Nominal Interest Rate Effects on Real Consumer Expenditure

By James A. Wilcox*

Expenditures by consumers are generally thought to be affected by interest rates. In practice, econometric models have come to focus on the effects of expected, after-tax, real *interest rates on households' purchases of durable goods. However, the empirical evidence presented here shows that interest rates have powerful effects on consumption, but they operate through* nominal, *not real, interest rates. Moreover, these nominal interest rate effects are not confined to spending for durables, but have equally important effects on spending on nondurables and services. These effects are presumed to arise because the household sector becomes increasingly borrowing-constrained as* nominal *interest rates rise and lenders impose limits on interest rate payments as a percent of income. Such liquidity constraints make consumer spending depend importantly on nominal interest rates and actual household cash flow. These factors are more easily measured and forecasted than the variables that theory and much practice suggest are relevant.*

IT IS COMMONLY claimed that interest rates affect households' spending, and therefore their saving decisions. Theory and practice both point to the real, as opposed to the nominal or market, interest rate as being the relevant concept and measure. More specifically, it has become conventional wisdom that higher real, after-tax interest rates lead consumers to tilt toward saving more and spending less. The household spending category thought to be especially influenced by real interest rates is expenditure for durable goods.[1]

Events have outrun evaluation, however. Even a cursory examination of the recent record renders the conventional view unpalatable. For the past decade, real, after-tax interest rates have been historically high. Contrary to what the conventional view would have predicted, however, we also have had high consumer debt ratios, overall consumption ratios, and durable goods expenditures. In general, econometric models also have tended to underforecast household consumption expenditures and overpredict saving rates during this period.

This article presents some evidence and an explanation for finding that it is nominal, as opposed to real, interest rates that most influence consumer spending and saving. The next section presents econometric support for the relevance of nominal interest rates and the irrelevance of real rates to consumer spending generally. The proposed explanation follows. It hinges on the widespread lenders' practice of granting credit subject to payment-to-income limits. That practice effectively constrains an important number of households to act as if they wish to reduce consumption when nominal interest rates rise. This effect operates quite apart from whether households prefer to alter their consumption expenditures in response to changes in real interest rates. The concluding section draws some implications from our findings for business forecasting.

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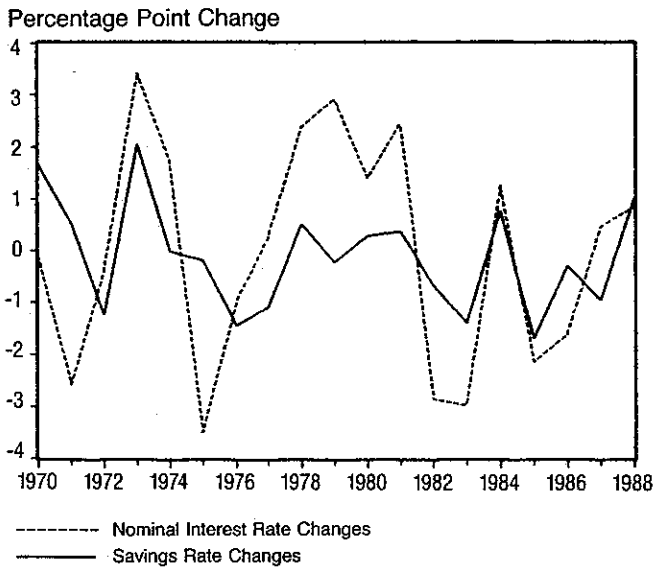
[1]See footnotes and references at end of text.

INTEREST RATES DO AFFECT CONSUMPTION

First, we look at the simple relation between saving (and therefore, consumption) rates and interest rates. Figure 1 plots, for the 1970-88 period, the changes in the annual average of the conventionally reported household saving rate as a percent of personal disposable income (the solid line) and changes in the nominal interest rate (the dashed line). During this period, the correlation of changes in the saving rate with changes in the nominal interest rate was 0.51. These interest rates were not only associated with saving rates, but tended to lead them.[2] (For forecasting purposes, this can be useful indeed and is discussed below.)

Figure 1

Nominal Interest Rate Changes Lead Household Savings Rate Changes



This alone does not allow us to determine whether real or nominal rates are most relevant. A similar impression would have resulted if we had plotted expected, real, after-tax interest rates, whose correlation with the saving rate was 0.32. One reason for this is that, perhaps surprisingly, changes in nominal and in real interest rates were atypically highly correlated during the past two decades.

Table 1 shows that if, instead, we examine the same variables for the 1950-69 period, an even stronger, *negative* correlation between saving and expected, real, after-tax interest rates is found. Indeed, the one consistent correlation in Table 1 that emerges over both halves of the postwar period is between saving and expected inflation. This suggests that saving rates and consumption may have more to do with the difference between nominal and real interest rates, i.e., expected inflation, than with either measure of interest rates.

Table 1

The Correlations of Savings and Interest Rates Shift Over Time

Variable	Correlation with Household Saving Rate 1970-1988	1950-1969	1950-1988
Real, After-tax Interest	.32	−.49	−.11
Nominal Interest	.51	−.22	.32
Expected Inflation	.32	.44	.37

Spending and Interest Rates

We next turn to the econometric evidence on the relation between household spending and interest rates. To facilitate comparison to widely recognized econometric specifications, we adopt a fairly standard empirical model of consumption expenditures. Households are presumed to base their spending on their wealth, on their income, and on interest rates. A basic representation of that consumer expenditure process is:

$$(1)\quad CONS = a + b*SW + c*NSW + d*PDI + e*NIR + f*ERATIR$$

The consumer expenditure (CONS) and the personal disposable income (PDI) data were taken from the National Income and Product Accounts and were expressed as annualized, real, per capita, seasonally adjusted levels. The data for stock market wealth (SW) and non-stock market wealth (NSW) were taken from the Federal Reserve Bank of San Francisco's econometric model and data base and were expressed as real, per capita, not seasonally adjusted levels.[3] This specification does differ from convention in that both nominal and real interest rates variables are entered, thereby permitting the data to produce estimates of the relative importance of these factors. The not seasonally adjusted, annualized, investment yield on six-month commercial paper (NIR) is taken as the measure of the nominal interest rate.[4] The corresponding expected, real, after-tax interest rate (ERATIR) was computed by subtracting the Livingston Survey expected inflation series from the nominal interest rate, after multiplying the nominal interest rate by one minus the measure of the marginal income tax rate.[5]

Table 2 presents the results of estimating variants of the consumer expenditure function (1), using as the dependent variable the sum of personal con-

Table 2

Nominal Interest Rates Affect Consumer Spending on Nondurables and Services
Quarterly, 1955Q2-1989Q2
(t-statistics in parentheses)

	Constant	Stock Wealth	Other Wealth	Disposable Income	Nominal Interest Rate	Expected Real After-Tax Interest Rate	RHO	R^2	S.E.E.
1.	0.429 (0.88)	0.020 (3.17)	0.132 (4.20)	0.323 (3.07)	—	—	.962 (32.52)	.9995	0.0285
2.	0.460 (0.90)	0.019 (2.89)	0.131 (3.96)	0.327 (2.89)	—	−0.011 (−0.81)	.963 (30.67)	.9995	0.0287
3.	0.871 (0.88)	0.011 (1.48)	0.139 (3.45)	0.296 (2.80)	−0.030 (−3.13)	0.013 (0.81)	.977 (43.61)	.9996	0.0277
4.	0.794 (0.82)	0.011 (1.52)	0.140 (4.06)	0.297 (3.01)	−0.026 (−3.24)	—	0.974 (43.26)	.9996	0.0275

sumption expenditures on nondurables and services. The sample period used was 1955Q2-1989Q2. Estimates were obtained using ordinary least squares with allowance for first-order autocorrelation of the error term, with estimated coefficient rho. The income and interest rate variables are each entered in polynomial distributed lag form in order to allow for lags in forming permanent income estimates and in adjusting consumption patterns.[6] The sums of these lag coefficients are reported. T-statistics for coefficient sums appear in parentheses below their respective coefficients.

Row 1 in Table 2 shows that the wealth and income variables each significantly affect household expenditures for nondurables and services. Row 2 adds the expected, real, after-tax interest rate, which has a negative, but insignificant coefficient. Thus, adding the real interest rate fails to improve the fit of the equation. In fact, its impact is so weak that the standard error of the unexplained movements even rises slightly. Row 3 includes both real and nominal interest rates, thereby allowing the data to choose the most empirically relevant specification. In contrast, the real rate effect is estimated here to be *positive*, though it is just as insignificant as in row 1. In spite of the presence of the real rate, the nominal interest rate effect is clearly discernible and negative. Thus the data decidedly point to significant nominal interest rate and insignificant real rate effects on consumer spending on nondurables and services.[7]

Table 3 uses the same specifications as table 2, substituting as the dependent variable personal consumption expenditures on durables. The conclusions regarding durables are similar to those reached for nondurables and services. Row 1 shows the results obtained when neither interest rate term is included. Row 2 adds the expected, real, after-tax interest rate. As in Table 1, its effect is estimated to be negative, but insignificant. Surprisingly, in each of these top two rows the income term is insignificant. That is likely a hint that they reflect misspecification. Row 3 again pits the nominal against the real, after-tax interest rate. We again see that the real rate carries a positive coefficient, though it is now significantly so. Here again the bottom two rows show the powerful, depressing effect of nominal rates, this time on consumer spending on durables.[8]

The Evidence Summarized

Two features of these estimates run counter to conventional wisdom. First, nominal interest rates appear to be the channel through which interest rates impinge on each category of household spending and therefore on saving. In these specifications, there is no detectable effect of real rates. Second, and perhaps just as notable, the similar magnitudes of the nominal interest rate coefficients in Tables 2 and 3 means that spending on nondurables and services reacts about as strongly to interest rates as does spending on durables. Just as pertinent is that the standard error of the unaccounted for movement in durable spending is nearly the same as that for nondurables and services. This finding may reinforce the perspective that changes in consumer spending are importantly determined by changes in the de-

Table 3

Nominal Interest Rates Affect Consumer Spending on Durables
Quarterly, 1955Q2-1989Q2
(t-statistics in parentheses)

	Constant	Stock Wealth	Other Wealth	Disposable Income	Nominal Interest Rate	Expected Real After-Tax Interest Rate	RHO	R^2	S.E.E.
1.	−1.03	0.024	0.049	0.059	—	—	0.835	.9925	0.0311
	(−9.72)	(4.00)	(2.80)	(1.20)			(18.18)		
2.	−1.02	0.024	0.048	0.062	—	−0.003	0.840	.9926	0.0314
	(−9.03)	(3.78)	(2.64)	(1.20)		(−0.32)	(18.15)		
3.	−1.09	0.002	0.048	0.117	−0.037	0.022	0.362	.9948	0.0266
	(−34.23)	(0.41)	(8.22)	(5.86)	(−11.39)	(4.59)	(4.14)		
4.	−1.09	0.013	0.059	0.068	−0.029	—	0.550	.9941	0.0280
	(−25.45)	(3.46)	(8.93)	(3.49)	(−8.34)		(7.52)		

gree of constraint, as opposed to changes in expectations, which have largely been ignored here and which theory would suggest are more salient for spending on durables.

We also investigated whether the nominal interest rate was not exerting a direct and independent effect, but rather was serving as a proxy for either expected inflation or for actual inflation. To check on this, we reestimated versions of the bottom row of Tables 2 and 3, in turn either substituting or adding expected or actual inflation for the nominal interest rate. Including both the nominal interest rate and actual inflation did not clearly favor one over the other. In the nondurables and services equation, both became insignificant; in the durables equation, both were significant. The most powerful single explanatory variable of the three was the nominal interest rate: the standard error of the estimate was the lowest when the nominal interest was included in place of either the expected or actual inflation rate. Thus,the nominal interest rate seems most likely not to be proxying for other variables. Nor did tests reveal any evidence of instability of the nominal interest rate coefficients over time.

WHY NOMINAL INTEREST RATES AFFECT CONSUMPTION

One explanation for the relevance of the nominal, as opposed to the real, rate of interest is that lenders' imposition of payment-to-income limits constrains many households in the amount of credit they can obtain.[9] Lenders generally establish payment-to-income ceilings up to which they will grant credit. Such ratios change very infrequently and do not appear to be consistently related to the inflation rate, a primary source of nominal interest rate variation during the past few decades.

The practice of determining borrowing limits subject to payment-to-income ceilings is based typically on beginning-of-loan income and payments.[10] Payments are a function of the nominal interest rate. They have no intrinsic connection to the real interest rate. Therefore, changes in either household cash flow, due perhaps to temporary unemployment, or in nominal interest rates, due perhaps to expected inflation, will change the *real* amount of credit that will be extended to households. Collectively, even if the household sector has no intention of deferring consumption when real interest rates are higher, it will be constrained to spend less (and save more) than it wishes if nominal interest rates rise and they are constrained in the amount they can borrow. Aggregate consumption is suppressed more the higher nominal rates rise, as more and more households become, or fear they might become, borrowing constrained.

Consider what happens if the expected and actual wage and price inflation rates rise from, say, 4 percent to 6 percent. Lending criteria are unlikely to change to compensate fully for the higher inflation rates. Nominal interest rates will rise by some amount. Nominal interest rates on loans will rise, perhaps, from 10 to 12 percent. Incomes will be expected to grow at 6 percent per year, but for many, many months they will be at levels that are little different from where they started. Although dollar incomes will be considerably higher on average over the entire life of loans, they will not have

risen much initially, when loans are applied for. The percentage increase in payments per dollar borrowed, by contrast, will be much larger and will all take place immediately.

If a household was initially borrowing constrained, the amount of credit it will qualify for will fall appreciably. The reason is that payment-to-income is for all practical purposes determined by the ratio of the nominal interest rate to beginning-of-loan income. The former responds to the expected *change* in the level of prices, while the latter responds to the level of prices.

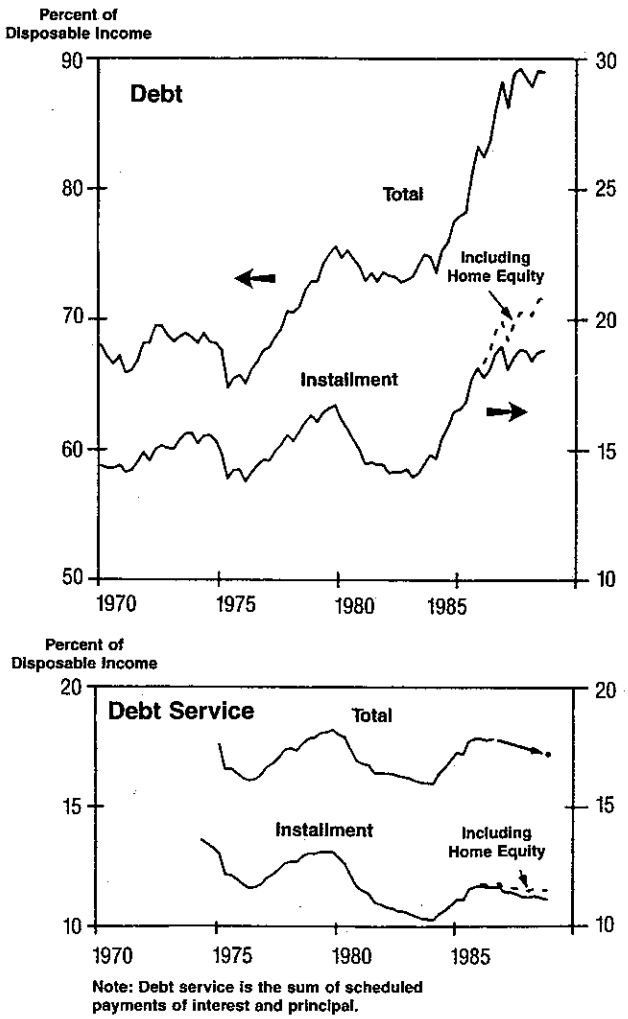
The peculiar, but traditional and near-universal, attachment to loan repayment schedules that provide for level dollar repayments is the fundamental source of this problem. In the presence of inflation, those level payments represent falling real payments over the life of the loan. Because later nominal repayments will be less in real terms, earlier ones must be greater to preserve the same real rate of interest on the loan. This phenomenon is familiar to virtually everyone who took out a mortgage in the past three decades; mortgage payments became easier and easier to make as dollar incomes rose. That stands in stark contrast to the remainder of household expenses, which rose over time with incomes and by definition with the overall level of prices.

Over time, in order to lessen the constraint the standard loan repayment schedule and their lending parameters impose, lenders might be expected to make lending policy parameters more "realistic." Payment-to-income ratios themselves might be adjusted to maintain optimal real borrowing limits. To the extent that nominal interest rates respond to expected inflation, we would expect such ratios to rise and fall with inflation. It does appear that on average, consumer credit parameters may have become somewhat looser in higher inflation periods. Such policies change so sluggishly in response to expected inflation that the aggregate borrowing constraint tightens as interest rates rise. Likewise, the extension of loan maturities may reflect an attempt to overcome the high initial real payments brought on by inflation. But loan maturities seem to have persistently lengthened during the past four decades, quite separately from the rise and fall of inflation.

How might we expect such constraints to manifest themselves? One way is in the behavior of debt-to-income and payment-to-income ratios. To the extent that lenders and households restrain credit as a function of payment-to-income ratios, we might expect to see greater stability in the aggregate payment-to-income ratio than in the debt-to-income ratio. In fact, the aggregate consumer payment-to-income ratio has shown remarkable stability. The much heralded increase in consumer debt burdens is depicted in Figure 2. As a percent of disposable income, both installment and total debt (which includes mortgages and other liabilities) rose dramatically, first in the late 1970s and again in the late 1980s.[11] The bottom panel in Figure 2 provides a very different view of the burden of consumer debt. Both debt service, or payment-to-income, ratios have moved relatively little, and have generally trended downward over the period. A study of consumer finances over the 1952-63 period showed that the aggregate payment-to-income ratio varied by only 2 percentage points, though the debt-to-income ratio varied considerably more.[12] Observing

Figure 2

Consumer Debt Service Ratios Trended Down as Debt Ratios Trended Up



Note: Debt service is the sum of scheduled payments of interest and principal.

SOURCE: McKelvey (1989).

that the payment-to-income ratio is more stable than the debt-to-income ratio does not imply that borrowing constraints are operative, but it is consistent with this perspective. Observing that the debt-to-income ratio rose when nominal rates fell and real rates rose also supports the borrowing constraint hypothesis.

CONCLUSION

The evidence presented here suggests that nominal, as opposed to real, interest rates are an important determinant of each category of consumer spending. It indicates that whatever aggregate spending response to expected, real, after-tax interest rates there may be is overwhelmed by the constraints imposed by lending criteria that are based on nominal interest rates.

These results and their source have important implications, almost all of them good (except for those who are so constrained). First, forecasting is made easier. Movements in consumer expenditures depend importantly not just on the unobservable and virtually unforecastable changes in expected, real, after-tax interest rates and "permanent" income. They also depend, and may primarily depend, on the observable and more easily forecastable nominal interest rates and household cash flows. Even better, they depend in part on past movements of those measurable magnitudes.

The results also suggest that there is an enormous amount of credit demand that is inappropriately, and probably unintentionally, constrained. That constraint results from the lack of financing instruments that are suited to a world where inflation is not zero. It also results from the lack of financing instruments that are suited to a world where an individual household's real income reliably grows over time. To the extent that much of the ensuing borrowing constraint is unintentional, obvious and simple financial innovations can raise both the profits of lenders and the living standards of consumers.

FOOTNOTES

[1]The federal government's National Income and Product Accounts classify residential construction expenditures as investment. Although those expenditures are not examined here, many of the arguments presented here apply with even more force to the housing market.

[2]The correlation between changes in the savings rate and the nominal interest rate is 0.23.

[3]See Throop (1989). Wealth is measured as of the end of each quarter. The variables used were the average of the values for the end of the current and preceding quarters. Though the income measure is adjusted for the loss of value of net financial assets due to inflation, the wealth measure does not take into account changes due to changes in the market value of bonds. This opens up the possibility that our estimates attribute to nominal interest rates direct, negative effects on consumption that are really wealth effects that are not tracked by the wealth variable.

However, the opposite is more likely to be the case. Wealth changes attributable to nominal interest rate changes will be concentrated in long maturity assets and liabilities, as opposed to short maturity assets (like deposits) and liabilities. Although the household sector is a net creditor, it is a net creditor at short maturities and a net debtor at long maturities. Thus, nominal interest rate changes probably increase, rather than decrease, the household sectors net financial assets. The implication is that a more conceptually accurate empirical measure of wealth would likely deliver even larger, direct effects of nominal interest rate than shown here.

[4]The one-year constant maturity Treasury issue yield produced similar results.

[5]The income-tax rate measure is taken from Peek and Wilcox (1987). For 1987, the tax rate value is set at 27 percent. For 1988 and 1989, it is set at 25 percent. The annual value was assigned to each of the quarters within that year. The results presented later in the paper are changed inconsequentially when after-tax rates are calculated by using the two-quarter-ahead tax rate. The basic results are also unchanged if we set the tax rate equal to zero, i.e., if we use before-tax interest rates. Quarterly expected inflation values were obtained by interpolating between the June and December values, which were assigned to second and fourth quarters, respectively.

[6]Each was specified as a second degree polynominal over eight quarters (current and the preceding seven quarters) with no endpoint constraints.

[7]Similar results were obtained when the variable definitions and model specification from the Federal Reserve Board's consumption function were used. One difference in variable definitions is that the Board's income variable makes allowance for the capital losses occasioned by inflation. Thus the results presented here are unlikely to be due to that effect.

[8]Steidtmann (1989) argues that real M2 may be more reliably related to consumer spending than are interest rates. Differences between his objectives and resulting specifications and those used here make direct comparisons impossible. Substituting real M2 for nominal interest rates in our specifications does produce statistically significant positive money coefficients. When money and interest rates are included simultaneously, the money coefficient is not significant for durables or for nondurables and services, while the interest rate coefficient remains significant in the latter.

[9]For a more complete discussion of this hypothesis and for both micro-based and macro-based empirical evidence on it, see Wilcox (1989).

[10]The enormous market share of adjustable rate mortgages, especially in relatively high housing-price areas, seems to have been due to the presence of their initial

discounts, which, for homebuyers, translate into access to larger mortgages.

[11]Dunkelberg (1989) details several reasons why debt ratios have changed in recent years.

[12]See Moore and Klein (1967).

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