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Price deflation and consumption: central bank policy and Japan's economic and financial stagnation

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Abstract

In this paper we review the major causes of Japan's economic and financial stagnation during the past decade, considering in particular how past policies of the Bank of Japan have generated the current deflationary environment. This paper does not attribute Japan's economic and financial distress entirely to Bank of Japan policy nor does it fail to recognize the shift in policy starting March 2001 when the Bank shifted toward a policy of "quantitative easing" that generated a significant increase in the growth of high powered money by late 2002. The paper argues the Bank's deflationary policies starting in the mid-1990s up to late 2002 exacerbated the distress and it remains to be seen whether the new policy will reverse deflationary expectations. We consider the economic effects of the deflation, and in particular we argue for a link between expected deflation when nominal interest rates approach their lower bound and a decline in consumption. We find some initial evidence for this hypothesis using both a simple two-period model with a simulation and estimates of consumption functions for both the United States and Japan. Reflation is thus a necessary, though not a sufficient condition for Japanese economic recovery.

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1. Introduction

Japan's economic and financial malaise has been extensively documented.¹ Despite much research effort and the lack of success of the numerous fiscal, monetary, and regulatory policy responses, including institutional redesign efforts and attitudinal changes by Japanese policy makers, debate persists over the causes of Japan's downturn, the causes of the continued stagnation, and the set of policies that will return Japan to sustained economic growth. Some view Japan's problems from a broader perspective. Krugman (2000), for example, argues that Japan is a leading indicator of "depression economics", that liquidity traps will increasingly confront policy makers, and that a new government paradigm is required to deal with these problems in the future.

The apparent lack of consensus reflects the more general difficulty of assigning responsibility for the cause of any major economic event. First, the impact of any exogenous shock to the system, such as the Bank of Japan's decision in May 1989 to initiate a tight money policy, is dependent on the existing structural characteristics of the real and financial sectors. Even if one can identify an initiating exogenous shock, it is not easy to assign causal importance to the shock since other shocks might have generated a similar response. Second, the causes of Japan's economic and financial malaise multiply in number and complexity as the problems persist. The longer lasting the problem, the more the problem becomes embedded throughout various sectors of the economy, the more difficult to identify any small set of causes, and the more difficult it becomes to reverse the process.

This paper, however, takes the view that despite the difficulty of assigning the status of "cause" to any one or small group of factors, the broad causative outline of Japan's stagnation can be identified and that a *necessary*, but not sufficient, condition for recovery can be identified. The paper specifically focuses on Bank of Japan policy, the gradual but definite decline in the price level, and the effect deflation has had on consumption spending.

The remainder of the paper is composed of five sections. In Section II, we present a causal outline of Japan's economic and financial stagnation drawn from the exiting literature. Section III summarizes the evidence that Bank of Japan policy has been insufficiently stimulative and as a result, has permitted the price level to fall after 1995. Section IV focuses on the link between deflation and aggregate demand from three perspectives: (1) a simple two-period theoretical model that illustrates why even if deflation is anticipated, consumption spending will likely decline; (2), a simulation of the theoretical model to illustrate how consumption spending responds to deflation; and (3), estimates of two consumption functions that suggest an empirically meaningful relationship between deflation and consumption spending in Japan. The theoretical and empirical model are not complex, but suggest that there is a link between deflation, even when anticipated, and consumption. To the extent central bank policy is responsible for the deflation process, the economy cannot recover until a reflation

¹ The following is a selected list: Cargill et al. (1997, 2000); Cargill and Yoshino (2003); Freedman (1999); Hoshi and Patrick (2000); Lincoln (2001); and Posen (1998).

process policy is adopted. A concluding section ends the paper with some observations on the political economy of Bank of Japan policy.

2. A causal outline of Japanese stagnation

We suggest that the causes of Japan's downturn and continued economic and financial malaise are summarized in the following seven-step sequence:

1. In the late 1970s and 1980s, Japan commenced a financial liberalization process that despite the rhetoric of liberalization either left in place or increased the emphasis on key characteristics of the old Japanese financial regime (Cargill, 2000), including: pervasive deposit guarantees managed through an extensive private–public mutual support arrangement; no bankruptcy in the financial sector and limited bankruptcy in the real sector; bank-finance with institutionalized feedback between land prices, equity prices, and bank lending; nontransparency; and public financial intermediation through the postal saving system and the Fiscal Investment and Loan Program.
2. Regulatory and market innovations designed to increase portfolio diversification in the context of continuing or enhanced key elements of the old regime generated a fundamental flaw: increased portfolio diversification increased the opportunity to assume and manage risk, and the key characteristics of the old regime provided incentives to assume risk. It was thus only a matter of time until this conflict would generate financial disruptions, as it did in the United States during the 1980s with regard to the Savings & Loan industry (Kane, 1989) and the commercial banking system in the early 1990s (Benston & Kaufman, 1997).
3. The unbalanced liberalization process was enhanced by accommodative monetary policy in the second half of the 1980s, as the Bank of Japan focused on external considerations (i.e. limiting yen appreciation) in the context of high rates of real economic growth and low inflation (Glick & Hutchison, 1994, and Ueda, 2000). The growth of both the monetary base and the money supply accelerated after 1986, but did not immediately impact the price level because of rapid real growth and increased productivity.
4. The unbalanced liberalization process combined with an accommodative monetary policy to provide a foundation for asset inflation in the late 1980s. Increased monetary growth led to increased bank lending, which in turn increased the demand for land, real estate, and equities. The resulting high prices for land, real estate, and equities fed back into the banking system to support additional lending through the role of land as a common collateral for loans and the role of “hidden reserves” in determining bank capital (Cargill, Hutchison, & Ito, 1997). The adoption of the BIS capital-asset requirements in 1988 contributed to the problem by strengthening the relationship between bank lending and equity prices.
5. The Bank of Japan initiated the decline in asset prices by raising the discount rate in May 1989, and continued with tight monetary policy through 1994. The decline in asset prices weakened bank balance sheets, reduced investment and consumption

spending, and generated a nonperforming loan and borrower problem. In hindsight, the Bank of Japan continued too long with tight monetary policy and did not shift aggressively to easy policy.

6. The unwillingness of regulatory authorities to allow bankruptcy to remove inefficient capital from the market, especially in the financial sector, and the willingness to adopt forgiveness and forbearance as the preferred policy response, seriously interfered with financial intermediation and credit allocation (Cargill, Hutchison, & Ito, 2000). The banking system continued to support weak borrowers and those who could not obtain credit from the banking system shifted to several government banks that are part of the Fiscal Investment and Loan Program. Postal deposits grew relative to total deposits in response to increased concern about the stability of the banking system, and thus provided increased funding for government banks through the Fiscal Investment and Loan Program (Cargill & Yoshino, 2003). Regulatory policy, loan guarantees that make up an important part of the numerous stimulus packages enacted throughout the 1990s, and public financial intermediation have permitted weak or insolvent financial institutions to continue operation and have permitted weak or insolvent borrowers to continue receiving funds.²
7. The Bank of Japan not only imposed tight monetary policy for too long a period of time in the early 1990s, but did not provide sufficiently stimulative policy to prevent a gradual but definite downward movement in the price level. When they acted, policymakers focused on decreasing nominal interest rates but failed to recognize that the decline in prices had increased the real rate of interest, exposed the Bank of Japan to a liquidity trap, increased the real burden of servicing debt, enhanced the nonperforming loan and borrower problem, and adversely impacted aggregate demand. The Bank of Japan, however, shifted from a “zero-rate” policy to a “quantitative” policy in early 2001. By late 2002 this generated 20–30% growth in high powered money that has leveled off in late 2003 to 15–20% growth. There are signs of a recovery in late 2003 and in particular, a slow down in the measured CPI deflation rate (Bank of Japan, 2004); however, it is not yet clear whether deflationary expectations have been reversed.

This sequence of events is consistent with the majority of views expressed in the academic literature during the past decade. The Bank of Japan, however, rejects the view that monetary policy has generated deflation in the second half of the 1990s, or that monetary policy has been insufficiently stimulative. The Bank of Japan argues that nonmonetary factors have been responsive for deflation (Noland & Posen, 2002) and that the zero-interest rate policy initiated in early 1999 suggests there is little more the Bank of Japan can do to stimulate the economy.³ The Bank of Japan’s view, however, is not widely accepted.

² Cargill and Parker (2002) provide a model to indicate the high cost of the transition from a financial system designed to limit bankruptcy to a system permitting bankruptcy. This model shows that while financial systems limiting bankruptcy may provide rapid growth at the start of the development process, the limited role of bankruptcy slows growth in the long run.

³ Many of these views are presented in Institute for Monetary and Economic Studies, Bank of Japan (2004).

The cause of the downturn is attributed to tight monetary policy in the context of a flawed liberalization process and the cause of the continued stagnation is the combined outcome of tight monetary policy, deflation, and an unwillingness to depart from many of the key characteristics of the old financial regime. That is, the Bank of Japan bears some responsibility for Japan's stagnation. This does not suggest that tight monetary policy in 1989 alone was responsible for generating the downturn, but only that it was a *sufficient* cause. Nor does this suggest that a more aggressive monetary policy would have returned Japan to sustained and stable economic growth, but only that such a policy would have been, and remains, a *necessary* condition for recovery.

3. Bank of Japan policy and deflation

The Bank of Japan's policy in the 1990s and continuing to 2002 has been tight according to at least four standards. First, the measured price level has declined over the period and, considering the standard upward bias to the measured inflation rate, Japan is the only industrial economy in the postwar period to exhibit a sustained decline in prices. While Japan's deflation is not of the same order of magnitude as the deflation experienced in the 1930s, the qualitative similarities cannot be ignored. Second, measured real interest rates have increased in the second half of the 1990s despite the fact that nominal interest rates have declined to historical lows. Third, the application of standard models of monetary policy, according to McCallum (2003), suggests that Bank of Japan policy has been tight throughout the 1990s. Hetzel (2003) reaches the same conclusion. Fourth, an extensive amount of theoretical and empirical research over the past five decades has demonstrated the validity of Friedman's well-known statement that inflation (or deflation) in the long-run is a monetary phenomenon directly attributable to the actions of the central bank (Gordon, 1975).

Thus, the deflation in Japan can thus be attributed to Bank of Japan policy. This conclusion is probably the consensus view, but what had not been emphasized in the literature, until Krugman (1998) suggested a return to "liquidity trap" economics, is that the deflation itself contributes to further deflation and makes deflation more difficult to reverse. In part, this is the reverse the effect of inflation on the demand for money suggested by Cagan (1956) almost a half a century ago.

Fig. 1 illustrates the behavior of money and consumption since 1955. While the ratio of M2 to GDP has tended to rise over time, perhaps as a result of Japan's financial deepening, the behavior of M2 also suggests that both disinflation since 1975 and deflation in the 1990s have both been accompanied by a decline in velocity. On the other hand, the ratio of M1 to GDP remained relatively stable until the deflation began, and then rose dramatically. The behavior of consumption is harder to discern, though an increase in money demand implicitly suggests a decrease in consumption demand. As a percentage of GDP, consumption has not declined since the deflation began, but aggregate real consumption (indexed to the year 1990) has clearly slowed.

To determine whether the disinflation and deflation in Japan has significantly increased the demand for money in Japan, Cargill and Parker (2004) estimated the

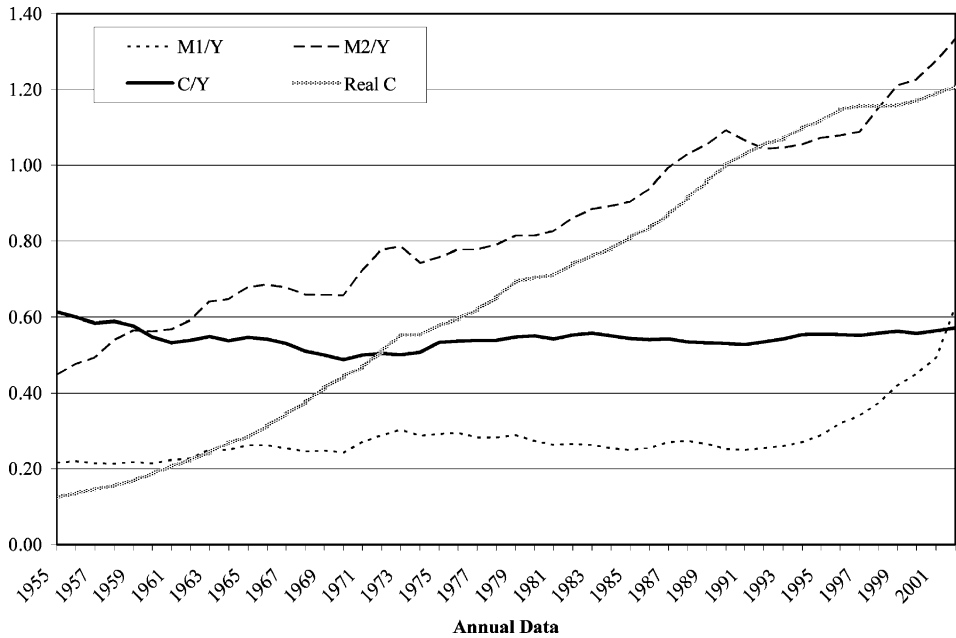


Fig. 1. Money and consumption in Japan.

demand for money from 1970:1 to 2002:4, and found that money demand was negatively correlated with the inflation rate (i.e. it increases with disinflation) and additionally positively (and significantly) correlated with the presence of price deflation. The impact was significant in terms of magnitude as well, since the presence of price deflation appeared on average to lead to an additional increase of approximately 5–10% in money demand.

4. Deflation and consumption spending

As money demand has increased while the deposit expansion multiplier has fallen, price deflation has therefore made it more difficult as time progresses for the Bank of Japan to emerge from its current difficulties. Deflation, however, has other serious effects on the economy through its impact on aggregate demand that contribute to Japan's stagnation.

There are at least two channels important for the Japanese context through which deflation adversely impacts aggregate demand, including Fisher's (1933) deflation-debt channel, since debt is fixed in nominal value, and deflation-led declines in consumer spending. Each channel has separate impacts; however, there is an overlap since one of the mechanism by which deflation-debt works is through reduced spending. Fisher's channel has been sufficiently explored elsewhere (Burdekin & Siklos, 2004).

This paper focuses on the effect of price deflation on consumption from three perspectives. First, we develop a simple two-period model to illustrate how even if prices are anticipated in the future, the zero bound on nominal interest rates can generate a deflation-induced decline in consumer spending. Second, we develop a simulation framework of the theoretical model based on specific forms of the utility function to illustrate from a simulation perspective how a deflation-induced decline in consumption can occur even if prices are anticipated. Third, we estimate two forms of the consumption function in Japan using annual data from 1955 to 2002 that provides meaningful econometric evidence that deflation has reduced consumer spending.

4.1. A simple two-period consumption model

Consider a simple framework, in which a consumer maximizing utility from real consumption C over two periods (numbered 1 and 2), has a binding budget constraint, so that current saving/borrowing plus interest (at nominal rate i) equals future dissavings/repayment. Assume that current real income Y_1 includes any current wealth that can be applied to consumption over the two periods. The maximand is:

$$\text{Max } U(C_1, C_2), \text{ subject to } P_1(Y_1 - C_1)(1 + i) = P_2(C_2 - Y_2). \quad (1)$$

Let the current price level $P_1 = 1$ and the future price level $P_2 = 1 + \pi$, where π is the expected inflation rate. We can then write the Lagrangian A as:

$$A = U(C_1, C_2) + \lambda((Y_1 - C_1)(1 + i) + (Y_2 - C_2)(1 + \pi)), \quad (2)$$

with the following three first-order conditions:

$$\begin{aligned} A_1 &= U_1 - \lambda(1 + i) = 0, \\ A_\lambda &= (Y_1 - C_1)(1 + i) + (Y_2 - C_2)(1 + \pi) = 0, \\ A_2 &= U_2 - \lambda(1 + \pi) = 0, \end{aligned} \quad (3)$$

and generate the following substitution effect:

$$\frac{U_1}{U_2} = \frac{1 + i}{1 + \pi} = 1 + r, \quad (4)$$

where r is the expected real interest rate. Solution for the comparative statics determines the income effect. The Hessian matrix for this problem is:

$$[H] = \begin{bmatrix} U_{11} & U_{12} & -(1 + i) \\ U_{21} & U_{22} & -(1 + \pi) \\ -(1 + i) & -(1 + \pi) & 0 \end{bmatrix} \quad (5)$$

and if this matrix is negative semidefinite then:

$$2U_{12}(1 + \pi)(1 + i) - U_{11}(1 + \pi)^2 - U_{22}(1 + i)^2 \geq 0. \quad (6)$$

Using Cramer's Rule and the assumption that current and future real consumption are normal goods, the following conditions can be imposed:

$$\begin{aligned}\frac{\partial C_1}{\partial Y_1} &= \frac{1}{|H|} (U_{12}(1+\pi)(1+i) - U_{22}(1+i)^2) > 0, \\ \frac{\partial C_2}{\partial Y_1} &= \frac{1}{|H|} (U_{12}(1+\pi)^2 - U_{11}(1+\pi)(1+i)) > 0, \\ \frac{\partial C_1}{\partial Y_2} &= \frac{1}{|H|} (U_{12}(1+\pi)^2 - U_{22}(1+\pi)(1+i)) > 0, \text{ and} \\ \frac{\partial C_2}{\partial Y_2} &= \frac{1}{|H|} (U_{12}(1+\pi)(1+i) - U_{11}(1+\pi)^2) > 0.\end{aligned}\tag{7}$$

To determine the effect of deflation on consumption, we consider the case where $\pi > 0$. If the real interest rate is exogenous to the rate of price inflation, then:

$$\frac{\partial i}{\partial \pi} = 1 + r,\tag{8}$$

and it is straightforward to demonstrate that expected price inflation is neutral:

$$\begin{aligned}\frac{\partial C_1}{\partial \pi} &= \frac{\lambda}{|H|} ((1+\pi)(1+i) - (1+r)(1+\pi)^2) = 0, \text{ and} \\ \frac{\partial C_2}{\partial \pi} &= \frac{1}{|H|} ((1+i)(1+\pi)(1+r) - (1+i)^2) = 0.\end{aligned}\tag{9}$$

This result may not hold, however, if the real rate of interest is not exogenous. Consider the case of price deflation, in which $\pi < 0$ and i has reached the zero lower bound, so that further decreases in π cannot further reduce i . This condition does not hold for inflation because there is no upper bound on the nominal interest rate. In the case of deflation, then:

$$\frac{\partial i}{\partial \pi} = 0,\tag{10}$$

and price inflation is no longer neutral:

$$\begin{aligned}\frac{\partial C_1}{\partial \pi} &= \frac{1+\pi}{|H|} (U_1 + (Y_2 - C_2)[U_{12} - U_{22}(1+r)]), \text{ and} \\ \frac{\partial C_2}{\partial \pi} &= \frac{-(1+\pi)}{|H|} (U_2(1+r)^2 + (Y_2 - C_2)[U_{12}(1+r) - U_{22}]).\end{aligned}\tag{11}$$

The first derivatives U_1 and U_2 are positive in sign, and we can show that the terms in brackets are also positive if consumption goods are normal (expression 8). Thus, the sign of these two terms depends on the sign of second period savings ($Y_2 - C_2$), and deflation has an income effect.

For borrowers (or small savers) in period 1, savings in period 2 is positive (or negative but sufficiently small), and thus consumers will respond to expected price deflation by delaying some of their spending until the future. For those who initially have large savings that will be consumed in the second period, however, the income effect may offset the substitution effect.

4.2. Simulation of the two-period model

Simulations are employed to determine the response of consumption to price deflation because the signs of the comparative static results are ambiguous. Two utility functions are specified and then, using a range of values for all parameters in the model, we solve for the choice variables to estimate the effects of price deflation. These two utility functions are:

$$(a) U(C_1, C_2) = C_1^\alpha C_2^{1-\alpha}, \text{ and} \quad (12)$$

$$(b) U(C_1, C_2) = \sum_{t=1}^2 e^{-\rho t} \frac{C_t^{1-\theta} - 1}{1-\theta} = \frac{C_1^{1-\theta} - 1}{1-\theta} + e^{-\rho} \frac{C_2^{1-\theta} - 1}{1-\theta}.$$

The first (12a) is the traditional Cobb–Douglas form and the second (12b) is the utility function used by Barro and Sala-I-Martin (1995) in their simulations of the Ramsey model. For each we begin with incomes of $Y_1 = Y_2 = 10$, and compare two scenarios: in the first, $i = 5\%$ and $\pi = 3\%$, so $r = 2\%$; in the second, $i = 0\%$ and $\pi = -3\%$, so $r = 3\%$.

In the Cobb–Douglas form the initial value of the parameter $\alpha = 0.5$. To check the relative importance of income and substitution effects for net savers and borrowers three alternatives of (13a) are specified. The first is a no-growth of income case which approximates the Japanese situation in the 1990s: (1.c) $Y_1 = Y_2 = 10$. The second and third cases are unrealistic, but are considered to provide two extreme border conditions: (1.b) $Y_1 = 19, Y_2 = 1$, a case that assumes that initial wealth is very high relative to income, and (1.c) $Y_1 = 1, Y_2 = 19$, a case that assumes initial wealth is very low relative to income. We then consider the effects of the parameters by resetting incomes back to $Y_1 = Y_2 = 10$, and report the effects of changing the value of α , using values of (2.b) $\alpha = 0.1$ and (2.b) $\alpha = 0.9$.

In the case of the Ramsey form, we begin with $\rho = 3\%$ and $\theta = 0.5$, and as above first consider the three alternatives of (1.a) $Y_1 = Y_2 = 10$, (1.b) $Y_1 = 19, Y_2 = 1$, and (1.c) $Y_1 = 1, Y_2 = 19$. We then reset incomes back to $Y_1 = Y_2 = 10$, and report the effects of changing the value of ρ and θ , using values of (2.a) $\rho = 1\%$, (2.b) $\rho = 5\%$, (3.a) $\theta = 0.1$, and (3.b) $\theta = 0.9$. We also consider the possible interaction effects of changing more than one variable at a time in both utility functions; however, we find no important differences.

The simulation results for the various specifications are summarized in Table 1. In virtually every case we find that deflation leads to less current consumption and greater future consumption, so that:

$$\frac{\partial C_1}{\partial \pi} > 0, \quad \text{and} \quad (13)$$

$$\frac{\partial C_2}{\partial \pi} < 0.$$

The only exceptions to this result are the two corner solutions in the Cobb–Douglas form, when either no future income ($Y_1 = 20, Y_2 = 0$) leads to no effect on current consumption, or no current income ($Y_1 = 0, Y_2 = 20$) leads to no effect on future consumption. These are

Table 1
Simulation of utility functions

Cobb–Douglas form										
	Y_1	Y_2	π	i	r	α	C_1^*	$\% \Delta C_1$	C_2^*	$\% \Delta C_2$
1.a	10	10	3	5	2	0.5	9.90	10.10		
	10	10	−3	0	3	0.5	9.85	−0.6	10.15	0.6
1.b	19	1	3	5	2	0.5	9.99	10.18		
	19	1	−3	0	3	0.5	9.99	−0.1	10.29	1.1
1.c	1	19	3	5	2	0.5	9.82	10.01		
	1	19	−3	0	3	0.5	9.72	−1.1	10.02	0.1
2.a	10	10	3%	5	2	0.1	17.83	2.02		
	10	10	−3	0	3	0.1	17.73	−0.6	2.03	0.6
3.b	10	10	3%	5	2	0.9	1.98	18.17		
	10	10	−3	0	3	0.9	1.97	−0.6	18.28	0.6
Ramsey form										
1.a	10	10	3	5	2	0.5	10.11	9.89		
	10	10	−3	0	3	0.5	10.00	−1.1	10.00	1.1
1.b	19	1	3	5	2	0.5	10.19	9.98		
	19	1	−3	0	3	0.5	10.13	−0.6	10.14	1.7
1.c	1	19	3	5	2	0.5	10.02	9.81		
	1	19	−3	0	3	0.5	9.86	−1.6	9.87	0.6
2.a	10	10	3	5	2	0.5	9.91	10.09		
	10	10	−3	0	3	0.5	9.80	−1.1	10.21	1.1
2.b	10	10	3%	5	2	0.5	10.30	9.69		
	10	10	−3	0	3	0.5	10.19	−1.1	9.80	1.2
3.a	10	10	3	5	2	0.1	10.53	9.46		
	10	10	−3	0	3	0.1	9.98	−5.3	10.02	6.0
3.b	10	10	3	5	2	0.9	10.06	9.94		
	10	10	−3	0	3	0.9	10.00	−0.6	10.00	0.6

Note: *t*-statistics in **bold** indicate statistical significance at 5% (one-tailed) level.

unrealistic solutions included only to define the extreme bounds of the simulation example. The magnitude of the resulting 1% increase in r varies according to initial parameter values, with the greatest degree of substitution in the Ramsey model when θ is low. At initial parameter values, the drop in current consumption varies from 0.6 to 1.1% in the two functional forms, and the extreme alternatives lead to a range in the decline from 0.1 to 5.3%.

4.3. An empirical relationship between deflation and consumption

Does price deflation have a significant impact on consumption? The approach used here to determine whether a significant relationship can be established relies on consumption functions suggested by Iwaisako (2000) and Cochrane (1994) that is based on the life cycle/permanent income hypothesis. We add to this a simple dummy variable for price deflation, and use annual data for Japan (1955–2002) and, as a benchmark, the United States (1929–2002) to determine if a negative association between consumption and

deflation can be identified.⁴ The United States is included because it represents a case where the deflation-induced decline in consumption during the Great Depression should show up the most prominently.

Two versions of the consumption function are estimated, one with the dummy variables in differences and one with the dummy variables in levels:

$$\Delta \ln C = \alpha_0 + \alpha_1 \ln \left(\frac{C_{t-1}}{Y_{t-1}} \right) + \alpha_C \Delta \ln C_{t-1} + \alpha_Y \Delta \ln Y_{t-1} + \beta_D \Delta D_t + \beta_W \Delta W_t \quad (14)$$

and

$$\Delta \ln C = \alpha_0 + \alpha_1 \ln \left(\frac{C_{t-1}}{Y_{t-1}} \right) + \alpha_C \Delta \ln C_{t-1} + \alpha_Y \Delta \ln Y_{t-1} + \beta_D D_t + \beta_W W_t \quad (15)$$

where C represents real consumption spending, Y represents real GDP, and D is set to 1 when $P_t < P_{t-1}$ and set to 0 otherwise, where P the consumption spending price index. In the case of the United States, a war period dummy variable, W , is set to 1 for the years 1941–1945 and 0 otherwise, but the Japanese data do not cover the wartime period so this variable is omitted. These two versions of the consumption function include the alternatives that price deflation affects either the level of C (Eq. (14)) or the growth rate of C (Eq. (15)). In the first case, very little variation is observed in the dummy variables and we would expect high standard errors.

This specific consumption function is admittedly a very simple model to explain the relationship between consumption and a small set of variables over long periods of time, and as such there may be complex variation in the residuals. The coefficients are estimated by OLS and the standard errors by the Newey and West (1987) procedure. The results for the United States and Japan, for both versions, are presented in Table 2.

For the United States, most parameters of the consumption function are not statistically significant, but in both versions deflation has an effect that is both statistically significant and of non-trivial size. If deflation is assumed to have a one-time effect on the level of consumption, then the dummy variables are differenced and the estimated effect is only about a 4% decrease. If deflation is instead assumed to have an effect on the growth rate of consumption—and this version results in a better fit, according to the adjusted R^2 —then the dummy variables are not differenced and deflation results in an annual consumption drop of about 6%. By comparison, the effect of the second world war on consumption was statistically insignificant in all cases, though still of the expected negative sign.

For Japan, the effect of deflation during the past decade has of course not been as significant as that experienced by the United States during the Great Depression. The consumption function results in a better fit for this smaller sample size, and the lagged ratio

⁴ The Japan GDP data was gathered from the website of the Economic and Social Research Institute <<http://www.esri.cao.go.jp/index-e.html>>, a cabinet office of the government of Japan. Private consumption and GDP data from 1955–1979 are on a different basis than more recent data, so a small factorial adjustment was made to the earlier data to connect the datasets, and the growth rates were unaffected. Data for the United States was gathered from the St. Louis Federal Reserve Bank's Federal Reserve Economic Data (FRED) website <<http://research.stlouisfed.org/fred2>>.

Table 2
Consumption Function Estimates

	Dummy variables differenced		Dummy variables in levels	
	OLS coefficients	Newey–West <i>t</i> -values	OLS coefficients	Newey–West <i>t</i> -values
United States				
α_0	−0.0005	−0.03	0.0283	0.96
α_1	−0.0519	−1.54	−0.0161	−0.23
α_C	0.3314	2.76	0.1103	1.27
α_Y	0.0348	0.35	−0.0208	−0.29
β_D	−0.0395	− 3.12	−0.0582	− 2.43
β_W	−0.0137	−0.42	−0.0056	−0.44
DW statistic	2.11		1.86	
Adjusted R^2	0.2376		0.2901	
Japan				
α_0	0.1765	4.12	0.1857	4.52
α_1	0.2683	4.02	0.2744	4.33
α_C	0.0116	0.04	−0.0524	−0.22
α_Y	0.4560	2.65	0.4424	2.72
β_D	−0.0021	−0.51	−0.0131	− 2.87
DW statistic	2.26		2.22	
Adjusted R^2	0.6026		0.6205	

Note: *t*-statistics in **bold** indicate statistical significance at 5% (one-tailed) level.

of consumption to output is significant in all cases. If deflation is assumed to have a one-time effect on consumption, then the effect is only a 0.5% fall in consumption, and it is not statistically significant. However, in the better-fitting second version of the model, which assumes that deflation affects the growth rate of consumption, the effect is approximately a 1.3% annual decrease in that growth rate, and the Newey–West *t*-values indicate that the effect is statistically significant.

The lower coefficient values for Japan is not surprising since the price declines in Japan have not been anywhere near as dramatic as during the 1930s in the United States. While these are very simple consumption estimates and still subject to a variety of econometric problems, they are nonetheless suggestive of a deflation-induced decline in consumption in Japan. Considered together, the results in Table 2 indicate that deflation did have a clear adverse impact during the 1930s in the United States and has likely had an adverse impact on consumption spending in Japan during the 1990s.

5. Concluding comment

The causes of Japan's stagnation are many and complex. No one factor or group of factors can be assigned the cause at this point in time given that Japan's stagnation has continued for almost fifteen years. However, in a broad outline of why the downturn occurred and the stagnation has continued, the Bank of Japan's willingness to permit

disinflation in the first part of the 1990s and deflation after 1995 has contributed importantly to Japan's problems.

Price deflation has generated a difficult, discontinuous environment for the Bank of Japan making easy monetary policy more difficult and contributing to further deflation as households adjust their portfolios toward money and away from goods and services. The deflation has also contributed to a decline in aggregate demand by postponing consumption in the short run in response to the increase in the real rate of interest. Reversing the decline in prices is not a *sufficient* condition for Japan's recovery, but it is a *necessary* condition. The recent changes in Bank of Japan policy in late 2002 and new leadership in early 2003 may yield a more aggressive policy, but there is little doubt that Bank of Japan policy by allowing the price level to fall has constrained recovery.

Bank of Japan policy has generated much discussion both inside and outside of Japan and while there is widespread consensus central bank policy has been insufficiently expansionary (with the exception of Bank of Japan officials), there is less agreement as to what accounts for this policy especially in light of the Bank of Japan's more independence design that became effective April 1, 1998. Of the several possible explanations, Cargill et al. (2000) and Cargill and Parker (2003) emphasize the public choice implications of independence itself as a possible constraint on the Bank's unwillingness to respond to outside pressure for more aggressive ease. Such response to outside pressure, no matter how responsible the pressure, would render the Bank of Japan less "independent".

Institutional response by the Bank of Japan, however, did shift in early 2001 and by late 2002 monetary policy shifted toward greater ease in terms of the growth of high powered money. Toshihiko Fukui, the new Bank of Japan Governor since March 2003, has continued this policy. Increasing outside criticism of the Bank of Japan's policies, public comments made by Prime Minister Koizumi in early 2003 about the need for a "deflation fighter" when considering the new Governor to replace the retiring Governor Hayami and suggestions by some Diet members that it was time to impose an inflation-target framework on the Bank of Japan may have provided the incentives for the Bank of Japan to shift policy toward greater ease.

There is general agreement, however, that the recent policy shift should be maintained and even more aggressive action should be considered, as one governor of the Federal Reserve Bank has clarified (Bernanke, 2003). It remains to be seen how monetary policy will develop in the near future, but unless the Bank of Japan reverses deflationary expectations, Japan may find it very difficult to continue its recent growth and solve the many structural problems of the economy. There are many ways deflation has an adverse impact. This paper has focused on the deflation-consumption channel and until deflationary expectations are reverse, consumption spending will restrain economic recovery.

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