Regarding The Relationship Between Income And Wealth In Retirement

Charles B. Hatcher[1]

The relationship between wealth and income during the entire economic life course is discussed. It is hypothesized that one's desired per-period wealth at retirement, the hypothetical per-period wealth level which would induce retirement, is generally less than income while working, and greater than income while retired. Some evidence regarding this hypothesis is given using the 1992 Survey of Consumer Finances.

Key Words*: Life-cycle model, Retirement planning, Survey of Consumer Finances, Wealth*

Section 1: Introduction

This paper exploits the concept of an individual's desired per-period wealth level at retirement (Hatcher, 1997a) to examine the relationship between income and wealth in the context of the retirement planning decision. The Life Cycle Theory of Saving (Ando & Modigliani, 1963) implies certain relationships between income and per-period wealth accumulation over the life cycle. Hanna, Fan and Chang (1995) illustrated some of these implications with several simple scenarios. Here, some of these implications will be 'tested' using data from the 1992 Survey of Consumer Finances (SCF) on both income, obtained from the raw data, and desired per-period wealth at retirement, obtained from estimates from Hatcher (1997b). The findings indicate both support for and limitations of the Life Cycle Theory of Saving.

Section 2 gives a brief introduction of the important points of the Life Cycle Theory of Saving, and the theory's implications for optimal retirement planning. Section 3 uses the construct of per-period wealth, and illustrates per-period wealth accumulation over the life course. Section 4 re-introduces the concept of desired per-period wealth at retirement as a criterion for the retirement decision, and how to estimate how much per-period wealth it would take to get an individual to retire. Section 5 looks at how desired per-period wealth at retirement and income are related for both retirees and non-retirees. Section 6 discusses some of the implications of the findings, and ideas for future research.

Section 2: Optimal Retirement Savings

According to the Life Cycle Theory of Saving, the motivation for saving or borrowing is to *smooth* consumption over one's lifetime -- saving when income is high, and borrowing (or spending past savings) when income is low, so that consumption stays at a stable level over the life course. Well functioning borrowing and lending markets would then make the particular timing of earnings irrelevant to when they were actually spent.

This *Life Cycle Income Hypothesis*, coupled with the various consumption and income circumstances that most households face during the life course, motivates the idea of the "economic life cycle" prevalent in the financial planning literature (Garman & Forgue, 1997; Gitman & Joehnh, 1996). Most conceptualizations of the economic life cycle would include four major stages -- (i) borrowing early in life when income is low (ii) paying down debt as income increases (iii) saving for retirement and (iv) spending down savings in retirement.

Figure 1 is more or less a stylized reproduction of optimal life cycle consumption from Hanna, Fan and Chang (1995) with a few important exceptions. First, post- and pre-retirement consumption are separate. This adds realism to the more simplified versions of the model (e.g., Figures 1 and 2 of Hanna, Fan & Chang, 1995), but is itself a simplification of the more advanced models, where planned consumption changes at every age (e.g. Figures 7 and 8, Hanna, Fan & Chang, 1995). This is also a popular simplification in the retirement planning literature, where it is widely prescribed to save enough to be able to finance post-retirement consumption at 75% to 90% of pre-retirement earnings (Gitman & Joehnk, 1996) Another exception is that here, I have separated earnings (from work) and income, which includes interest income on past savings as well as earnings from work. Pensions here are conceptualized as savings, and therefore not included as earnings, although implicitly as income.

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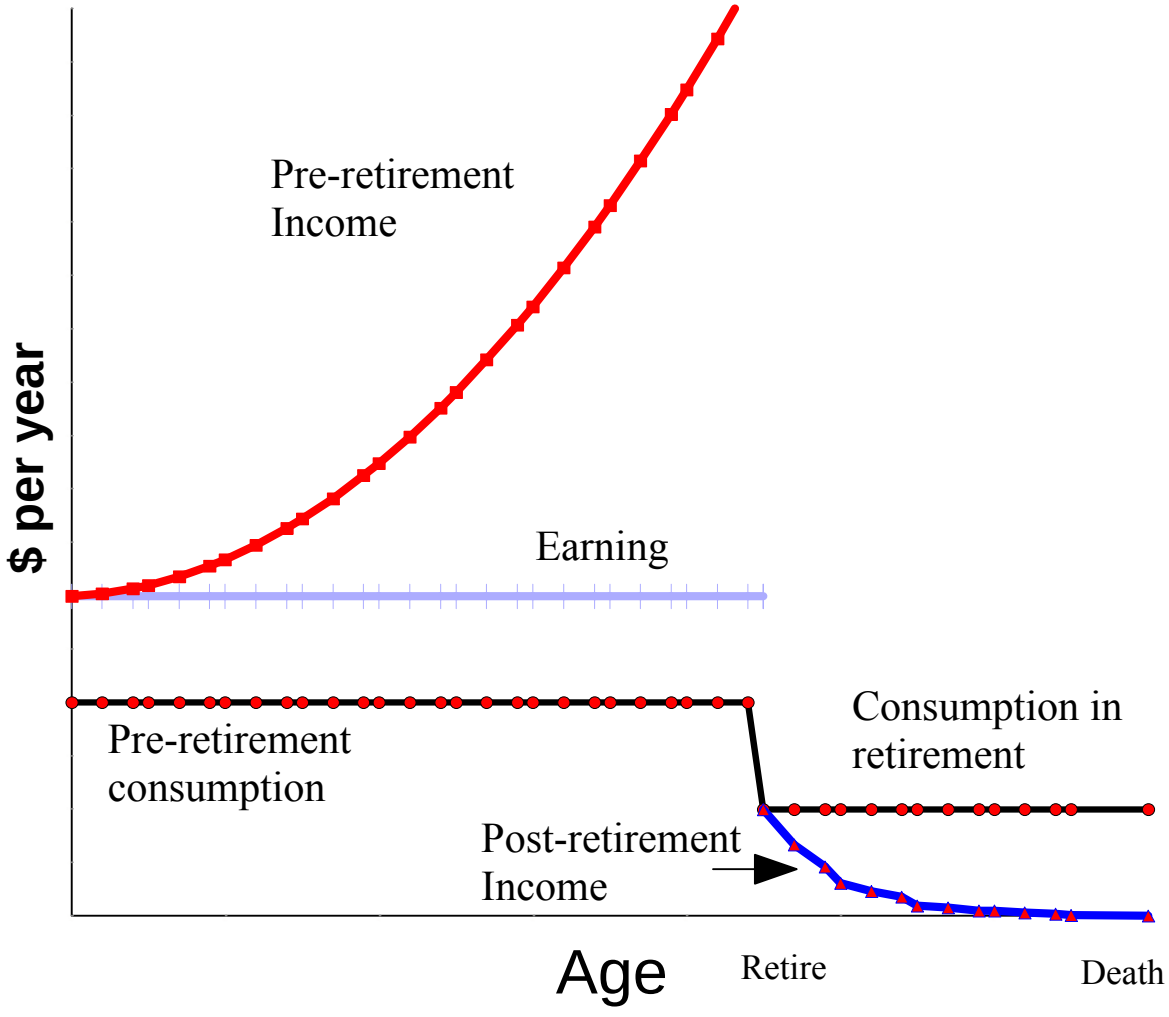
Figure 1
Consumption, Earnings and Income over the Life Course



The budget constraint for the consumer is that the present value of consumption, pre- and post-retirement, must equal the present value of earnings plus initial wealth, given the relevant borrowing and savings rates for the individual.

One can see that, since our stylized example has the individual saving from the beginning, income starts above consumption and continues to climb as interest income gets larger, a result of past saving. Income takes a precipitous drop at retirement; it is made up only of interest income, and it goes down as the individual

spends more of principal to finance consumption. If the individual leaves no bequests, then income will be zero at exactly the time of death.

While there is an abundance of empirical support for the Life Cycle Income Hypothesis, there is much evidence that individuals tend not to spend down their assets until well into their retirement years. (Menchik & David, 1983; Kurz, 1984; Jianakoplos, Menchik & Irvine, 1996). One possible explanation for this is that a retiree's wealth is often made up of housing wealth, which they might not be able to spend down without moving (Venti & Wise, 1990). Another reason is that the effect of expected inflation on an optimal retirement plan is fairly straightforward: you need to save more if you expect prices to go up during retirement. This means that one would expect the nominal dollar value of consumption to be lower during one's first year of retirement than one's last, even if the actual level of goods and services consumed stayed constant. Yet another reason why we might find the elderly not spending down their assets is for protection -- from a bad economy, poor investment performance, or an unexpectedly long life (Leland 1968). Last, an individual may have a bequest motive, either for altruistic reasons (Becker, 1974), or strategic reasons (Yagi & Maki, 1994). These *anomalies* to the Life Cycle theory might hinder the link between any theoretical model and empirical fact with respect to individual savings behavior.

Section 3: The Concept of Per-Period Wealth

What is missing from Figure 1 is an illustration of the wealth accumulation process (e.g., Figures 3 and 6, Hanna, Fan & Chang, 1995). The existence of the economic life cycle implies that the savings level at which a person voluntarily retires should correspond to a *permanent income measure*. This should be, as Ando & Modigliani reason, "...based on considerations relating to the life cycle of income and consumption "needs" of households" (Ando & Modigliani, 1963, p. 55). Much work has been done to formalize this conceptualization. A form of this measure, heretofore called *per-period wealth* was first introduced by Weisbrod and Hansen (1968). It measures the amount of annual income that an individual could guarantee over the expected lifetime, given net worth, life expectancy, inflation and interest rates. If an individual has a per-period wealth of $10,000, then, the individual has enough net worth so that if he or she spent $10,000 per year, adjusted each year to account for inflation, and net worth would be drawn down to exactly zero at the individual's expected date of death. Two people with identical net worth but different ages would presumably have different per-period wealth levels -- the individual with the longer life expectancy would have the smaller per-period wealth because of the need to spread net worth over a longer period of time.

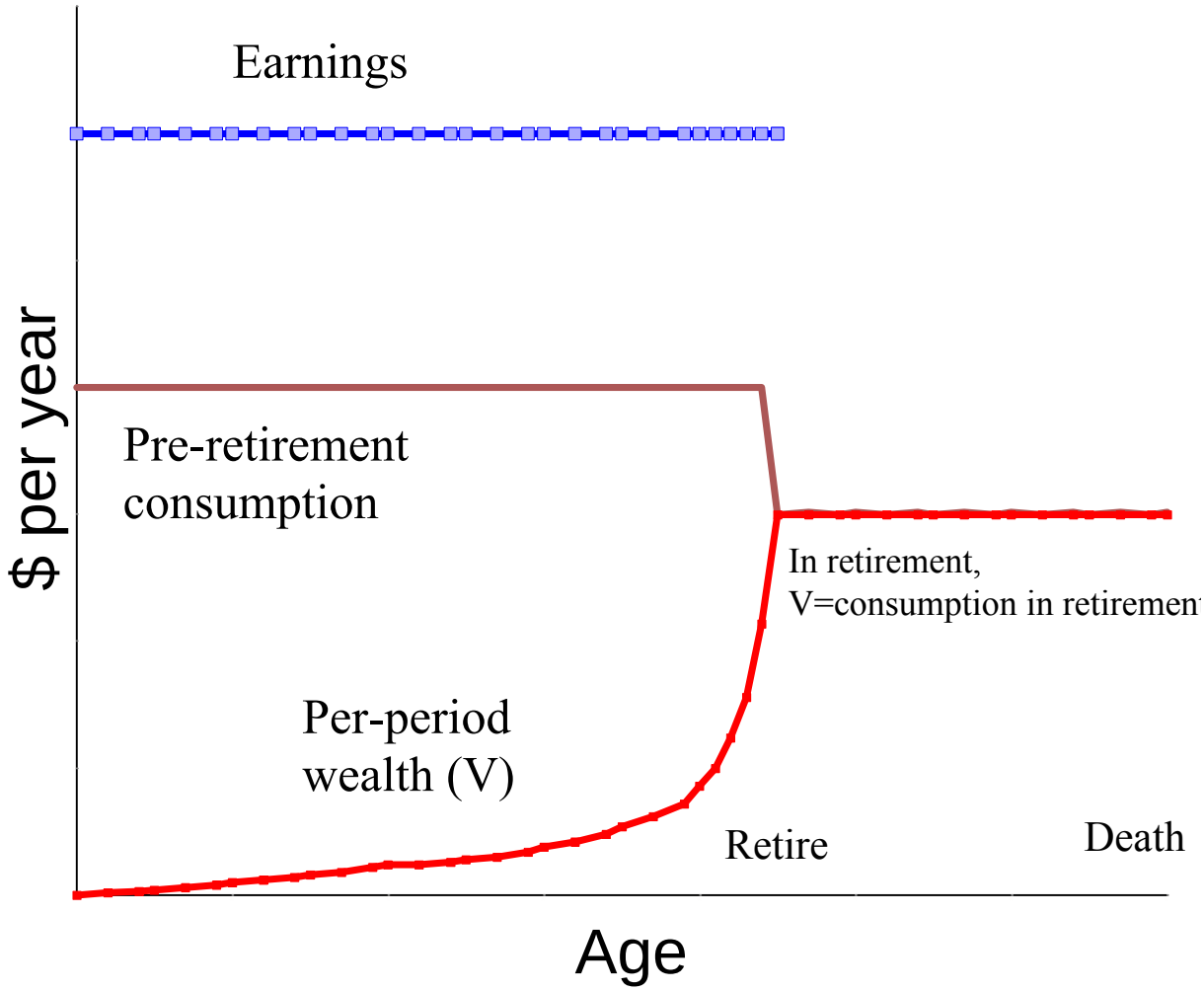
The concept of per-period wealth is an important one because it is precisely the kind of measure that should be relevant to the prospective retiree -- how much consumption per-year one's savings can finance over the rest of one's life. This means that the rational consumer need not think so much about the balances in savings accounts, mutual funds, etc. but rather how those balances translate into an annuitized value like per-period wealth. Social Security is already denominated as an a per-period inflation-adjusted measure, and so are many defined benefit pensions, although some do not adjust for inflation. If an individual's entire net worth consists of a claim on Social Security, and if that claim would not be subject to legislative or political uncertainty, then per-period wealth for this individual would be whatever amount the person could start collecting -- because that number adjusts for inflation, and it pays out until death.

Figure 2 includes the amount of per-period wealth that the individual from Figure 1 would accumulate over a life span. Again, it differs from the Hanna et al. (1995) conceptualization of wealth, because they used net worth, a *stock*, while per-period wealth is the *flow* of income which could be generated from net worth at any given point in time. Note that before retirement, per-period wealth increases for two reasons -- one, because the individual is accumulating savings, and two, because the individual is getting older, and therefore the more that could be drawn each year to run net worth to zero at death. Note also that at the point of retirement, per-period wealth equals post-retirement consumption. This is by definition: The amount of per-period wealth that one's net worth could afford per year must be the amount needed for consumption, otherwise the retirement plan would not be self financing, and therefore not *optimal*.

Section 4: Concept of Desired Per-Period Wealth

If we assume that someone planning for retirement uses a concept such as per-period wealth to determine when there is enough to retire, then it must follow that there is some hypothetical number for each individual such that if that much was accumulated, he or she would retire. For individuals who are working, this desired per-period wealth level must be greater than actual per-period wealth level; otherwise, they would have retired.

Figure 2
Per-period Wealth Accumulation



For retired individuals it is vice-versa -- their desired per-period wealth level must be less than or equal to their actual per-period wealth level.

What would determine this desired per-period wealth at retirement? According to the aforementioned retirement planning literature, earnings would be a large factor. Specifically, desired per-period wealth at retirement should be 75% to 90% of pre-retirement consumption. Since the marginal propensity to consume income tends to be greater than zero, we should therefore expect that individuals with larger incomes should have larger desired per-period wealth at retirement. A more formal economic model of labor supply would tend to support

this hypothesis (see appendix and Hatcher, 1998). Theoretically, individuals with higher wages, more education, more dependents, and workers in white-collar jobs should have higher desired per-period wealth in retirement.

We can estimate the effects of desired per-period wealth at retirement by exploiting the fact that whether or not you are retired is determined by the latent variable *per-period wealth minus desired per-period wealth*. Again, if this variable is less than zero, you are not retired, but if it is greater than or equal to zero, you are retired. Furthermore, we can examine how a person's market wage affects desired per-period wealth at retirement using a four-step procedure. Two of those steps are Heckman's (1974) procedure for estimating the effects of different variables on a person's market wage (using a sample of individuals, some of whom work). The third and fourth steps are to regress per-period wealth, and then the dummy variable *retired -- yes or no?* on those same variables. The third step, an Ordinary Least Squares regression (OLS,) measures the effects of the explanatory variables on per-period wealth. The fourth step measures the effects of those same variables on the latent variable *per-period wealth minus desired per-period wealth*. The appendix gives more detailed information on the estimation strategy employed.

Section 5: Income and Desired Wealth

This section illustrates and estimates the expected relationship between desired per-period wealth at retirement and income (both from labor market earnings *and* from interest) over the life cycle. Examining the relationship between income and desired wealth is important because income is one of the most readily available constructs at the financial planner's disposal, so that looking at the relationship between retirement savings and an individuals's current income can yield insight into the financial planning process. Economic theory does little to inform the relationship between income and desired per-period wealth at retirement. Therefore, we will need to use the definition of desired wealth (and remember, desired wealth is defined completely by its relationship to actual per-period wealth) to guide us in this endeavor.

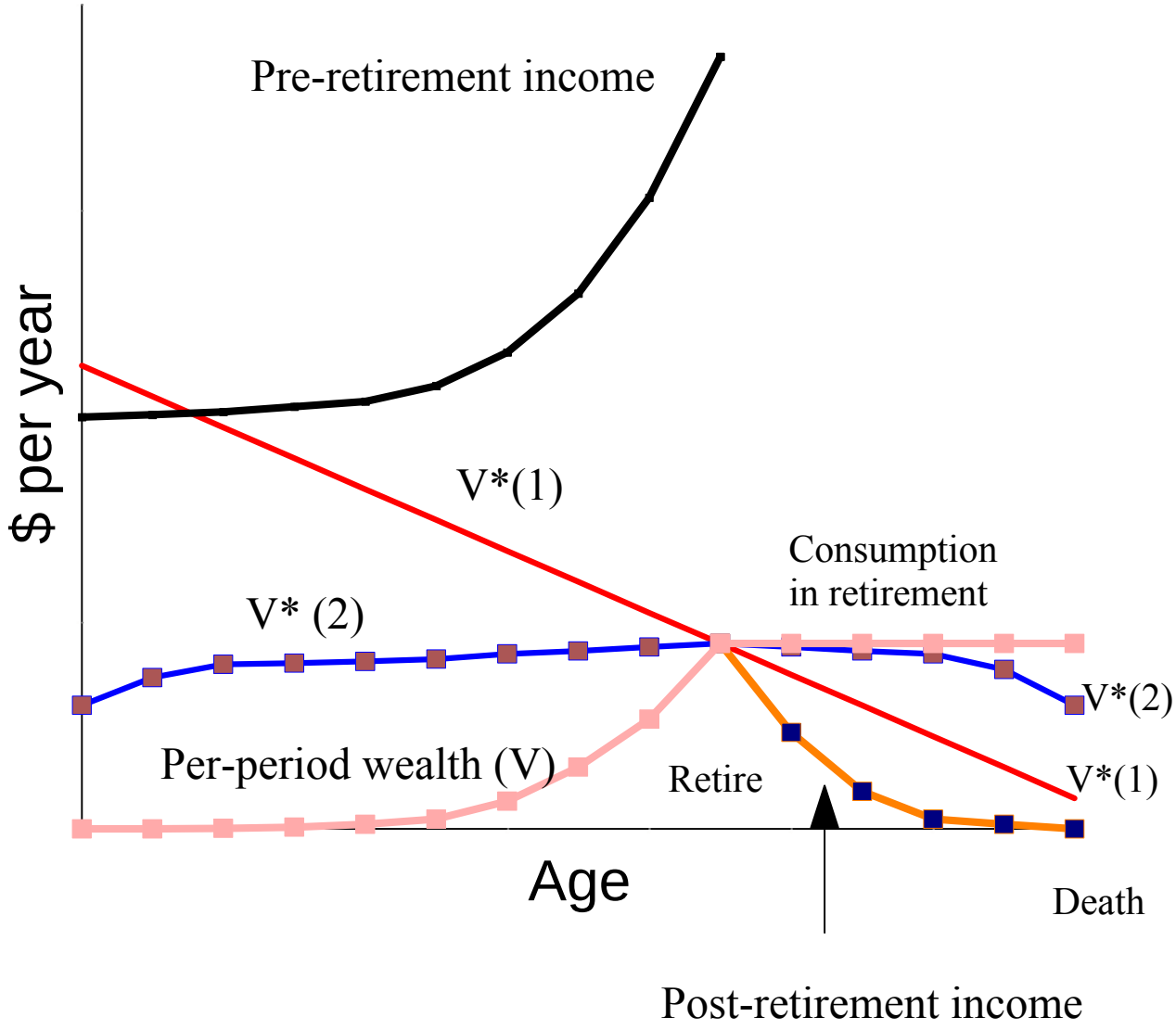
Figure 3 includes two hypothetical paths for desired per-period wealth (V*). Three criteria exist for the V* path. The first is that it be greater than per-period wealth (V) before retirement (i.e. the individual doesn't have the amount of per-period wealth needed to retire). The second is that V* must be less than or equal to V after retirement (i.e. the individual has the desired amount -- otherwise, he or she would not be retired). The third is that V* must cross V at the point of planned retirement. If we assume that the V* function is continuous, then it must either look somewhat like V*(1), where it continuously decreases, or V*(2), where it increases and then decreases at retirement. V*(1) seems a more realistic choice, because V*(2) requires a change in slope at the point of retirement, which seems unlikely. Also, labor supply theory assumes that V* declines with age throughout the life cycle, since it is commonly assumed that leisure becomes more productive relative to consumption as one ages (see Hatcher 1998). The specific nature of V* notwithstanding, what does seem highly likely is that for most retired individuals, V* should be greater than income, and for most non-retirees, V* should be less than income. One would be hard pressed to construct a conceivable V* curve that exhibited otherwise, except for at very young ages (one can see, for example, in Figure 3 that V*(1) is in fact greater than income at the very beginning of the life cycle). While violation of this claim would not necessarily violate the Life Cycle Income Hypothesis, it would contradict the intuitive hypothesis, drawn from the casual observation of the graph.

The hypothesis that desired per-period wealth at retirement is larger than income in retirement, and less than income before retirement, is an assertion that can be taken to the data. Again, Hatcher (1997b) gives us estimates on an individual's desired per-period wealth level at retirement for all 1992 SCF respondents, and the 1992 survey itself gives estimates on income of all forms (labor, interest and capital gains -- for more background information on the 1992 SCF, see Montalto and Sung, 1996).

Table 1 gives average values of predicted desired per-period wealth at retirement for married men, married women, single men, and single women, along with the corresponding average incomes. As an example of how to interpret these results, the average married man has an estimated desired per-period wealth at retirement of about $21,000 per year, adjusted for inflation. The average predicted desired per-period wealth at retirements is much smaller than average income. Note that for married couples, true desired consumption in retirement is really measured desired per-period wealth at retirement plus per-period wealth from your spouse's earnings. The analysis employed in Figure 3 assumes that there is no income from a spouse. This means that we will expect the cross-tabulations for the married

group not to tell us anything, since it is an inappropriate test of the logic from Figure 3.

Figure 3
Desired Wealth at Retirement Over the Life Course



One interesting feature of the desired per-period wealth at retirement predictions is that average desired per-period wealth at retirement tends to be much larger than average actual per-period wealth. This suggests that the majority of the sample is still working, which is the case (the next section will delve into individual predictions more closely). The desired per-period wealth at retirement predicted values have particularly low

sample variances, especially considering the variance of per-period wealth is so high. The fact that the expected values have a small variance is somewhat a feature of the fact that these are predicted values, and that there was significant variance in the distribution of the residuals from the regressions which generated these predictions (see Hatcher, 1997b).

Average desired per-period wealth at retirement is much larger for single men and women than for married men and women. Actual per-period wealth was only slightly larger for single individuals. This large difference in desired per-period wealth at retirement between married and single individuals arises from the fact that many married men and women can count on income from their spouses. For married individuals, real desired per-period wealth at retirement includes wealth from a spouse's future earnings. These earnings do not show up in their predicted values. This is why we might suspect that married women have lower desired per-period wealth at retirement than their husbands'; this might have a lot to do with the fact that wives can count on more future income from their husbands than husbands can count on income from their wives. Even if husbands and wives have the same desired consumption level to trigger retirement, we would expect this result nonetheless.

Table 1
Average Desired Per-Period Wealth and Income

	Desired Per–Period Wealth (1992 $)	Income (1992$)
Married Men (n=2177)		
Mean	21,895	50,909
Standard Deviation	11,735	65,862
Married Women (n=2177)		
Mean	16,333	50,909
Standard Deviation	12,606	65,862
Single Men (n=445)		
Mean	40,787	27,392
Standard Deviation	34,021	38,836
Single Women (n=751)		
Mean	89,765	19,340
Standard Deviation	84,312	36,023
Weighted Estimates		

What is a little disturbing is the high predicted average desired per-period wealth at retirement for single women. It is not the result of a few observations distorting the mean, at least no more than individual observations influence the means of the other results. This is an empirical concern that has been left unresolved, and as we will see it will affect some of our results in this and the following section.

Table 2 gives the cross tabulation of those who have predicted desired per-period wealth at retirement greater than current income, versus who is retired. One striking result is that for married men and women, most of those who are not retired have a predicted desired per-period wealth at retirement less than their income, which is what was predicted (i.e. these empirical facts correspond to Figure 3). This result was more striking for the married women than for the married men. Among the retired, most seemed to have predicted desired per-period wealth at retirement less than income as well. Keep in mind that the married men and women should not necessarily fit the story illustrated by Figure 3, because they also may have spouse's income, which distorts all the values (see Hatcher, 1997b for a more detailed description of this issue).

Figure 3 should directly apply to single men and women, since the model developed in Figures 1-3 was for individuals who are not necessarily married. The single men and women, however, show a very different story from the married. For the single men, there are actually more non-retired single men with predicted desired per-period wealth at retirement greater than income. In fact, it is also true that most retired single men have predicted desired per-period wealth at retirement greater than income, although it is a greater percentage for the retired than the non-retired. For the single women, the model yields values so high that the desired per-period wealth at retirement predictions exceeds income for everyone. While this is certainly a plausible, even believable result, it probably has to do with the large numbers for predicted values than anything else.

Table 2.
Desired Per-Period Wealth and Income

	DPPW ≥ Income	DPPW ≤ Income
Married Men		
Retired (n=319)	107	212
Not Retired (n=1858)	178	1,680
Total	285	1,892
Married Women		
Retired (n=629)	120	509
Not Retired (n=1548)	71	1,477
Total	191	1,986
Single Men		
Retired (n=73)	64	9
Not Retired (n=372)	204	168
Total	268	177
Single Women		
Retired (n=255)	255	0
Not Retired (n=496)	496	0
Total	751	0

(Unweighted Estimates)
(DPPW = Desired Per-Period Wealth)

Section 6: Implications

The results on average desired per-period wealth at retirement were reassuring because they corresponded nicely with what we know about per-period wealth and income for these groups, with a few exceptions. These results are no doubt influenced by the transitory component of an individual's income -- it would be an advantage to get a more permanent measure, which wasn't subjected to period-specific shocks. The hypothesis that per-period wealth is less than income before (and greater than income after) retirement is not supported by the data generally. One of the main limitations of the study from an empirical perspective is that different types of single family households -- never married, widowed, and divorced -- have been assigned into one group. It is therefore not surprising that the model seemed to be more consistent with married households than single households, even though it was originally hypothesized that the model would suit single households better than married ones.

The main purpose of this paper is to show that there is some evidence from the SCF that individuals use concepts such as per-period wealth in deciding whether or not to retire. Furthermore, the concept of desired per-period wealth in retirement, and the findings regarding its relationship to income, have some implications for the financial planning field. First of all, the theoretical model highlights the differences that one would observe between consumption, income, and per-period wealth, at any point in time, given the life cycle income hypothesis. Individual deviations from this pattern, while they might signal mis-specification of the model presented here, might also be a signal of poor retirement planning.

It is important to note that while an income is probably the individual's most readily available and costless piece of financial information (an individual sees this number every year when filing taxes), one year's income is not that important to a rational retirement plan. With respect to retirement planning, income is more of a result than a decision parameter. Savings decisions are based on the life cycle pattern of earnings and consumption needs, and income is the result of that savings process. One can see from Figure 3 that income is the one measure that seems to "stick out," unrelated to the rest. While income was used here to test the concept of desired per-period wealth at retirement, it is the position of the author that understanding consumption needs in retirement, life expectancy, interest rates, and earnings possibilities are much more important to the development of a sound retirement plan than how much income you make. Therefore, using information about income to develop a retirement plan might lead to financially poor, if not unsound, planning.

The final tool that these results can yield financial planners is with respect to the estimates on single women. The fact that the model presented here does such a poor job of describing their behavior suggests that the models we have at our disposal are inadequate for this group. Clearly we are missing key elements which motivate savings and retirement behavior with respect to this group. The issue of widowhood could be a major stumbling block in this respect. Richer models, which help describe the work process for women who become single as a result of their spouse dying, might lead to more accurate results for this group. Nevertheless, the results suggest that financial planners need to understand that retirement planning needs of women, widows or prospective widows, can be very different from what we would naturally predict.

Consumption data will be the key to understanding the dynamics and relevance of desired per-period wealth at retirement. Although we have shown here that desired per-period wealth at retirement is somewhat consistent with the Life Cycle theory of savings, we don't know if the inconsistencies that we have seen are due to the existence of a bequest motive, sub-optimal savings plans, lack of information, or what. Consumption data would

go a long way towards answering some of these questions. For example, is the desired per-period wealth level at retirement for a given working individual sufficient to generate 75% of her current consumption, as financial planners recommend? While the information in the SCF is not sufficient to answer questions like this, it is nevertheless the next logical question.

Appendix

We can learn a lot about the determinants of V* using simple economic theory. Using a one-period model, where individuals have a choice between consumption and leisure, V* is the hypothetical amount of wealth which equates the marginal rate of substitution between consumption and leisure equal to the market wage rate. Suppose we give M a specific functional form

$$M(H,V,Z) = \alpha_0 + \alpha_1 H + \alpha_2 V + \alpha_3 Z \quad (1)$$

where H is hours of work in the market, V is unearned per-period income and Z is a matrix of other characteristics that influence labor supply. Setting Equation 1 = w (the market wage) and setting H=0 then gives a functional form for V*:

$$V^* = \frac{w - \alpha_0 - \alpha_3 Z}{\alpha_2} \quad (2)$$

Since α_2 is unambiguously positive (assuming diminishing returns in consumption and leisure), the effect of market wages on desired per-period wealth should therefore be positive. Furthermore, α_2 greater than zero means the effects of the Z characteristics should have the opposite effect on V* that they do on M, since $-\alpha_3/\alpha_2$ has the opposite sign as α_3. Also, since a_1 has traditionally been found to be less than zero as well (i.e. the substitution effect is greater than the income effect with respect to labor supply), this will also mean that the Z characteristics should effect V* in the same way it affects hours of work.

Estimating V* (Equation 2) is a problem, because it is not directly observable, and because wages are observable only for workers. A strategy for the identification of the effects of Wages and other characteristics on wages using a sample of retirees and non-retirees follows.

Start with the estimation of a wage equation for an individual I.

$$W_i = \beta_1 X_i + \beta_2 \lambda_1 + \mu_{1,i} \quad (3)$$

Where X is a matrix of variables determining labor supply and past asset accumulation, and λ is the inverse mills ratio from a probit on labor force participation. Ideally, λ includes variables not found in the X matrix, and vice-versa. Ordinary least squares applied to the equation above yields estimates of β_1 and β_2.

Actual Wealth, V, is also function of all past labor supply and asset accumulation. It is also a function of the wage rate:

$$V_i = \beta_3 X_i + \xi_1 W_i + \mu_{2,i} \quad (4)$$

Substituting the wage Equation 3 into Equation 4 gives the following:

$$V_i = (\beta_3 + \beta_1 \xi_1) X_i + (\beta_2 \xi_1)\lambda_1 + (\xi_1 \mu_{1,i} + \mu_{2,i}) \quad (5)$$

Ordinary Least squares on Equation 5 will yield estimates of $(\beta_3 + \beta_1 \xi_1)$ and $(\beta_2 \xi_1)$. Desired per-period wealth takes a functional form similar to actual wealth. If β_5 and ξ_2 are the effects of the X matrix and the market wage on desired per-period wealth, respectively, and u_3 is the error term associated with the error term of the reduced form of desired per-period wealth, then the long form looks like the following:

$$V_i^* = (\beta_5 + \beta_1 \xi_2) X_i + (\beta_2 \xi_2)\lambda_1 + (\xi_2 \mu_{1,i} + \mu_{3,i}) \quad (6)$$

As noted previously, the latent variable that determines retirement is the difference between Equation 7 and Equation 8. A probit using *retired* (yes or no) as the dependent variable therefore identifies the difference between the coefficients on X and λ in the desired per-period wealth and wealth equations. Taking this retirement probit with the wealth and wage OLS estimates, and a zero restriction in the X matrix of the desired per-period wealth equation, identifies β_5 and β_6.

The exclusion is a dummy variable for whether or not the household expects to receive an inheritance. Keeping this variable out of the desired per-period wealth equation can be justified since the threshold level of wealth which determines the retirement decision shouldn't necessarily be influenced by what type of wealth it is. It should be included in the wealth equation, however, since access to a future inheritance should influence savings behavior over the life cycle through an income effect.

The standard errors of the estimates are estimated using a bootstrap procedure (Efron & Tibshirani, 1993). This procedure seemed an improvement over identifying standard errors by assuming covariance between error terms in several of the above equations were zero, given the interrelationships of the independent variables.

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