

# Is Consumption in the United States and Japan Too Much or Too Little?

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## ABSTRACT

This article reports on the results of an empirical examination of whether consumption in the United States and Japan is too much or too little relative to productivity in these countries (1993-2011). Findings reveal some clear and common characteristics of both countries for the sample period. The most typical one occurred during financial crises around 2008, which is often called the Lehman shock. In both countries, consumers had considerably reduced consumption around that period. The IT boom collapse at the beginning of the 2000s also diminished consumption in the United States. This paper examines impulse responses to trace the effect of a productivity shock to one of the innovations on the current and future value of consumption. Findings indicate that the effect of the shock of productivity on consumption is long both countries.

**Keywords:** Consumption; IT Boom; Japan; Production; Productivity; United States

## 1. Introduction

Many developed countries have experienced booms and suffered recessions in the 1990s and 2000s repeatedly and cyclically. This article focuses on the United States and Japan among other industrialized economies. The United States experienced recession; however, the economy has been stable except for the period of the Lehman shock, which damaged not only the United States but also the world economy around 2008. On the contrary, Japan has suffered unprecedented recession and deflation for more than 10 years. The Japanese economy, at last, had begun an optimistic atmosphere of recovery from long recession and deflation around the middle of the 2000s; however, the situation has not changed greatly. The 2011 earthquake seriously damaged the Japanese economy. These two countries have experienced opposite economic situations from the beginning of the 1990s until now. Analysis of these factors for some European countries would be interesting and important; however, the period since the introduction of the Euro is not adequate to allow performance of empirical analyses. This article focuses on the relationship between consumption and productivity in the United States and Japan. The possible existence of a link between consumption and productivity raises a question about the relationship, and no consensus has yet been formed. Few studies have focused on this relationship.

This reports on an empirical examination of the relationship between consumption and productivity for the United States and Japan based on the theoretical models of [1,2]. The main assumption in the present study is that current movements in consumption are primarily influenced by changes in consumers' expectations of the economy's long-run potential. More concretely, consumers continuously obtain information about the future. Based on this information, consumers decide on consumption and affect output in the short run. If *ex post* the information turns out to be noise, the economy returns to its initial condition. This assumption does not seem to fit perfectly, however, in the real economy. The following section explains this in detail.

[3-5] suggested that permanent shocks appear to lead to an increase in production activity in the short run and may have a larger effect in the long run. [2] used the data for the United States and found that consumers learned about a subsequent decline in productivity, which led to the 2008 financial crisis. However, little recent study has analyzed consumption empirically, especially the case of Japan.

The topic of too much and too little consumption, or the relationship between consumption and productivity is important, but few studies have analyzed it. There are some related studies. Deviations from rational expectation in consumption decisions are linked to previous ex-

ercises that have attempted to find deviations from the efficient market hypothesis in stock markets. [4,6-9] showed that demand shocks account for a small portion of volatility and permanent technology shocks provide a bigger one. [10] indicated that housing effects are bigger in the United States than in Europe and Japan. [11] examined the impact of fluctuations on consumption in the United States and Japan and found the effect of the wealth ratio on predictions of stock returns in Japan. Some articles have examined the relationship between consumption and financial variables (e.g., stock prices); however, the relationship between consumption and productivity has not been examined fully.

This article is structured as follows. Section 2 presents a model for the empirical analysis. Section 3 shows the results and analyzes them. Finally this paper ends with a brief summary.

## 2. Model for Empirical Analysis

### 2.1. Theoretical Analysis

This empirically examines the relationship between consumption and productivity. The model employed here is based on the theoretical model in [1].

First, consumers with rational expectations anticipate what the future will bring in terms of productivity, which is, for simplicity's sake, determined exogenously by a permanent and a temporary component. Consumers' decisions are made based on their expectations of future productivity. Consumers are rational in that they employ the information available as well as they are able, and they change consumption volume according to the permanent income hypothesis. Their expectations affect consumption and output in the short run.

The permanent component of consumption  $pe_t$  follows a trend that changes randomly as a result of permanent productivity shocks.

$$\Delta pe_t = \alpha \Delta pe_{t-1} + \varepsilon_t \quad (1)$$

$t$  means time and  $\varepsilon_t$  denotes normal shock with variables  $\sigma_\varepsilon^2$ . The temporary component  $te_t$  changes as a result of shocks that die out over time:

$$te_t = \alpha \Delta te_{t-1} + \eta_t \quad (2)$$

$\eta_t$  denotes normal shock with variables  $\sigma_\eta^2$ .

Actual productivity (in logs) is determined by the sum of these two components:

$$ac_t = pe_t + z_t \quad (3)$$

$ac_t$  is assumed to be a random walk and is defined as follows:

$$ac_t = ac_{t-1} + u_t \quad (4)$$

$u_t$  is normal shocks with the variances at equal to  $\sigma_u^2$ .

[12] showed a similar process for technology. The coefficient  $\alpha$  is in  $(0, 1)$ . Consumers observe productivity but not the two components separately. According to the permanent income hypothesis, consumers maximize the expected utility function given the information for each period.

Consumers are assumed to follow Euler's equation, which leads to the smoothing process (5):

$$c_t = E \left[ c_{t+j} \middle| I_t \right] \quad (5)$$

where  $I_t$  is the consumer's obtained information  $I$  at date  $t$ . To simplify the model and analyze consumption directly, consumption is set as the only component of demand and output is determined only by the demand side. Output  $y_t$  is given  $y_t = c_t$  and the labor cost adjusts to produce  $y_t$ , and given the current level of moves, leads to its natural level in the long run, as show in Equation (6):

$$\lim_{j \rightarrow \infty} E_t \left[ c_{t+j} - ac_{t+j} \right] = 0 \quad (6)$$

Consumption smoothing movements leads to the equation (in logs).

$$c_t = \lim_{j \rightarrow \infty} E_t \left[ ac_{t+j} \middle| I_t \right] \quad (7)$$

Equation (7) shows that consumption is determined by expectations about the level of productivity in the long run. Moreover, it is necessary to specify the consumers' information set. Consumers observe current and past productivity,  $ac_t$ .

From Equations (1)-(3) and (7), the result is as follows:

$$c_t = pe_t + (\alpha/1 - \alpha) \left( pe_t \middle|_t - pe_{t-1} \middle|_{t-1} \right) \quad (8)$$

In Equation (8),  $pe_t \middle|_t$  and  $pe_{t-1} \middle|_{t-1}$  denote consumers' expectations.

Consumers enter the market at each period with consumption  $x_t \middle|_t$  and  $x_{t-1} \middle|_{t-1}$  for the current and lagged values of the permanent component of productivity.

### 2.2. Empirical Analysis

This model is estimated using data for consumption and productivity. The logarithm of the ratio of consumption to GDP and the logarithm of the ratio of GDP to employment are used for consumption and productivity. The variables, the permanent component of productivity,  $pe$  is calculated by Hodrick-Prescott method. This method is a tool used in economics in business cycle theory to separate the cyclical component of a time series from the original data. The method can obtain a smoothed one in the data that is more sensitive to long-run than to short-run fluctuations.

Before estimating using the data, it is necessary to check unit root tests for estimation. This study employs

three typical methods: augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests.

The ADF test is often used for empirical estimation; however, if the series is correlated at higher order lags, the assumption of white noise disturbances is violated. The PP test proposes a method by which to control for higher order serial correlation in a series than is accepted in the equation. The test makes a nonparametric correction to the t-test statistic. The test is robust with respect to unspecified autocorrelation and heteroskedasticity in the disturbance process of the test equation. Finally, KPSS time series test is stationary around a deterministic trend. This test differs from those in common use in that they have a null hypothesis of stationarity. The test may be conducted under the null of either trend or nontrend stationarity. Inference from this test is complementary to that derived from those based on the ADF. This test is often employed with ADF to examine the possibility that a series is fractionally integrated [13].

This article examines the effect of changes in production on consumption. The method employed is LS (least squares) and VAR (vector autoregression). VAR is commonly used to forecast systems of interrelated time series and to analyze the dynamic impact of random disturbances on the employed variables. Empirical estimation and interface are complicated by the fact that endogenous variables may appear on both the left and right sides of equations. The use of VAR can avoid this issue. The variables employed are consumption and production [13]. Also, impulse responses are examined to trace the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables.

The sample period is from 1993:1 to 2011:4. The year 1993 was selected for data availability (for Japanese employment). The data are quarterly. All the data are from International Financial Statistics (IMF). Around the middle of 2008, the differences in the economic situations of both countries appear evident. Since the middle of the 1990s, the Japanese economy has been in recession and deflation; on the other hand, the US economy has expanded stably except for a few years. Moreover, it has been said that consumption is too large for economic

conditions in the United States. Whether or not this is true or should be examined. Also, the effect of production shock on consumption is examined. The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

### 3. Empirical Results

The results of the unit root tests are shown in **Table 1**.

In some cases, the results are not conclusive. However, the use of each datum is not problematic especially in the case of the PP test for empirical estimations.

The results of the regressions for Equation (9) are shown in **Table 2**.

The results fit well for both the cases of the United States and Japan. Also, it is interesting to note that the coefficients of both countries are similar. Both countries have common characteristics in consumption patterns despite that both countries have experienced opposite economic conditions since the middle of the 1990s. In the past, US overconsumption has been pointed out; on the contrary, lower Japanese consumption has been pointed out. However, in reality, the two countries have similar characteristics in consumptions.

**Figure 1** (US) and **Figure 2** (Japan) show the consumptions in reality with the HP filter and as estimated.

It should be noted that US overconsumption and lower levels of Japanese consumption were found in general. During the sample period, the US economy expanded at a steady rate; however, the Japanese economy has suffered recession and deflation. In Japan, reduced wages and uneasiness about the future have both seemed to lead to declines in consumption. From 1992 to 2011, the Japanese average wage fell about 11%. No downward wage rigidity has been found in the past. Also, people are concerned about the future because of the huge deficit in

**Table 1. Unit root tests.**

	US			Japan		
	ADF	PP	KPSS	ADF	PP	KPSS
$c_t$	-2.555*	-3.546***	1.061***	-2.011	-4.398***	0.992***
$pe_t$	-0.916	-2.695*	1.068***	-1.657	-3.512***	1.048***
$pe_t - pe_{t-1}$	-1.737	-11.571***	0.081***	-2.932**	-11.470***	0.065**

Note: \*\*\*, \*\*, and \* denote statistical significance at the levels of 1%, 5% and 10% respectively. For the ADF and PP tests, the series contain a unit root under the null, whereas the KPSS test assumes stationarity under the null.

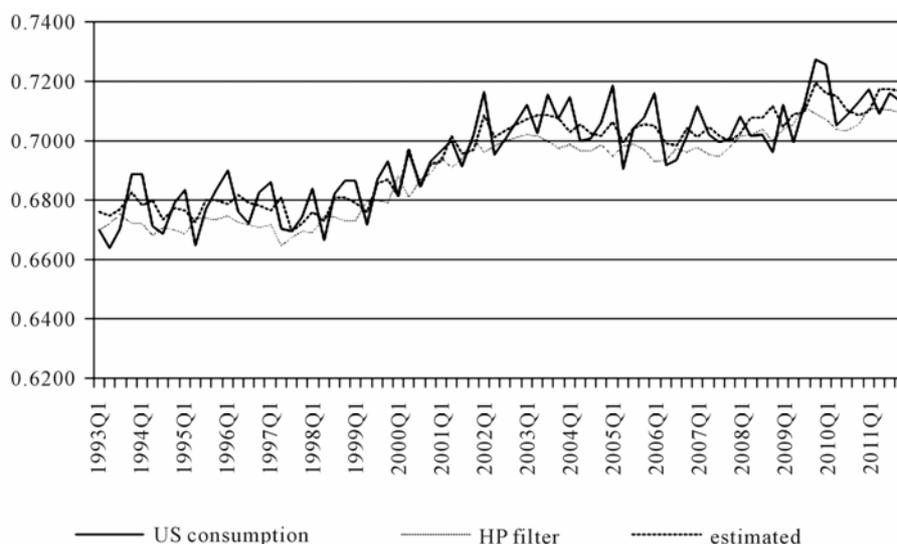


Figure 1. US consumption.

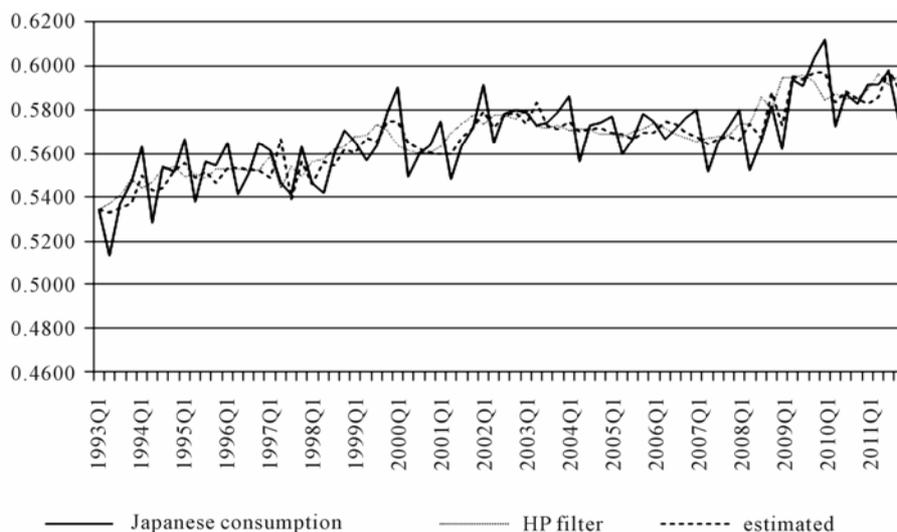


Figure 2. Japanese consumption.

Table 2. Regression results for consumption.

	US	Japan
$pe_t$	1.009*** (898.747)	1.000*** (504.605)
$pe_t - pe_{t-1}$	-1.438*** (-5.933)	-1.521*** (-6.157)
D.W.	2.252	2.302
Adj.R <sup>2</sup>	0.825	0.705

Note: \*\*\*, \*\*, and \* denote statistical significance at the levels of 1%, 5% and 10% respectively. Parentheses in the table indicate  $t$  values.

Japan. The ration of the Japanese deficit/debt to GDP is the highest among industrialized economies. Regardless of a long period quite low interest rates in Japan to overcome recession, people in Japan have not consumed much because of the reform plan for increased consump-

tion taxes and pension reduction, which has been discussed for several years. For the United States, the debt ratio also is high; however, the situation is not as serious as in Japan.

The United States experienced a large increase in permanent productivity in the second half of the 1990s. The productivity boom that started in 1995 can be related to a number of major innovations in information and communication technology. This situation did not occur in Japan. A slowdown in 2000 (with the collapse of IT boom) and a further decline in 2005 were expected with the start of the fall in housing prices. Consumption growth slowed started in 2007 and exhibited a large decline at the end of 2008. The September 2008 financial crisis triggered a decline in expectations about the future.

In Japan, consumption showed a large decline from

2007 to 2009, similar to the case of the United States. The damage seemed small compared the effect with the United States. In 2010, consumption rose greatly. However, a sharp decline occurred as a result of the 2011 earthquake.

Finally, the VAR results are shown in **Table 3**.

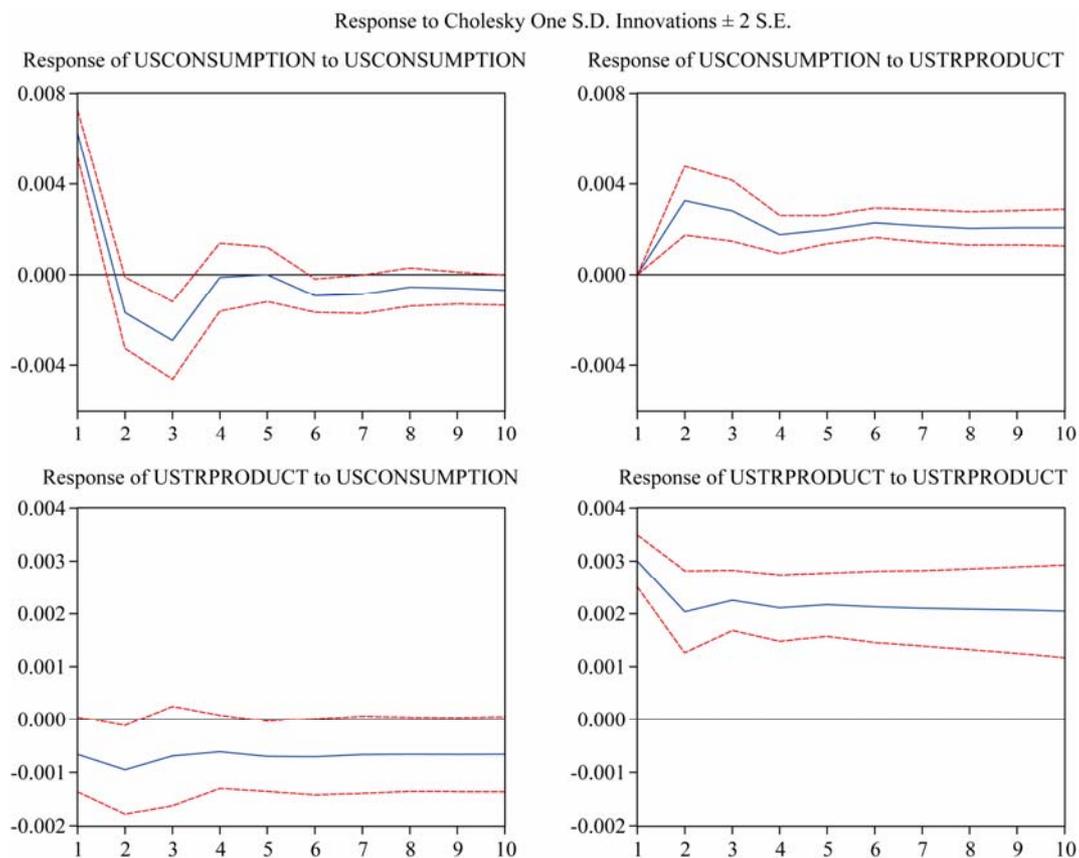
The impulse responses are shown in **Figures 3** (US) and **4** (Japan).

As in [14], temporary shocks to consumption around the permanent component of production seem large in both countries. The effects of other shocks (response of consumption to consumption, consumption to production, and production to production) are quite large and continuous. According to these production shocks, consumers in both countries are likely to make mistakes, thinking of these movements as permanent until they have

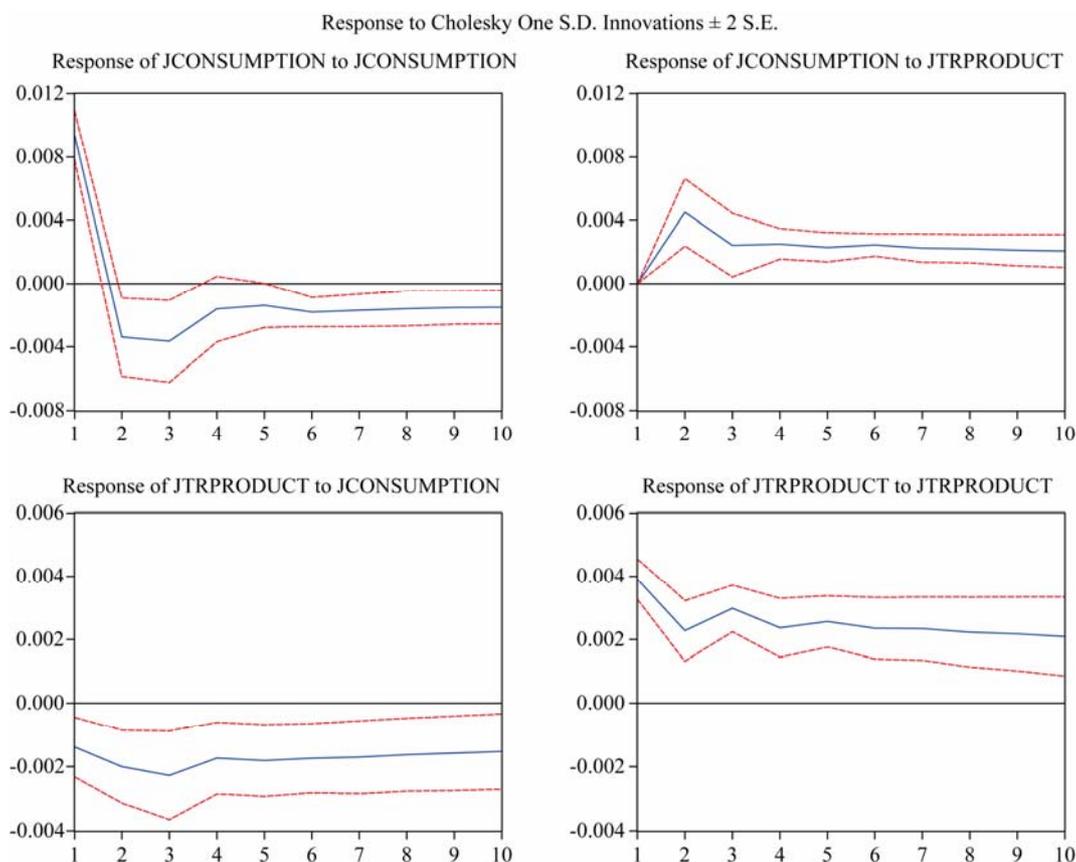
**Table 3. VAR results for consumptions.**

	US		Japan	
	Consumption	Production	Consumption	Production
c	0.016 (0.442)	0.010 (0.576)	0.032 (0.732)	0.031 (1.596)
Consumption (-1)	-0.156 (-1.407)	-0.080 (-1.468)	-0.191* (-1.622)	-0.127** (-2.433)
Consumption (-2)	-0.306*** (-3.357)	0.010 (0.241)	-0.188* (-1.948)	-0.079* (-1.861)
Production (-1)	1.082*** (4.583)	0.678*** (5.833)	1.151*** (4.532)	0.582*** (5.183)
Production (-2)	0.370 (1.232)	0.377** (2.548)	0.171 (0.525)	0.570*** (3.965)
Adj.R <sup>2</sup>	0.832	0.952	0.682	0.912
F-static	95.565	366.443	40.231	191.383
Akaike AIC	-7.252	-8.667	-6.437	-8.068

Note. \*\*\*, \*\*, and \* denote statistical significance at the levels of 1%, 5% and 10% respectively. Parentheses in the table indicate *t* values.



**Figure 3. US impulse response.**



**Figure 4. Japanese impulse response.**

obtained sufficient evidence to convince themselves otherwise. In Japan, the effect of production shocks on consumption is larger than in the United States. In Japan, severe economic conditions have continued for so long that people have tended to react too much or too nervously to production shocks, including innovation. These effects may reveal some important implications for policymakers to use to prompt recovery from such serious economic situations.

#### 4. Conclusions

This article examined US and Japanese consumers' behavior in terms of too much or too little consumption. The study examined empirically how customers tried to identify shifts in permanent productivity.

Similar characteristics exist in both countries, especially in the case of financial crisis all over the world around 2008. Also, US consumption reduced around the beginning of the 2000s because of the collapse of the IT boom. Americans have reduced consumption to less than the level as expected. Such situations sometimes have occurred in Japan; however, they have been little bit small. Also, the trend of over-consumption in the United States and under-consumption in Japan was noted in

general. US consumption is too much and Japanese consumption is too little for most cases from the 1990s until the present.

Japan has suffered unprecedented recession and deflation for more than 20 years, which may have affected consumption. Finally, the shock of productivity has influenced consumption for a longer time in Japan than in the United States. The effect of production shocks on consumption is much larger in Japan than in the United States. Serious economic conditions in Japan have continued for more than 20 years, so people may tend to overreact to production shocks.

Some problems remain in this study. The sample size is small. Also, only two variables have been employed here. The addition of investment, for example, seems an essential step in building models of the business cycle driven by anticipation. Considering supply-side situations seems necessary. Improvement in potential productivity would be important. Instead of two variables, HP filter, and empirical methods used for the regressions, other possibilities could be available. Finally, it would be useful to examine consumption patterns relative to the formulation or economic policies. Further study is needed.

## 5. Acknowledgements

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