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Inflation Expectations, Wealth Perception, and Consumption Expenditure

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I. INTRODUCTION

The traditional Keynesian consumption function, $c = f(y_d)$, has long since been refined into the form $c = c(y_d, w)$, as exemplified by the life-cycle hypothesis of Ando-Modigliani (1963). Thus, consumption c is commonly taken to be determined not only by a flow (disposable income y_d) but also by a stock (wealth w). A more recent—and more controversial—question is whether the wealth variable should be measured by its accounting value, or its perceived value. One widely recognized reason why the perceived wealth, w^p, can differ from its accounting value, w, is the tax discounting of government bonds, as discussed by Patinkin (1965), Barro (1974), Kochin (1974), Yawitz-Meyer (1976), Tanner (1970, 1979a, 1979b), Seater (1982), and others. This is based on the possibility that the private sector may capitalize, partly or wholly, the future tax liabilities entailed by the servicing of such bonds. Another reason—less widely discussed today—is the view of Pesek-Saving (1967) that the private sector may consider as its net wealth not only the high-powered money held, but also the demand-deposit money (less the portion held as reserves) that it supports, even though the deposit-money asset is offset by an identical amount of bank liability. Tax discounting of bonds would cause the perceived value of wealth to fall short of the accounting value; the Pesek-Saving effect would have the opposite effect.

The central point of the present paper is that there is yet a third reason for w^p to deviate from w, which has unfortunately been almost totally neglected in the literature,[1] namely, the effects of inflation expectations on wealth perception. Such effects are present in both the stock and the flow aspects of wealth perception. And, according to our empirical results, the private sector is much more aware of the effects of expected inflation on wealth than it is of the future tax liability entailed by the servicing of government bonds. This finding—for which we shall offer a plausible intuitive explanation—throws a different light on the relative potency of monetary and fiscal policy instruments. Judging from their effects on the equilibrium level of consumption, bond financing of budget deficits then turns out to be more stimulative than money financing. And, more significantly, open-market operations then become not only ineffective, but also capable of producing perverse results.

II. WEALTH AND PERCEIVED WEALTH

A. Wealth

Private net wealth is usually defined as private claims not offset by counterpart private liabilities. Using lower-(upper-) case letters to denote real (nominal) variables—excepting certain standard symbols—we may write the equation

(1) $$w \equiv W/P \equiv V/P + B/rP + H/P,$$

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where w = real private net wealth, W = nominal private net wealth, P = price level, V = nominal market value of equities, B = number of privately held government bonds, each yielding an annual interest of one dollar in perpetuity, r = nominal interest rate, and H = nominal value of high-powered money. The value of equities is linked to the capital stock K by Tobin's q:

$$\text{(2)} \qquad V/P = qK/P = qk,$$

where k = real capital stock. Thus we can also express w by

$$\text{(3)} \qquad w \equiv qk + B/rP + H/P.$$

B. Perceived Wealth—The Stock Aspect

When tax discounting of government bonds and the Pesek-Saving effect exist, the nominal values of the bond stock B/r and the money stock H need to be duly modified.

Following Sargent (1979, p. 39), assume that the existing stock of government bonds is never retired and that a constant nominal interest rate r is used in the discounting process. Then the present value of the future interest expense associated with that bond stock, r(B/r) = B, is

$$\text{(4)} \qquad PV(B) = \int_0^\infty Be^{-r\tau}\,d\tau = B/r,$$

where τ is time. The constant nominal interest rate to be used in the discounting process should be a long-run expected average interest rate. But if static (naive) expectation prevails, this interest rate will be the same as the current interest rate at the time of discounting. Now let $(1 - \beta)$ represent the fraction of PV(B) that the private sector perceives to be a liability that offsets their bond wealth. Then the perceived nominal value of government bonds should be

$$\text{(5)} \qquad (B/r)^p = B/r - (1 - \beta)PV(B) = B/r - (1 - \beta)(B/r) = \beta(B/r),$$

where $0 \leq \beta \leq 1$. Note that β is a perception parameter that indicates the fraction of bond value perceived by the private sector to be wealth; $\beta = 1$ implies no tax discounting, whereas $\beta = 0$ means complete tax discounting of government bonds. We view the economy as consisting of two types of people; (a) forward-looking people who are capable of anticipating the tax implications of bond servicing, and (b) people who are not so "forward-looking." The value of β is an average measure of the overall "forward-lookingness" of the private sector.

The Pesek-Saving effect modifies the value of high-powered money H. By the usual definition of private net wealth, high-powered money should be counted as wealth, but demand deposits should not, since depositors' claims are always exactly offset by the banks' liabilities. Pesek-Saving (1967) argue, however, that the creation of deposit money generates increased bank earnings, and since the capitalization of such earnings causes the private sector to feel richer, demand deposits ought to be included in wealth. From the opposing view, such as Smith (1970), it is propounded that deposit money is not costless to produce, so that when total deposits change in magnitude, there is little if any change in the market value of bank ownership. According to Smith, perceived money, H^p, should be equal to H. But, Pesek-Saving would argue that $H^p = H + (1 - r_d)D$, where r_d = the reserve ratio, and D = demand deposits. To link D to H, we can make use of the notion of a deposit-expansion multiplier, m. Since D = mH, it follows that

$$H^p = [1 + m(1 - r_d)]H,$$

which is always greater than H because m > 0 and $r_d < 1$. In order to accommodate the various conceivable values of H^p, let us introduce a new perception parameter, μ, to denote the proportion (multiple) of H that the private sector perceives to be wealth as a result of the Pesek-Saving effect. Thus, we have[2]

$$\text{(6)} \qquad H^p = \mu H, \qquad (1 \leq \mu \leq 1 + m - mr_d).$$

Apart from the multiplier μ, however, the H expression in (6) would require yet another modification, if inflation expectations could cause a downward revision in the perceived value of H on account of the expected inflation tax on the money held. Let π denote the expected rate of inflation at some point of time. Then the present value of the future expected inflation tax on the existing stock of high-powered money at that point of time can be expressed as

$$\text{(7)} \qquad PV(\pi H) = \int_0^\infty \pi He^{-r\tau}\,d\tau = (\pi/r)H,$$

where the nominal interest rate is used to discount the stream of future expected inflation rates.[3] The constant expected inflation rate used in the calculation of the future expected inflation tax should be a long-run expected average inflation rate. But if static (naive) expectation is assumed, the value of π will be the same as the actual rate of inflation at the time of discounting.[4] Let $(1 - \epsilon)$ be the fraction of $PV(\pi H)$ that the private sector perceives would entail a loss of purchasing power. Then the H variable must be replaced by the expression

$$\text{(8)} \qquad H^* = H - (1 - \epsilon)PV(\pi H) = H - (1 - \epsilon)(\pi/r)H = [1 - (1 - \epsilon)(\pi/r)]H.$$

Substituting H^* for H in (6), we obtain the new version of the perceived value of high-powered money

$$\text{(9)} \qquad H^p = \mu[1 - (1 - \epsilon)(\pi/r)]H,$$

where $0 \leq \epsilon \leq 1$. The symbol ϵ is another perception parameter akin to β in (5); $\epsilon = 1$ implies no expected-inflation discounting, whereas $\epsilon = 0$ means complete expected-inflation discounting of money.[5] Similarly to β, the value of ϵ represents the average measure of the "forward-lookingness" of the private sector, this time with regard to the expected inflation tax on money.

Replacing the (B/r) and H terms in (3) by their perceived counterparts, we can therefore write the following for the perceived private net real wealth:

$$\text{(10)} \qquad w^p = qk + \beta(B/rP) + \mu[1 - (1 - \epsilon)(\pi/r)]\,(H/P).$$

C. Perceived Wealth—The Flow Aspect

The above discussion shows how wealth perception might modify the stock variables (B/rP) and (H/P). But wealth perception also produces flow effects because of the dynamic link between wealth (stock) and saving (flow): $dw/d\tau = s$, where τ is time. If perceived wealth w^p differs from accounting wealth w, then $dw^p/d\tau \neq dw/d\tau$, and wealth perception will affect saving and, by implication, consumption as well.

To see the specific nature of the flow effect, we differentiate (10) with respect to time, to get (after rearrangment)

$$\text{(11)} \qquad \dot{w}^p = q\dot{k} + \dot{q}k + \beta(\dot{B}/rP) - \beta(\dot{r}/r + \dot{P}/P)(B/rP) + \mu[1 - (1 - \epsilon)(\pi/r)](\dot{H}/P) + \mu[(1 - \epsilon)(\pi/r)(\dot{r}/r + \dot{P}/P - \dot{\pi}/\pi) - \dot{P}/P](H/P),$$

where the over-dot denotes the operator $d/d\tau$. In deriving (11), we have held constant the perception parameters β (bonds), μ (money à la Pesek-Saving), and ϵ (inflation expectations), but have allowed everything else to vary. Assuming static expectation, we can equate π with $\dot{P}/P$. Then (11) can be rewritten as

$$\text{(12)}\quad \dot{w}^p = q\dot{k} + \dot{q}k + \beta(\dot{B}/rP) - \beta(\dot{r}/r + \pi)(B/rP) + \mu[1 - (1 - \epsilon)(\pi/r)](\dot{H}/P) + \mu[(1 - \epsilon)(\pi/r)(\dot{r}/r + \pi - \dot{\pi}/\pi) - \pi](H/P).$$

Of the six terms on the right-hand side, three involve the wealth-stock variables k, (B/rP), and (H/P); the other three relate to the time derivatives (flow aspects) of those stock variables. All of these would have a bearing on the consumption function.

III. THE CONSUMPTION FUNCTION

When perceived wealth differs from accounting wealth, the consumption function should be written as $c = c^p(y_d^p, w^p)$ instead of $c = c(y_d, w)$. The reason for the substitution of w by w^p is self-evident, but the y_d^p term (perceived disposable income) deserves a word of explanation.

A. Perceived Disposable Income

The equation $\dot{w} = s$, which links wealth stock to saving flow, implies a similar equation $\dot{w}^p = s^p$ in the present framework. The perceived disposable income is simply the sum of real consumption c and the perceived saving s^p:

$$\text{(13)}\quad y_d^p = c + s^p = c + \dot{w}^p,$$

where we can substitute (12) for the $\dot{w}^p$ expression. Before doing this substitution, however, let us first note that by using the identity $i = \dot{k}$ (real investment = rate of change of real capital stock), and the government-budget constraint

$$\text{(14)}\quad g - t = \dot{B}/rP + \dot{H}/P$$

(real deficit = real new issues of bonds and money), we can express the actual disposable income as

$$\text{(15)}\quad y_d = y - t = c + \dot{k} + g - t = c + \dot{k} + \dot{B}/rP + \dot{H}/P.$$

Thus, we can add y_d to, and subtract $(c + \dot{k} + \dot{B}/rP + \dot{H}/P)$ from, the right-hand side of (13) without affecting its magnitude. We can then substitute (12) into (13), and obtain an expression for y_d^p that reveals how it differs from y_d:

$$\text{(16)}\quad y_d^p = y_d + (q - 1)\dot{k} - (1 - \beta)(\dot{B}/rP) + \{\mu[1 - (1 - \epsilon)(\pi/r)] - 1\}(\dot{H}/P) + \dot{q}k - \beta(\dot{r}/r + \pi)(B/rP) + \mu[(1 - \epsilon)(\pi/r)(\dot{r}/r + \pi - \dot{\pi}/\pi) - \pi](H/P).$$

One interesting feature of (16) is that the perceived disposable income contains wealth effects in both their stock and flow aspects. This implies that wealth effects can enter into the consumption function via the y_d^p argument even if the wealth argument itself is omitted. And this is true for all three types of assets (k, B/rP, and H/P). For capital, the flow effect (the $\dot{k}$ term) will disappear only if $q = 1$, and the stock effect (the k term) will be absent only if q is constant. For government bonds, the flow effect (the $\dot{B}$/rP term) will be present as long as $\beta < 1$, but the stock effect (the B/rP term) can exist even if $\beta = 1$ (no tax discounting). Finally, for high-powered money, the flow effect (the $\dot{H}/P$ term) will vanish if $\mu = 1$ (no Pesek-Saving effect) and $\epsilon = 1$ (no expected-inflation discounting of money), but, again, the stock effect (the H/P term) can remain nonzero even if $\mu = \epsilon = 1$.

B. The Consumption Function

On the basis of y_d^p in (16) and w^p in (10), let us specify a consumption function that encompasses all the potential wealth-flow and wealth-stock effects. For simplicity, we shall assume that the "propensity to spend out of resources," denoted by σ, is a constant. But, the coexistence of the (perceived) income and wealth arguments in the consumption function necessitates the use of two separate propensities, σ_y and σ_w, where the subscripts refer to income and wealth, respectively. The symbol σ_y, which may be identified with the standard marginal propensity to consume, should be a positive fraction (closer to one than to zero). On the other hand, σ_w is expected to be a much smaller positive fraction, because an individual's wealth is to be consumed not all at once, but over an entire lifetime.

Applying these two propensities, respectively, to the w^p expression in (10) and the y_d^p expression in (16), and upon rearranging, we finally obtain the desired consumption function

$$\text{(17)}\quad c = a + \sigma_y y_d - \sigma_y(1 - q)\dot{k} - \sigma_y(1 - \beta)(\dot{B}/rP) - \sigma_y(1 - \delta)(\dot{H}/P) + q\,[\sigma_w + \sigma_y(\dot{q}/q)]k + \beta[\sigma_w - \sigma_y(\dot{r}/r + \pi)](B/rP) + \delta\{\sigma_w - \sigma_y[\pi + (1 - \mu/\delta)(\dot{r}/r - \dot{\pi}/\pi)]\}(H/P),$$

where $\delta \equiv \mu[1 - (1 - \epsilon)(\pi/r)]$.

This function gives a complete picture of how the wealth-perception parameters β, μ, and ϵ analytically enter into the determination of consumption expenditure. The empirical significance of these parameters, however, can only be ascertained by means of an econometric investigation. We are, of course, particularly concerned with the effects of expected inflation. But, since the existing empirical studies on the β parameter (tax discounting of bonds) yield such diverse conclusions—with Tanner (1970) (1979a) claiming almost complete tax discounting, Yawitz-Meyer (1976) finding no evidence of any tax discounting, and Seater (1982) obtaining conflicting results depending on the definition of consumption expenditure adopted[6]—we are certainly also interested in finding out how the β parameter would fare in a model that explicitly considers inflation expectations.

IV. THE EMPIRICAL EVIDENCE

To facilitate the econometric analysis, we shall first simplify (17). Because of possible adjustments in r, P, q, and π, the definition of perceived disposal income in (16) includes the real stocks of capital, government bonds, and high-powered money, modified by coefficients involving the time derivatives of the afore-mentioned variables. In the econometric analysis that follows, we assume that these coefficients are constants; i.e., we are estimating the average value of each coefficient over the sample period. Then (17) can be rewritten in a more compact form as

$$\text{(18)}\quad c = a + \sigma_y y_d - \sigma_y(1 - q)\dot{k} - \sigma_y(1 - \beta)(\dot{B}/rP) - \sigma_y(1 - \delta)(\dot{H}/P) + q(\sigma_w + \sigma_y\gamma_k)k + \beta(\sigma_w - \sigma_y\gamma_b)(B/rP) + \delta(\sigma_w - \sigma_y\gamma_h)(H/P),$$

where

$$\gamma_k = \dot{q}/q, \qquad \gamma_b = \dot{r}/r + \pi,$$

and

$$\gamma_h = \pi + (1 - \mu/\delta)(\dot{r}/r - \dot{\pi}/\pi).$$

Given a constant term plus seven coefficients of the independent variables, it is not possible to identify the nine parameters contained in (18). To remedy the situation, we need to introduce an additional constraint. Since our major concern is about the expected-inflation discounting of high-powered money and the tax discounting of government bonds, it seems that the most innocuous place to impose that constraint is on the capital side. We choose, therefore, to restrict Tobin's q to be a constant ($\gamma_k = 0$).

A. The Data

In choosing the data for the estimation of (18), the first question to settle is the proper definition of c. Yawitz-Meyer (1976) define this variable to be "total consumption," which includes the purchases of consumer durables. Kochin (1974), on the other hand, defines it to mean only the expenditure on nondurables and services. And Seater (1982) and Seater-Mariano (1985) employ both definitions. We prefer Kochin's choice, because purchases of durables are more properly identified with saving. The information used to calculate the consumption series as well as the disposable-income series are obtained from *The Economic Report of the President* (1983). The data employed are annual observations from 1948 to 1979.[7] All variables, including those yet to be discussed, are deflated by the implicit price deflator of nondurables and services.

For government bonds B/rP, we adopt the December-market-value series of privately-held federal debt provided by Cox-Hirschhorn (1983, p. 268, Table 6), duly deflated. While desirable as a stock series, these figures unfortunately do not allow us to calculate a $\dot{B}$/rP series by taking the first differences of B/rP. This is because the difference between the market values of bonds in two consecutive years reflects not only the amount of bonds newly issued, but also the change in market valuations of the bonds already outstanding. For this reason, we measure $\dot{B}$/rP separately, by first calculating the private holdings of the federal debt measured at par, then taking first differences, and then deflating the result. We have also tried an alternative measure of $\dot{B}$/rP in our estimation. From the national-income-accounts federal deficit figures, we subtract $\dot{H}$/P (see below for the definition of $\dot{H}$/P) to produce the alternative measure. The results of estimation using the new $\dot{B}$/rP measure turn out to be essentially the same as those using the other $\dot{B}$/rP measure; both are reported in Table I.

On the money side, we also find it necessary to gather the stock and the flow data separately. The stock H/P is proxied by the deflated value of unborrowed base money (from various issues of the *Federal Reserve Bulletin*), which is chosen in preference to the total (borrowed and unborrowed) base money, because borrowed reserves would represent a private asset carrying an offsetting private liability, and hence would not qualify as a wealth item as we have defined it. At first glance, there would seem to be nothing wrong with taking the first differences of two consecutive H observations to arrive at the $\dot{H}$ figure. But, since we wish to capture the money-financed portion of deficits rather than changes in H due to other factors (such as adjustment in "float"), it is more appropriate to proxy $\dot{H}$ by the change in Federal Reserve Banks' holdings of the federal debt, which is then deflated to yield $\dot{H}$/P. The calculations for $\dot{B}$/rP and $\dot{H}$/P are based on information in *The Economic Report of the President* (1983).

Finally, for the stock of K, we use the net stock of fixed nonresidential business capital and

TABLE 1

	Col. 1	Col. 2	Col. 3	Col. 4
a	0.2399	0.2237	0.0406	0.0308
	(1.01)	(0.96)	(0.59)	(0.52)
σ_y	0.6859*	0.6923*	0.6454*	0.6609*
	(21.54)	(23.67)	(15.77)	(18.86)
σ_w	0.0480*	0.0458*	0.0581*	0.0538*
	(3.52)	(3.73)	(3.82)	(4.10)
q	0.9560*	0.9515*	0.9717*	0.9608*
	(39.16)	(36.93)	(33.87)	(32.89)
β	0.9109*	0.9053*	0.8587*	0.8508*
	(9.04)	(8.82)	(8.41)	(8.41)
δ	−0.4499	−0.5067	−0.1971	−0.3113
	(−1.41)	(−1.56)	(−0.71)	(−1.04)
γ_b	−0.0481	−0.0496		
	(−0.67)	(−0.71)		
γ_h	−1.3371	−1.1238		
	(−1.51)	(−1.45)		
$\hat{\rho}$	0.4529*	0.4132**	0.6437*	0.5762*
	(2.16)	(1.92)	(3.60)	(3.17)
$\bar{R}^2$	0.9996	0.9996	0.9995	0.9995
F	8742	8772	10,938	10,896
D.W.	1.7541	1.7679	1.6892	1.7258

All regressions are run on the Times Series Processor (TSP), version 3.5B (September 1980). Numbers in parentheses under coefficient estimates are z-statistics. Tests for a, β, δ, γ_b, and γ_h are two-tailed; other tests are one-tailed. Columns 1 and 3 employ the privately-held federal-debt measure of $\dot{B}$/rP while Columns 2 and 4 employ the national-income-accounts federal-deficit measure. The coefficient $\hat{\rho}$ is the estimated autocorrelation parameter. It is estimated jointly with the other parameters using the LSQ procedure in TSP.

The LSQ procedure does not report $\bar{R}^2$ and F statistics. The numbers reported are approximations as follows:

$$\bar{R}^2 = 1 - SSR/(T - K)SDS,$$
$$\text{and } F = (T - K)[(T - 1)SDS - SSR]/(K - 1)SSR,$$

where SSR = sum of squared residuals, T = number of observations, K = number of parameters estimated, and SDS = standard deviation squared.

Finally, D.W. is the Durbin-Watson statistic.

*The coefficient is significantly different from zero at the five-percent level.

**The coefficient is significant at the ten-percent level.

residential housing given by Musgrave (1981), deflated as the other variables. And $\dot{k}$ is obtained by taking the first difference of K, which is then deflated.

B. The Results and Their Interpretation

We estimate (18) by means of a nonlinear estimation routine, so that intra-equation parameter restrictions can be imposed. When the restriction $\gamma_k = 0$ is used alone without any other constraints, we obtain the results shown in Columns 1 and 2 of Table I. These two columns differ by the way $\dot{B}$/rP is measured. In Column 1, $\dot{B}$/rP is calculated from changes in private holdings of federal debt; in Column 2, $\dot{B}$/rP is derived from the national-income-accounts federal deficit figures. It turns out that, in both columns, the coefficients γ_b and γ_h are not significantly different from zero at the ten-percent level. For this reason, we also estimate (18) with the additional restrictions $\gamma_b = \gamma_h = 0$. The results are reported in Column 3 (corresponding to Column 1) and Column 4 (corresponding to Column 2).

We note that the intercept term is never significant at the ten-percent level. The estimated values for σ_y (roughly between 0.65 and 0.7) and σ_w (roughly between 0.045 and 0.06) are all significantly positive at the five-percent level. Moreover, they are in line with previous works. In particular, our range on σ_w lies above Yawitz-Meyer's estimate of 0.03 (1976, p. 253) and Tanner's figures of 0.028 [1979a, p. 217, eq. (4)] and 0.035 [1979b, p. 319, eq. (4)], but below Ando-Modigliani's general range of 0.07 to 0.08 (1963, p. 71).

Tobin's q is estimated to be positive and highly significant, but slightly less than one. A formal test of the hypothesis that $q = 1$ reveals, however, that q is less than one at the ten-percent level for Columns 1 and 2 only. In addition, q is never significantly different from one at the five-percent level.

As regards the tax discounting of government bonds, we find that β is significantly greater than zero at the five-percent level in all four columns. Besides, we are unable to reject at the ten-percent level the hypothesis that $\beta = 1$ in any of the four cases. Consequently, we find little evidence of tax discounting of government bonds.

Finally, we come to the issue of expected-inflation discounting of high-powered money. This issue revolves around the parameter ϵ, which we can analyze on the basis of the estimate of $\delta = \mu[1 - (1 - \epsilon)(\pi/r)]$. In all four columns of Table I, δ is not significantly different from zero at the ten-percent level. In fact, all four values of δ are negative. To deduce the value of ϵ, let us first examine the case of $\delta = 0$. Since μ is positive [see eq. (6)], we have $1 - (1 - \epsilon)(\pi/r) = 0$, or

$$\epsilon = 1 - r/\pi. \tag{19}$$

There exist three possibilities: (a) If $r = \pi$, then $\epsilon = 0$, implying complete expected-inflation discounting of high-powered money. (b) If $r > \pi$, and if there is positive inflation, then $\epsilon < 0$, implying more than complete discounting of high-powered money.[8] (c) If (and only if) $r < \pi$—a somewhat unusual situation—then $0 < \epsilon < 1$, so that expected-inflation discounting is less than complete. Note, also, that the complete absence of expected-inflation discounting would, according to (19), require that $r = 0$, which is a practical impossibility. Furthermore, if δ is indeed negative (rather than zero as assumed above), then the implied value of ϵ will become even smaller, thus further intensifying the expected-inflation discounting effect.

In sum, our empirical evidence points to little or no tax discounting of government bonds, but significant and possibly complete expected-inflation discounting of high-powered money. This suggests that the private sector is more cognizant of the implicit tax of inflation on money holdings than it is of the implicit future tax associated with bond-financed deficits.[9]

The fact that the private sector should behave so differently with respect to the two assets, money and bonds, may at first glance seem surprising. A moment's reflection, however, will suggest the following plausible intuitive explanation. The incidence of the expected inflation tax is strictly proportional to the amount of high-powered money held. Thus all money-holders, facing the same proportional inflation tax, may be expected to be reasonably aware of the tax burden involved. In contrast, the incidence of the implicit future tax on bonds is not tied to bond ownership. Hence, bondholders, who do not have to bear the full tax burden, need not be overly concerned about it, and yet at the same time, nonbondholders, with no bonds in their possession, may be quite ignorant about the tax burden associated with government bonds that they eventually may bear. Consequently, the overall concern about the bond-servicing tax burden

may be very low. This explains why the average measures of the "forward-lookingness" with regard to the two assets could indeed turn out to be so widely apart.

V. MACROECONOMIC POLICY IMPLICATIONS

Macroeconomic policies produce their effects by, among other things, encouraging or discouraging expenditure, including consumption. When the traditional consumption function is replaced by one with wealth-perception arguments, it is only natural to expect the effectiveness of the various macroeconomic policy instruments to be affected. As it turns out, our empirical results imply far-reaching changes in the relative potency of the policy instruments.

A. The Equilibrium Level of Consumption

The traditional consumption function can be written in the linear form as $c = a + \sigma_y y_d + \sigma_w w$. Substituting (3) for w, and (15) for y_d, and then solving for c, we obtain the equilibrium level of consumption[10]

$$\bar{c}_{trad} = [a + \sigma_y(\dot{k} + \dot{B}/rP + \dot{H}/P) + \sigma_w(qk + B/rP + H/P)]/(1 - \sigma_y). \tag{20}$$

This expression gives the equilibrium consumption based on traditional accounting wealth. Note that, by using (15), which involves the government-budget constraint, we have explicitly introduced the $\dot{B}/rP$ and $\dot{H}/P$ terms into (20). This is essential for the purpose of our policy analysis, for the latter two terms embody the two modes of financing a government deficit (bond versus money financing). Together, they also provide the instruments for open-market operations.

When the consumption function is based instead on perceived wealth, we have the complicated expression in (18). To simplify it, let us put into service our empirical findings, and assume the extreme case where $\beta = 1$ and $\delta = 0$. We shall also assume that $\gamma_k = \gamma_b = \gamma_h = 0$, and $q = 1$. Then, by substituting (15) for y_d again, and solving for c, we obtain the equilibrium consumption based on perceived wealth

$$\bar{c}_{per} = [a + \sigma_y(\dot{k} + \dot{B}/rP) + \sigma_w(k + B/rp)] /(1 - \sigma_y). \tag{21}$$

This result differs sharply from (20). Whereas the $\dot{B}/rP$ and $\dot{H}/P$ terms enter into (20) in a perfectly symmetrical manner, they do not in (21). In fact, the $\dot{H}/P$ term is altogether missing from (21). How does this difference affect the effectiveness of various policy measures?

B. Bond-Financed Budget Deficits

Let there be an increment to the deficit, $d(g - t)$, entirely financed by bond issue. Then $d(\dot{B}/rP) = d(g - t)$, but $d(\dot{H}/P) = 0$. From the traditional result (20), we observe a stimulative comparative-static effect on equilibrium consumption equal to $[\sigma_y/(1 - \sigma_y)]d(g - t)$, where the $\sigma_y/(1 - \sigma_y)$ expression is the multiplier.

It happens that exactly the same effect emerges from the alternative version (21). This is due to the fact that the complete absence of tax discounting of bonds is assumed. If some tax discounting exists, then this stimulative effect would be attenuated somewhat under (21). Our empirical evidence, however, suggests little if any tax discounting of bonds.

C. *Money-Financed Budget Deficits*

If the same deficit increment $d(g - t)$ is financed by money creation, we have instead $d(\dot{H}/P) = d(g - t)$, but $d(\dot{B}/rP) = 0$. From the traditional result in (20), the stimulative comparative-static effect is again equal to $[\sigma_y/(1 - \sigma_y)]d(g - t)$. This implies that the mode of financing the deficit is immaterial, and only the magnitude of the deficit matters.

But our alternative result in (21) tells a much different story. Since the $\dot{H}/P$ term is absent, money-financed budget deficits do not bring about any stimulative effects on equilibrium consumption at all. This conclusion is noteworthy, because in the perceived-wealth framework, with high-powered money discounted but government bonds undiscounted, a bond-financed deficit is now seen to be the more potent stimulative policy on equilibrium consumption than a money-financed deficit, which is at variance with the conventional wisdom.

D. *Open-Market Operations*

An open-market operation—say, a purchase—involves an even exchange of H/P for B/rP. That is, $d(\dot{H}/P) = -d(\dot{B}/rP)$. Such an exchange leaves a neutral effect on the traditional result (20), because of the perfect symmetry between the $\dot{H}/P$ and $\dot{B}/rP$ terms.

When that symmetry is lost, as in our alternative result (21), the open-market purchase does produce an effect on equilibrium consumption equal to $-[\sigma_y/(1 - \sigma_y)]d(\dot{B}/rP)$. What is so striking about this outcome is its negative sign: A supposedly stimulative policy measure has brought about a decline in equilibrium consumption! The dramatic way this perverse effect appears here is partly due to the fact that we are dealing with the extreme case of $\beta = 1$ and $\delta = 0$. But even if some tax discounting of government bonds is admitted, and simultaneously the expected-inflation discounting of high-powered money is made less than complete, the qualitative distinction between our new result (21) and the traditional result (20) will remain. In particular, the possibility of a perverse effect on equilibrium consumption from open-market operations cannot be dismissed.

VI. CONCLUSION

By incorporating inflation expectations into the framework of wealth perception, we have broadened that framework from the tax discounting of government bonds and the Pesek-Saving effect to the inclusion of expected-inflation discounting of high-powered money. Empirically, we find in this new setting little or no evidence of tax discounting of government bonds, but the expected-inflation discounting of high-powered money turns out to be overwhelming. This finding has important implications with regard to the relative potency of various macroeconomic policy instruments as far as equilibrium consumption is concerned. In contrast to conventional belief, bond-financed budget deficits now appear as the more stimulative policy than money-financed deficits. More strikingly, open-market operations are found to be able to produce perverse effects on equilibrium consumption.

FOOTNOTES

1. It may be noted that Kochin (1974, p. 388) does discuss the possibility that the issuance of money may result in an increase in the price level, which amounts to a tax on money balances. We are here concerned with, not the actual inflation, but the subjective expectations of it. Also, Seater (1982, pp. 377–8) does discuss the theoretical effects of expected-inflation discounting of money. His discussion, however, is employed only to obtain information about the discounting of bonds, which is the focus of his paper. Thus, while he draws conclusions about the tax discounting of bonds, there are no conclusions concerning the expected-inflation discounting of money.

2. Equation (6) is equivalent to the expression $(1 + \omega)B$ used by Brunner-Meltzer [1972, p. 955, eq. (4)], where ω = the ratio of the banking system's net worth to the monetary base B. Brunner-Meltzer believe that it is the value of the monopoly power of the banking firms that contributes to the positive value of ω, a position also shared by Patinkin (1965).
3. Since we are ultimately interested in the perceived *real* values of bonds and money, it may seem more appropriate to calculate instead $PV(\pi H/P)$, the present value of the *real* expected future inflation tax in (7), and calculate $PV(B/P)$, the present value of the *real* future interest expense in (4). But if we do that, we need to employ the *real* interest rate in the discounting process, because if we want to purge a cash flow of the expected inflation effects, then we must purge the discount rate as well. The net result is the same as using the nominal values of interest expense and inflation tax, as in (4) and (7), and then deflating the results of (4) and (7) by P, as we show later in (10).

   This can be seen from the real-value versions of (4) and (7):

   $$PV(B/P) = \int_0^{\infty} (B/P_o e^{\pi\tau}) e^{-(r-\pi)\tau}\, d\tau = B/rP_o \qquad (4')$$

   and

   $$PV(\pi H/P) = \int_0^{\infty} (\pi H/P_o e^{\pi\tau}) e^{-(r-\pi)\tau}\, d\tau = (\pi/r)(H/P_0) \qquad (7')$$

   where $P = P_0 e^{\pi\tau}$, P_0 = the price level at the time of discounting, and $r - \pi$ = the real interest rate. The results in (4′) and (7′) are nothing but the deflated versions of the results in (4) and (7), respectively.
4. To calculate the present values in (4) and (7), we need to specify the time paths for π and r. The simplest assumption is that π and r are expected to remain constant into the future. Constant time paths of π and r enable us to obtain closed-form solutions for the discounted values. To allow other expected time paths would not vitiate the concept of discounting, but would immeasurably complicate the task of integration. For this reason, the assumption of a constant discount rate has been a standard practice in the literature on the tax discounting of government bonds. Here we adopt this practice, and also extend it to the expected-inflation discounting of money.

   Ideally, the constant π and r values to be used are the long-term expected average inflation rate and nominal interest rate. For simplicity, we assume static expectation, which serves to link the constant time paths of π and r to the specific inflation rate and nominal interest rate that are current at the time of discounting. This assumption does not conflict with the fact that π and r themselves can change over time. As time passes and as the discounted values are recalculated at another point of time, the constant paths of π and r selected will be at new levels prevailing at the new time of discounting.
5. Note that while the procedures for calculating PV(B) and $PV(\pi H)$ are basically the same, the resulting perceived values $(B/r)^p$ and H^p differ from each other in one significant respect. For bonds, if the private sector completely discounts the future interest expenses ($\beta = 0$), the entire bond value will be viewed as non-wealth, i.e., $(B/r)^p = 0$. In contrast, for money, even if the future lost purchasing power is completely discounted ($\epsilon = 0$), H^p will not be zero provided the expected rate of inflation π and the rate of discount r have different values. In particular, as long as $\pi < r$, H^p will be positive, and money will appear as an item in perceived wealth, even if expected-inflation discounting is complete.
6. Seater (1982) finds full tax discounting when *total* consumption expenditure is used, but no tax discounting when the expenditure on consumer durables is excluded. In a more recent paper, Seater-Mariano (1985) claim to find complete tax discounting for both measures of consumption. Their conclusion may be too strong, however, since the regression that excludes consumer durables has none of the coefficients significant.
7. We end the data series with the year 1979 because the capital-stock series we employ extend only to 1979.
8. This would be in line with Seater's (1982, p. 377) suggestion that the expected-inflation discounting of money might be more than complete.
9. Unfortunately, our econometric results do not allow us to draw any inferences about μ, the Pesek-Saving parameter. It could be one, or much greater than one, and would still be consistent with

our econometric results. We note here, however, that Tanner (1970) concludes that the Pesek-Saving effect is small on the basis of Canadian data.

10. Note that, deviating from the usual practice, we substitute the expenditure identity (15) into the consumption function, rather than the converse. Thus, we obtain the equilibrium level of consumption rather than income. We do this primarily because the focus of our paper is on the influence of the different perception effects on the consumption function. If desired, a similar discussion examining equilibrium income can easily be undertaken.

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