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DIFFERENCE OR RATIO: IMPLICATION OF STATUS PREFERENCE ON STAGNATION

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Implication of Status Preference on Stagnation*

by

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Abstract

We consider a dynamic macroeconomic model with households that regard relative affluence as social status. The measure of relative affluence can be the ratio to, or the difference from, the social average. The two specifications lead to quite different results: with the ratio specification full employment is necessarily realized, whereas with the difference specification persistent shortages of aggregate demand and employment can arise. Furthermore, using the data of an experiment of affluence comparison we empirically find that the difference specification is far more persuasive than the ratio specification. Thus, the present model provides an analytical framework for persistent stagnation.

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Introduction

Japan has been suffering from serious stagnation for more than two decades since the stock-price bubble burst in 1990. Furthermore, in 2008, the international financial crisis occurred and thereafter stagnation has spread worldwide. Facing such a serious situation, economists more than ever need an analytical framework that can treat inefficient macroeconomic outcomes and valid policy options for recovery from 'chronic' stagnation. A currently dominant research agenda dealing with stagnation may be the New-Keynesian approach such as Christiano, Eichenbaum and Evans (2005) and Blanchard and Galí (2007). They developed microeconomic foundations of price sluggishness in order that they could analyze macroeconomic fluctuations. This type of analysis, however, treats not a chronic stagnation but a short-run recession that fades out as prices adjust.

Possibility of persistent stagnation in a dynamic optimization framework was first explored by Ono (1994, 2001), following the spirit of Chapter 17 of Keynes's *General Theory*. In his model households have insatiable preference for money, which yields a liquidity trap. Prices continue to adjust and nevertheless shortages of aggregate demand and employment appear in the steady state. Murota and Ono (2011) also presented a model of persistent stagnation in which status preference plays the same role as the insatiable preference for money in creating persistent stagnation. They considered three objects of status preference, viz. consumption, physical capital holding and money holding, and found that an economy grows or stagnates depending on which object people most seriously take as status. If it is money (viz. an unproducible asset), persistent stagnation with unemployment occurs.

The above-mentioned insatiable desires for absolute and relative money holdings were discussed by J. M. Keynes (1972, p. 326). He wrote: "Now it is true that the needs of human beings may seem to be insatiable. But they fall into two classes—those needs which are absolute in the sense that we feel them whatever the situation of our fellow human beings may be, and those which are relative in the sense that we feel them only if their satisfaction lifts us above, makes us feel superior to, our fellows." It may, however, be ambiguous if the target of people's desire is to hold money or wealth. In the recent literature of status preferences, such as Corneo and Jeanne (1995) and Futagami and Shibata (1998), status concerns are often defined over wealth holdings.

Following such convention, we present a model with status preference for wealth and explore the possibility of persistent stagnation. In this analysis there are two alternatives of specifying social status: one is that people care about the difference of their wealth holdings from the social average, and the other is that people care about the ratio of those to the social average.[1] Murota and Ono assumed that people care about the difference of money holdings because this specification is necessary for persistent stagnation to occur. Corneo and Jeanne (1995) and Futagami and Shibata (1998) took the ratio as the target of status because that specification is required for endogenous growth to occur in their models.[2] We examine both cases and find that persistent stagnation occurs with the difference specification but does not with the ratio specification. Thus, the difference specification is indispensable for the model to treat persistent stagnation.

In order to see which specification is more plausible, we empirically examine the plausibility of the two specifications using the data set of the hypothetical discrete choice experiments on status preference conducted by Yamada and Sato (2010). We find that the difference specification is much more plausible than the ratio specification. Therefore, our model can apply to analyze persistent stagnation.

1. Two Specifications of Status Concern

We consider a representative household that cares about social status, whose utility is

$$\int_0^\infty [u(c) + v(m) + \sigma(a, \bar{a})] \exp(-\rho t)\, dt, \tag{1}$$

where $u(c)$ is utility of consumption c, $v(m)$ is utility of money m for transaction, $\sigma(a, \bar{a})$ represents status preference, a is total asset holding, and $\bar{a}$ is the social average of a. Functions $u(c)$ and $v(m)$ satisfy

$$\begin{gathered} u'(c) > 0, u''(c) < 0, u'(0) = \infty; \\ v'(m) > 0, v''(m) < 0, v'(0) = \infty, v'(\infty) = 0. \end{gathered} \tag{2}$$

[1] Clark and Oswald (1998) considered both the difference and ratio specifications of social status and explored tax policy implications for both cases in a static setting.

[2] With the difference specification and decreasing returns to real capital, Murota and Ono (2011) showed that endogenous growth occurs when households regard real capital as status.

Two types of status preference $\sigma(a, \bar{a})$ are considered: one is that the household cares about the difference (which we call case D) while the other is that he or she cares about the ratio (which we call case R).

$$\text{Case D:} \quad \sigma(a, \bar{a}) = \sigma_D(a - \bar{a}),$$
$$\text{Case R:} \quad \sigma(a, \bar{a}) = \sigma_R\left(\frac{a}{\bar{a}}\right). \tag{3}$$

The flow budget equation and the asset budget constraint are

$$\dot{a} = ra + wx - Rm - c - \tau,$$
$$a = m + b, \tag{4}$$

where r is the real interest rate, w is the real wage, x is employment, b is interest-bearing assets, R is the nominal interest rate, and τ is a lump-sum tax. Obviously R satisfies

$$R = r + \pi,$$

where π is the inflation rate. Maximizing (1) subject to (4) gives the Ramsey equation and the portfolio choice that are summarized as follows:

$$\rho + \eta\frac{\dot{c}}{c} + \pi = R + \frac{\sigma_a(a,\bar{a})}{u'(c)} = \frac{v'(m)+\sigma_a(a,\bar{a})}{u'(c)}, \tag{5}$$

where

$$\eta = -u''(c)c/u'(c), \quad \sigma_a(a,\ \bar{a}) = \frac{\partial\sigma(a,\bar{a})}{\partial a}.$$

The number of households is normalized to unity and hence the amount of employment x straightforwardly represents the employment rate.

The firm sector uses only labor to produce the commodity with linear technology:

$$y = \theta x, \tag{6}$$

where θ is the labor productivity and is assumed to be constant. Its profit maximization behavior leads to

$$\frac{W}{P} = w = \theta, \tag{7}$$

where W is the nominal wage and P is the nominal commodity price. Since profits with the linear technology are zero, the firm value equals zero. Therefore, interest-bearing assets b consist of only government bonds.

In the money market,

$$\frac{M}{P} = m,$$

where M is the nominal money stock. The monetary authority is assumed to keep the nominal money stock M to be constant, for simplicity, and thus

$$\frac{\dot{m}}{m} = -\pi. \tag{8}$$

The fiscal authority finances interest payments rb by collecting tax τ and issuing new bonds.[3] Formally,

$$\dot{b} + \tau = rb. \tag{9}$$

The fiscal authority adjusts $\dot{b}$ and τ so that the no-Ponzi-game condition is satisfied.

Nominal price P perfectly adjusts and hence in the commodity market

$$c = \theta x, \tag{10}$$

while nominal wage W adjusts in a sluggish manner depending on the excess demand rate:

$$\frac{\dot{W}}{W} = \alpha(x - 1), \tag{11}$$

where α is the speed of wage adjustment. From (7) and (11) we find

$$\pi = \alpha(x - 1). \tag{12}$$

Equations (4), (5), (8), (9), (10) and (12) give

$$\begin{aligned} \eta \frac{\dot{c}}{c} &= \frac{v'(m) + \sigma_a(a, \bar{a})}{u'(c)} - \rho - \alpha\left(\frac{c}{\theta} - 1\right), \\ \frac{\dot{m}}{m} &= -\pi = -\alpha\left(\frac{c}{\theta} - 1\right), \\ \dot{b} &= \left[\frac{v'(m)}{u'(c)} - \alpha\left(\frac{c}{\theta} - 1\right)\right] b - \tau. \end{aligned} \tag{13}$$

Since $a = \bar{a} = m + b$ in the present dynamics, from (3) and (13) $\sigma_a(a,\ \bar{a})$ satisfies

$$\begin{aligned} &\text{Case D:} \quad \sigma_a(a, \bar{a}) = \sigma_D'(0), \\ &\text{Case R:} \quad \sigma_a(a, \bar{a}) = \frac{\sigma_R'(1)}{m+b}. \end{aligned} \tag{14}$$

Therefore, (13) formulates a three-dimensional autonomous dynamic system with respect to c, m and b. If full employment ($x = 1$) is eventually reached, from (10) $c = \theta$ and hence from (13) and (14),

$$\text{Case D:} \quad c = \theta, \ \frac{v'(m) + \sigma_D'(0)}{u'(\theta)} = \rho,$$

[3] We ignore government purchases, for simplicity. Even if government pourchases are considered, the following areguments are essentially the same.

$$\text{Case R:} \quad c = \theta, \quad \frac{v'(m)+\frac{\sigma_R'(1)}{m+\bar{b}}}{u'(\theta)} = \rho, \tag{15}$$

where $\bar{b}$ implies the steady-state level of b that the fiscal authority determines.

Note that if perfect adjustment of W, instead of (11), is assumed, the state given by (15) is realized from the beginning, as in the standard money-in-the-utility-function model (see Blanchard and Fischer, 1989, pp. 239-243). However, this state may not exist as shown below.

From (2), in case R the value of *m* that satisfies (15) definitely exists since

$$\lim_{m\to 0} \frac{v'(m)+\frac{\sigma_R'(1)}{m+\bar{b}}}{u'(\theta)} (= \infty) > \rho > \lim_{m\to\infty} \frac{v'(m)+\frac{\sigma_R'(1)}{m+\bar{b}}}{u'(\theta)} (= 0).$$

Thus, full employment is indeed realized in the steady state.[4] In case D, however, there is no *m* that satisfies (15) if

$$\left(\frac{v'(m)+\sigma_D'(0)}{u'(\theta)} >\right) \lim_{m\to\infty} \frac{v'(m)+\sigma_D'(0)}{u'(\theta)} = \frac{\sigma_D'(0)}{u'(\theta)} > \rho. \tag{16}$$

In this case preference for money holding always dominates preference for consumption, which leads to a demand shortage. Note that if productivity θ is high or if the status preference $\sigma_D'(0)$ is strong, the property of (16) is likely to hold and then full employment is unattainable.

By substituting the first equation of (14) into the first equation of (13) we find that in case D the first and second equations of (13) form a two-dimensional autonomous dynamic system with respect to *c* and *m*:

$$\eta \frac{\dot{c}}{c} = \frac{v'(m)+\sigma_D'(0)}{u'(c)} - \rho - \alpha\left(\frac{c}{\theta} - 1\right),$$
$$\frac{\dot{m}}{m} = -\pi = -\alpha\left(\frac{c}{\theta} - 1\right). \tag{17}$$

The steady state of the present dynamics satisfies

$$\Phi(c) \equiv \frac{\sigma_D'(0)}{u'(c)} - \left(\rho + \alpha\left(\frac{c}{\theta} - 1\right)\right) = 0. \tag{18}$$

Under the condition given by (16), one has

$$\Phi(\theta) = \frac{\sigma_D'(0)}{u'(\theta)} - \rho > 0.$$

[4] The uniqueness and the stability of the present dynamics is proved in the same way as in Ono (1994, 2001), who treats the case where $b = 0$.

Therefore, in order for (18) to have a positive solution, it must be satisfied that

$$\Phi(0) = -(\rho - \alpha) < 0, \tag{19}$$

and then c satisfies

$$0 < c < \theta.$$

Therefore, a demand shortage arises in the steady state.[5] Deflation persists, making m diverge to infinity, and nevertheless the transversality condition is valid since

$$\lim_{m\to\infty} \frac{\dot{m}}{m} = \rho - \frac{\sigma_D'(0)}{u'(c)} < \rho.$$

Note that in this state $v'(m) = 0$ and hence from the second equation of (5)

$$R = 0,$$

i.e., the zero interest rate holds.

Let us give economic implications about the difference between the two specifications. In case R, in which households care about the ratio of asset holding compared to the social average, the marginal utility of real balances, represented by $v'(m) + \sigma_R'(1)/(m + b)$, converges to zero as m expands to infinity. Thus, there is a level of m that equalizes the desire to accumulate real balances to the desire to consume so much as to realize full employment. Then, full employment and the steady-state price obtain. In case D, in which households care about the difference, the desire to accumulate assets, represented by $\sigma_D'(0)$, remains strictly positive. Thus, no matter how much do assets accumulate, the desire to accumulate money as an asset will not decrease and hence the purchasing power will not be directed toward consumption enough to reach full employment. A demand shortage remains although prices continue to decline and real balances keep expanding.

2. Experimental Evidence of the Two Specifications of Status

In the previous section we show that persistent stagnation arises when households care about not the ratio of their asset holdings to, but the difference from, the social average. In order to see its relevance to the real world, we investigate which of the two specifications of social status is more plausible. In doing so, we exploit a data set created by a hypothetical

[5] The dynamic equations given in (17) are mathematically the same as those in the case there is a strictly positive upper bound of the marginal utility of money analyzed by Ono (2001). He showed that there is a unique dynamic path that converges to the steady state if (16) and (19) are valid.

discrete choice experiment study of Yamada and Sato (2010). They conducted an original Internet-based survey in March 2010 with Japanese subjects, and investigated the intensity of comparison against the social average. In the survey, respondents were presented with alternative combinations of hypothetical monthly income amounts for themselves and the social average. From the data on respondents' choices of preferred income scenarios, they estimate the intensity of comparison. We in turn exploit the same data set for the purpose of comparing plausibility between the ratio specification and the difference specification.

It must be noted that there is a difference between the theoretical structure shown above and the experimental setting below. In the choice experiment relative concerns are associated with income whereas in the present theory they are with wealth. However, income levels are predictors of asset holdings in the permanent income hypothesis models. Moreover, Headey and Wooden (2004) found that income and asset levels are both important determinants of happiness levels, and that the positive effect of wealth on happiness is taken away by the income term when both of them are taken into account in happiness regressions. This finding implies that income is a good proxy for assets in the happiness analysis, as we assume in the present analysis.

2.1 Summary of the survey

The survey by Yamada and Sato (2010), which is used in the present analysis, was conducted by a Japanese consumer monitoring company, Nikkei Research Inc., under the direction of the authors.[6] 60,482 subjects in Japan with ages between 20 and 65 were chosen with stratified random sampling from the Nikkei Database (where more than 160,000 subjects are registered) so that the cohort profile of our samples mirrored the Japanese census statistics. 14,370 subjects (23.8%) completed the survey. The decisions of participation should have been driven by unobservable characteristics that differentiated between participants and nonparticipants. However, if the characteristics were independent of the income comparison effects, the sample selection should not have biased the results. Furthermore, 29% of the responded samples were excluded because the time to complete the survey was too short, information for some variables used in the empirical analysis was not

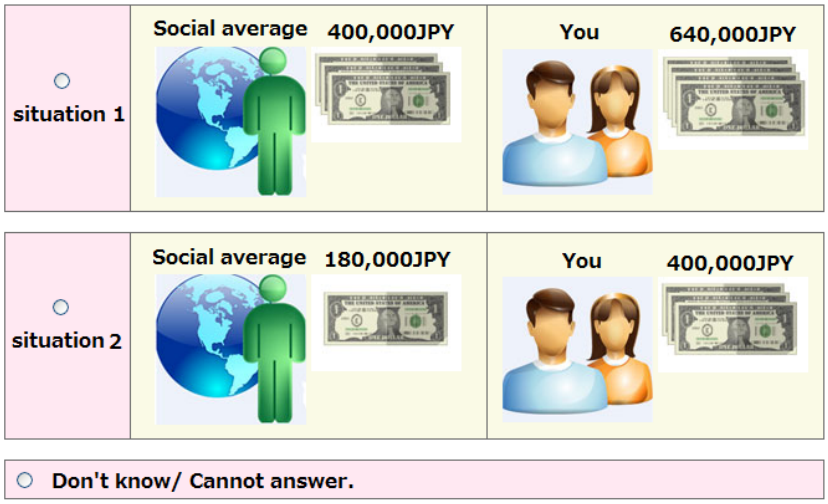
[6] See Yamada and Sato (2010) for the complete descriptions on the questionnaire, data collection, and study sample construction.

provided, or the answers had some inconsistency. Eventually, we were left with 10,203 respondents. Note that the main results documented below remained qualitatively unchanged even in the case where all the responded samples were used.

The data of the survey were respondents' choice data for hypothetical discrete choice questions designed to measure the sign and intensity of income comparisons, where the reference person was the average citizen in Japan.[7] The sets of income scenarios were constructed via the orthogonal design. There were in total 25 sets of income scenarios describing specific hypothetical amounts of before-tax monthly income for the respondent and the average citizen. He or she answered five sets that were randomly assigned out of them.

At the beginning of this task, respondents were told the following:

> *This figure shows your hypothetical monthly income (before tax). Also displayed in the same figure is Japan's overall average monthly income (before tax). That is, suppose that the current situation of your monthly income (before tax) and Japan's overall average monthly income (before tax), are both as shown.*



They were then asked the following question while the figures were given below it:

[7] The data are from "social average task" in Yamada and Sato (2010). In the survey everything in the figures was explained in Japanese. Images for monthly income differ, depending on the levels of the attribute.

Comparing situation 1 and situation 2 shown in the figures, which is more preferable to you? Suppose that the price levels in the two situations are the same. Please choose from the following options.

An option of "Don't know / Cannot answer" was also provided. Eventually, 48,172 observations were collected from 10,203 respondents.

2.2 Empirical results

Since we use income *y* as a proxy for assets *a* in the utility function of status, the utility function $\sigma(a, \bar{a})$, given in (3), is replaced by $\sigma(y, \bar{y})$. In order to examine the plausibility of the ratio specification and the difference specification, we reformulate this model to a random utility model and compare the Akaike Information Criteria (AIC) with the two specifications.

The random utility model is

$$\sigma(y_i, \bar{y}_i) = \beta X_i + C + \epsilon_i,$$

where i represents each income scenario, X_i is

$$\text{Case D:} \quad X_i = y_i - \bar{y}_i,$$
$$\text{Case R:} \quad X_i = \frac{y_i}{\bar{y}_i},$$

β is the marginal utility from the status, C is the constant term, and ϵ is the error term which follows an independent and identical distribution of extreme value type 1 (IIDEV1). The probability p_{ij} that respondents prefer income situation i to income situation j is given by

$$p_{ij} = \text{Prob}\left(\sigma(y_i, \bar{y}_i) > \sigma(y_j, \bar{y}_j)\right), \text{ for all } i \neq j.$$

By assuming IIDEV1 for the error term we consider a conditional logit model (McFadden, 1974) and estimate the parameters of the random utility function using the maximized likelihood method. It is also assumed that irrelevant alternatives are independent (IIA) and that the random components of each alternative, and those within each subject, are respectively uncorrelated.

Table 1 summarizes the results. The first and second rows show the results with the ratio and difference specifications, respectively. In both cases the relative income terms affect positively and significantly, which suggests that the comparison effect is not so strong as to validate the Easterlin Paradox (Easterlin 1974). The striking finding here is a significant

difference in the AIC between the two specifications. The AIC with the difference specification is much smaller than that with the ratio specification. Also, the pseudo R-squared for the difference specification has a high value of 0.22 in a non-linear model. Therefore, the difference specification is much more plausible than the ratio specification.

Table 1: Estimation results from the conditional logit model

Dep var: Utility	Relative income		Pseudo R2	AIC	N
	Sign	robust s.e.			
Ratio	0.4430***	(0.1059)	0.0053	63261.28	48172
Difference	0.0337***	(0.0004)	0.2255	51721.87	48172

Robust standard errors clustered by subjects, *** $p < 0.01$.

As proved in section 1, with the difference specification persistent stagnation obtains. With the ratio specification, however, full employment is necessarily attained in the steady state. The present experiment results strongly support the former and hence we may conclude that the present model provides a theoretical framework for analyzing persistent stagnation and unemployment.

3. Conclusion

When the relative affluence compared to the social average is taken as status, the measure can be the ratio to, or the difference from, the social average. The two specifications lead to mutually quite different scenarios of business activity. If it is the ratio, full employment is necessarily reached in the steady state. If it is the difference, there is a case where unemployment and stagnation due to aggregate demand shortage obtain in the steady state. This case arises particularly if the output capacity is high or if the status preference is strong.

Using the data of the experiment of affluence comparison carried out by Yamada and Sato (2010), we find that the difference specification is far more plausible than the ratio specification. Thus, our model can be applied to analyze persistent stagnation, such as Japan has been suffering for two decades. Furthermore, since the mathematical structure of the

present model is the same as that of Ono (1994, 2001), the same policy implications as those of Ono hold. They are quite different from those of the conventional models and more in conformity with Keynes (1936): an increase in government purchases expands private consumption, while a rise in the wage adjustment speed and an improvement in productivity reduce private consumption and worsen stagnation.

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