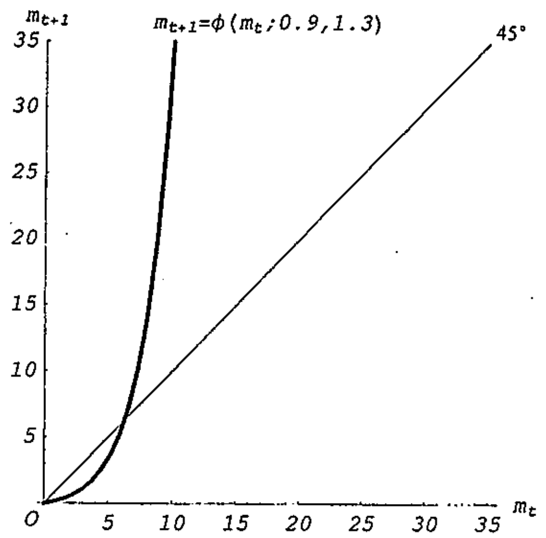
In this section, we consider an economy in which individuals dislike not only inflation but also deflation. To avoid difficulty of mathematical handling, we restrict our analysis to the case without nominal money supply growth; i.e.,

[6] Lahiri and Puhakka (1998) show the possibility that habit persistence preferences for savings converts a classical economy into a Samuelson economy.



(a) The case of no "dislike-for-inflation psychology" ($\alpha = 0$).

No monetary equilibrium.



(b) The case with "dislike-for-inflation psychology" ($\alpha = 1.3$).

There is a monetary equilibrium.

Figure 1: Dynamics of real money balance under positive rate of money supply growth ($\mu = 1.3$)

$\mu = 1$, $H_t = 0$ and $M_t = M_0 \equiv M$ for all $t \geq 1$. Suppose that the effective endowment for the old agents in period t is given as

$$\hat{w}_{2t} \equiv \left\{ \frac{1}{1 + \left(\frac{p_t - p_{t-1}}{p_{t-1}}\right)^2} \right\}^{\alpha} w_2 = \frac{w_2}{\left\{1 + \left(\frac{p_t - p_{t-1}}{p_{t-1}}\right)^2\right\}^{\alpha}}.$$

That is, both a $k\%$ inflation and a $k\%$ deflation will make the second period effective endowment depreciate equivalently. The lifetime utility function for generation t is again given as in equation (1). The saving of the young agents in period t is

$$s_t \equiv \arg\max_{s} \log(w_1 - s) + \beta \log \left[\frac{w_2}{\left\{1 + \left(\frac{p_{t+1} - p_t}{p_t}\right)^2\right\}^{\alpha}} + \frac{p_t}{p_{t+1}} s \right],$$

and the first-order condition will be given as

$$\beta \frac{p_t}{p_{t+1}} (w_1 - s_t) = \frac{w_2}{\left\{1 + \left(\frac{p_{t+1} - p_t}{p_t}\right)^2\right\}^{\alpha}} + \frac{p_t}{p_{t+1}} s_t. \tag{6}$$

The real money balance at period t is redefined as $m_t \equiv M/p_t$ and the clearing condition for the money market is $m_t = s_t$ for all $t \geq 1$ as before. Substituting these into (6), we obtain the law of motion for m_t as follows.

$$\beta \frac{m_{t+1}}{m_t} (w_1 - m_t) = \frac{w_2}{\left\{1 + \left(\frac{m_t}{m_{t+1}} - 1\right)^2\right\}^{\alpha}} + m_{t+1} \tag{7}$$

In the following, we simplify our analysis by assuming that $\alpha = 1$. The condition which ensures that this economy is of Samuelson type turns out to be

$$\frac{\beta w_1}{w_2} > 1, \tag{8}$$

Ultimately the price level in the monetary steady state is identical with that of Koide (1999). It should be noted that, different from Koide's (1999) result, the autarkic point is not a steady state in the economy considered in this section. It is easily confirmed by computing $\psi(0)$, which is

$$\psi(0) = \frac{\beta}{1+\beta} w_1 \neq 0.$$

Finally, we consider the dynamic stability of the monetary steady state of this economy. Taking total differentials of both sides of (7), deriving dm_t/dm_{t+1} and evaluating it at $m_t = m_{t+1} = m^*$ yield

$$\left.\frac{dm_t}{dm_{t+1}}\right|_{m_t=m_{t+1}=m^*} = \frac{w_2}{\beta w_1},$$

which is greater than zero since $w_2 > 0$ and is less than one from condition (8). This result implies that the steady state is asymptotically stable in backward dynamics. That is, the indeterminacy of equilibrium arises.[9] An example of the phase diagram is depicted in figure 2.[10] In this case, any sequence of $\{m_t\}$ starting from the neighborhood of the steady state can be dynamic equilibria. It is well known that, in the standard monetary overlapping generations model without agents' dislike for price volatility, the dynamics of the real money balance is expressed in a forward difference equation under logarithmic utility function (1) and the dynamic monetary equilibrium is determinate.[11]

[9] See Azariadis (1993, Section 28.5), Benhabib and Rustichini (1994) and Fukuda (1995, Chapter 5) for the problems of indeterminate equilibria.

[10] This phase diagram is depicted under the following parameter settings: $w_1 = 100$, $w_2 = 30$, $\alpha = 1$ and $\beta = 0.8$.

[11] See, for instance, Blanchard and Fischer (1989, Chapters 4 and 5) and Azariadis (1993,

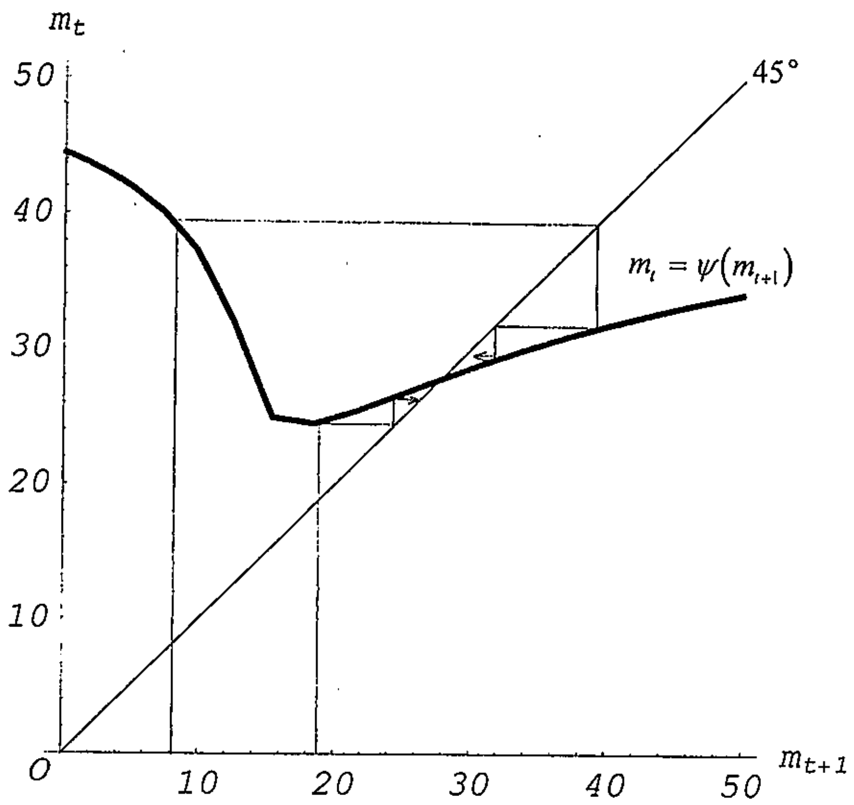


Figure 2: Indeterminacy of equilibrium

Our result here implies that the agents' dislike for price volatility makes it impossible to define the motion of this economy in forward dynamics and breaks the determinacy of equilibrium.

4 Conclusion

This note considered two variations of Koide's (1999) monetary overlapping generations model in which agents have a kind of "dislike-for-inflation psychology." In section 2, we analyzed how the "dislike-for-inflation psychology"

Chapters 19 and 24) for details.

and nonmonetary steady states.

3. It is possible that the monetary steady state becomes asymptotically stable. This implies that the dynamic equilibrium may become indeterminate due to the agents' psychology that they dislike price volatility.

Appendix: Derivation of equation (9)

MATHEMATICA is one of famous technical computing software. Here we used this software to solve equation (7) for m_t. The solution is obtained by the following short program.

```
1 f[mt1_, mt_] := β mt1 / mt (w1 - mt)
2        - w2 / (1 + (mt / mt1 - 1)^2) - mt1;
3 Solve[f[mt1, mt] == 0, mt]
```

A brief explanation of this program should be provided. Moving the right-hand side of (7) to the left yields an equation which takes a form of $f(m_{t+1}, m_t) = 0$. Lines 1-2 define this $f(m_{t+1}, m_t)$. Here `mt1` stands for m_{t+1}, `mt` for m_t, `w1` for w_1 and `w2` for w_2. Line 3 is a command to solve $f(m_{t+1}, m_t) = 0$ for m_t.

This program provides three solutions: one real solution and two conjugate complex ones. We accept the real one as the solution of (7) since complex ones are not meaningful in our economic model. Equation (9) is an arranged one clearer than the solution outputed by the above program.

References

[1] Azariadis, C. (1993), *Intertemporal Macroeconomics*, Cambridge: Blackwell.

[2] Benhabib, J. and A. Rustichini (1994), "Introduction to the Symposium on Growth, Fluctuations, and Sunspots: Confronting the Data," *Journal of Economic Theory* 63, 1-18.

[3] Blanchard, O. J. and S. Fischer (1989), *Lectures on Macroeconomics*, Cambridge: The MIT Press.

[4] Fukuda, S.-i. (1993), "The Emergence of Equilibrium cycles in a Monetary Economy with a Separable Utility Function," *Journal of Monetary Economics* 32, 321-334.

[5] Fukuda, S.-i. (1995), *Kakaku-hendou no Makuro-keizaigaku (Macroeconomics of Price Volatility)*, Tokyo-daigaku Shuppan-kai (University of Tokyo Press) (in Japanese).

[6] Grandmont, J.-M. (1985), "On Endogenous Competitive Business Cycles," *Econometrica* 53, 995-1045.

[7] Koide, T. (1999), "Dislike for Inflation Creates Endogenous Price Fluctuations: An Analysis under a Logarithmic Utility Function," Discussion Paper Series No. 821, Institute of Policy and Planning Sciences, University of Tsukuba.

[8] Lahiri, A. and M. Puhakka (1998), "Habit Persistence in Overlapping Generations Economies under Pure Exchange," *Journal of Economic Theory* 78, 176-186.

[9] Shafir, E., P. Diamond and A. Tversky (1997), "Money Illusion," *Quarterly Journal of Economics* 112, 341-374.