HABITS AND THE SAVINGS-GROWTH RELATIONSHIP

Why US Personal Savings Rates Are At Historic Lows

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Abstract

In this paper we show that the solution to the standard consumer maximisation problem which is augmented by habit-persistence can imply a positive and linear relationship between **changes** in the level of savings and changes in present income. We show that these savings-income dynamics contrast with the orthodox view that the **level** of the savings rate is related to the present growth rate of income. The model also implies that if expectations of future changes in income are positive and present income itself is stationary, then the level of consumption tends to converge on income over time and savings fall. In these circumstances the standard model predicts that the level of savings and consumption remain constant. Using personal savings and disposable income time series data, we show that a simple bivariate version of the habits-augmented model which assumes constant expectations of future changes in income and strong habit persistence performs extremely well in terms of explaining the dynamics of post-war United States personal savings rates; in particular their recent decline to historic lows.

JEL Classifications: D91, E21.
Keywords: Savings, Consumption, Habits, Growth

I. Introduction

By the end of 1998, personal savings rates in the United States had fallen below zero for the first time since personal savings data began being gathered in 1946. From the early-1950s to the mid-1970s personal savings rates accelerated slightly to about eight per cent of personal disposable income; since then however the personal savings rate has suffered an inexorable decline. In recent years this dramatic decline in the savings of American households has raised a growing disquiet amongst economists which has only been muted by the extraordinary sustained performance of the broader economy. Until the early 1990s, the post-1975 fall in personal savings rates had been mirrored by a fall in the gross national savings rate; it has since recovered by a few percentage points while the personal savings rate has continued to fall.

Figure 1.1 illustrates the history of personal savings rates since World War II.[1] Correspondingly, Table 1.1 presents the decade averages of disposable income growth rates over the past five decades; the

[1] Figure 1 includes a durables-adjusted version of personal savings rate; this will be discussed below.

pattern can be most simply characterised as hump-shaped with a peak in the 1960s and a continuing deceleration since then. A closer look at recent disposable income growth reveals that, despite the fact that the US economy has recently enjoyed an unprecedented period of sustained expansion, the growth rate of real per capita personal disposable income continues to remain below the post-war average.

In this paper we present a solution to a habit-augmented version of the modern permanent-income consumer maximisation model which, given certain assumptions, can predict that changes in savings are related to the changes in income. We also show that the solution can be written in terms of the growth rate of income, in which case it implies that changes in the savings rate are related to the rate of income growth. The econometric results suggest that a simple bivariate form of the solution can explain a vast majority of the movements in the United States personal savings rate since the late-1940s including the precipitous decline that began in the mid-1970s.

The prediction of the model presented herein contrasts with the traditional view of the relationship between savings and income. While the standard modern permanent income model of consumption behaviour predicts that the level of savings is totally disengaged from present income, it is a long and continuing practice when assessing the savings-growth relationship that one looks at the correlation between the growth rate of income and the savings rate; specifically the <u>level</u> of the savings rate.[2] Despite having been shown not to hold except in its most simple forms, this approach stems from Modigliani's Life-Cycle model. In the most simple versions of this model, income growth across generations results in the young saving more than the old in order to finance a higher level of consumption in their retirement and thus providing a positive correlation between the rate of income growth and the level of the savings rate. It is easy to show however that if, for example, there is income growth within a generation, the relationship breaks down.

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[2] See for example Deaton [1992].

There have been numerous papers that have explored this relationship within the framework of both the Life Cycle model and modern renderings of the Permanent Income model. Recent examples include the World Bank [1993] and Carroll and Weil [1994] both of which, in addition to reaffirming the traditional savings-growth relationship, also suggest that income growth causes high (not higher) savings rates.

The balance of this paper is laid out as follows: in the next section we present a solution the habit-augmented consumer maximization problem and derive a simplified specification of the solution based on the assumptions of strong habit persistence and constant consumer expectations of changes in future income. We also derive a savings rate version of the solution. In section III we test various specifications of the model using personal savings and disposable income time series data for the United States. Section IV recalls references in the consumption theory, growth accounting and growth theory literature which allude to the more dynamic savings-income relationship we propose herein. We end the paper by reassessing the recent decline in US personal savings rates in light of the model developed and tested in the body of the paper.

II. The Consumer Maximisation Problem with Habits

The standard consumer maximisation problem as presented by Hall [1978] can be generalised to include a representation of habit persistence. The instantaneous utility function can be augmented with a lagged consumption term such that

(2.1) $$v = v(c_t - ac_{t-1})$$

so that utility at any point of time is a positive function of the present level of real per capita consumption c_t and a negative function of the last period's level of consumption c_{t-1} which is weighted relative to current consumption by the constant a and represents the strength of the effect of habits.[3] This specification can be embedded into the standard consumer maximisation model where the agent maximises the following utility function

(2.2) $$\max E_t \sum_{\tau=t}^{\infty} (1+\rho)^{t-\tau} v(c_\tau - ac_{\tau-1})$$

subject to the intertemporal budget constraint:

(2.3) $$\sum_{\tau=t}^{\infty} (1+r)^{\tau-t} c_\tau = (1+r)A_{t-1} + \sum_{\tau=t}^{\infty} (1+r)^{\tau-t} y_\tau$$

where E_t is the expectations operator, ρ is the consumer's rate of time preference, A_t is the real per capita value of non-human wealth which returns r the real interest rate (which is assumed to be constant) and y_t is the level of real per capita labour income.

Spinnewyn [1979*a*,*b*], Muellbauer [1988] and Alessie and Lusardi [1997] show how to use instruments to solve the intertemporal consumption problem with habit persistence. By defining an instrument equal to $c_t - ac_{t-1}$ and making the same assumptions as Hall [1978], Flavin [1981] and Campbell [1987], a closed-form solution can be derived. While the solution is usually expressed in terms of the present level of consumption, the solution can be also written in terms of current savings,

(2.4) $$s_t = as_{t-1} + \frac{a}{1+r}\Delta y_t - \left(1 - \frac{a}{1+r}\right)\sum_{\tau=t}^{\infty} (1+r)^{t-\tau} E_t \Delta y_\tau$$

[3] If a<*0* then, rather than habit persistence, this function can be thought of a one in which a stock of consumables provides positive utility into the future after the purchase date. Braun, Constantinides and Ferson [1993] test a model with both habit persistence and durability of consumption and find that in most cases the effect of habits dominates that of durability.

thus isolating the various underlying determinates of the present level of savings: the effect of habits (represented by the coefficient a), the previous level of savings, the interest rate/rate of time preference, contemporaneous changes in income, and the effect of expectations of changes in future income.

When the effect of habits is removed by setting $a = 0$ we have the ‘saving for a rainy day’ equation where the level of savings only depends on expected future income changes; as such, the standard model predicts that the level of current savings is totally disengaged from current income and/or current income growth (in so far as expectations of future changes in income are uncorrelated to changes in present income).

If on the other hand the effect of habits is present ($a > 0$) a relationship between savings and contemporaneous income is predicted by the model, although, as we shall see, the stronger the effect of habits, the more the relationship diverges from that long suggested in the literature when invoking habit persistence. This can be most clearly illustrated if we simply assume very strong habits such that $a = 1$.[4] In that case, in terms of savings, the solution to the consumer problem becomes:

(2.5) $$\Delta s_t = s_t - s_{t-1} = \frac{1}{1+r}\Delta y_t - \frac{r}{1+r}\sum_{\tau=t}^{\infty}(1+r)^{t-\tau} E_t \Delta y_\tau$$

It is immediately evident in expression (2.5) that *changes* in the level of savings (rather than the levels themselves) are positively related to contemporaneous changes in income and negatively related to discounted expectations of changes in future income.[5]

We can further simplify the expression by recalling the so-called ‘second excess smoothness’ result of Christiano [1987], West [1988], Campbell and Deaton [1989], Viard [1993] and Carroll [1994]. These

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[4] Actual estimates of the value of *a* range as high as 0.95 (see references in Carroll and Weil [1993] and Muellbauer [1988]). A high habit persistence parameter means that consumers put more value on how the level of consumption in this period compares with that in the previous period and put less value on the actual level of consumption.

authors present evidence which suggests that, contrary to the modern permanent income hypothesis, current aggregate consumption is unresponsive to changes in expected future aggregate income. Indeed Campbell and Mankiw [1989] and Carroll [1994] show that current consumption is strongly linked to predictable *current* income.

While this suggests that the expectations term could be set to zero, we retain it as a constant and test both specifications in the econometrics section of this paper. A constant expectations term which is found to be significant could imply that agents simply have stationary non-zero expectations about changes in future income.

Based on the supposition of constant expectations of changes in future income and strong habit persistence, we can now rewrite expression (2.5) such that:

$$\Delta s_t = \beta_0 + \beta_1 \Delta y_t \tag{2.6}$$

where β_0 represents constant expectations and β_1 is a slope coefficient representing the influence of the interest rate (and the rate of time preference).[6,7]

This specification implies that if income is stationary, the level of savings will vary by an amount representing consumers' (constant) expectations of changes in their future income. From the point of view of consumption, if the present level of income remains unchanged but consumers expect future income growth $(\beta_0 < 0)$ then the level of consumption will, over time, converge on income and savings

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[5] Note that expression (2.4) can accommodate both a "**level** of savings-change in income" relationship (as *a* approaches zero; a very weak habit effect) and the proposed "**change** in savings-change in income" relationship (as *a* goes to one; ie. very strong habits).

[6] Note that the concept of the interest rate has a somewhat ambiguous meaning in this context because of the assumption we made when solving the model that the interest rate is equal to the rate of time preference, and that both were constant.

[7] Note that this expression can also be written as the Keynesian consumption function with an extra time trend: that is $s_t = (\beta_2 + \beta_1 y_t) + \beta_0 t$.

will fall; consumers increase their present level of consumption based on expectations of future income growth and present income growth is insufficient in terms of maintaining the present level of savings.

What more does expression (2.6) imply about consumption/savings behaviour? In order to further explore this question it is useful to define the *threshold increment in income* $\Delta^* y$ as the change in income that yields a stationary level of savings. Setting $\Delta s_t = 0$ we can write:

(2.7)
$$\Delta^* y = -\frac{\beta_0}{\beta_1}$$

which, given our specification, is constant. Moreover, if the two coefficients have opposite signs, the threshold will be positive and would imply that income must be incremented by a constant positive quantity over each period in order to maintain the present level of savings; that is, to overcome the erosion in savings due to expectations of positive changes in future income.

A further insight into the nature of the behaviour implied expression (2.6) may be gained by expanding the expression so that

(2.8)
$$\begin{aligned} s_t &= [\beta_0 + \beta_1(y_t - y_{t-1})] + s_{t-1} \\ &= [\beta_0 + \beta_1(y_t - y_{t-1})] + [\beta_0 + \beta_1(y_{t-1} - y_{t-2})] + s_{t-2} \\ &= ..... \end{aligned}$$

which, using the threshold expression (2.7), can be reduced to

(2.9)
$$s_t = \beta_1 \sum_{i=0}^{\infty} (\Delta y_{t-i} - \Delta^* y) .$$

This implies that the current level of savings is proportional to the sum of all changes in the level of income that varied from the threshold increment. Expression (2.9) in particular highlights the strong time dependence of the level of savings: while the change in the level of savings depends only on the constant expectations term and the current change in income, the actual level of savings depends on the complete history of income growth.

It is interesting to express this solution to the model in terms of the savings rate sr_t. It is straight forward to rewrite expression (2.6) giving

$$sr_t = sr_{t-1} - \gamma_t sr_t + \frac{\beta_0}{y_t} + \beta_1 \gamma_t \quad (2.10)$$

where $\gamma_t = (y_t - y_{t-1})/y_{t-1}$ is the rate of income growth. Normally we would expect the second term ($\gamma_t sr_t$) to be extremely small relative to the other terms so that we can further simply the expression to

$$sr_t - sr_{t-1} \cong \frac{\beta_0}{y_t} + \beta_1 \gamma_t . \quad (2.11)$$

Now *changes* in the savings rate are positively related to the rate of income growth. We see now even more clearly the contrast with the traditional view of this relationship which has it that *levels* (rather than changes in) of the savings rate are positively related to the growth rate of income; that is $sr_t = f^+(\gamma_t)$ rather than expression (2.11) where $\Delta sr_t = f^+(\gamma_t)$.

The first term on the right hand side of expression (2.11) implies that changes in the savings rate are also negatively related to the level of income, although given the likely relative variance of the two terms on the right hand side, over the short term the β_0/y_t term would most likely behave like a constant intercept. If so that we could write

$$\Delta sr_t \cong \beta_0' + \beta_1 \gamma_t . \quad (2.12)$$

In the econometrics section of this paper we test both specification (2.11) and (2.12).

Like expression (2.6), expression (2.12) can be rewritten in various forms; most interestingly we can derive a levels form such that $\ln(sr_t) = \phi e^{\beta_0' t} y_t^{\beta_1}$ or $sr_t = \phi + \beta_0' t + \beta_1 \ln(y_t)$.

As previously, we can define a threshold – in this case a *threshold rate of income growth* – at which the savings rate is constant; that is

(2.13) $$\gamma^* = -\frac{\beta_0'}{\beta_1}$$

which, as above, can be used to derive the expression

(2.14) $$sr_t \cong \beta_1 \sum_{i=0}^{\infty} (\gamma_{t-i} - \gamma^*)$$

so that the present savings rate is effectively the (scaled) sum of all previous income growth rate deviations from the threshold rate. This can explain the frequently noted strong correlation between present period savings rates and long unweighted averages of past rates of income growth.

III. Empirical Evidence

We now proceed to test four of the specifications derived above using quarterly time series data of real per capita personal disposable income, real per capita personal savings and personal saving rates for the United States between 1947:1 and 1998:4.[8]

Before we begin presenting the results of the empirical analysis, we need to say a few words about the issues surrounding the definition of personal savings and the measurement thereof. There has been considerable debate surrounding measures of savings, particularly at the personal/household level, as to

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[8] Data for the United States was taken from Econdata's Quarterly National Accounts database (NIPAQ). The following series were used to calculate the two real per capita personal savings series, the two personal savings rate series and the real per capita real personal disposable income series: Nominal Personal Disposable Income (c0126 $b sa), Real Personal

the importance of measurement issues. It has been suggested that these may account for a significant proportion of the mid-1970s peak in savings rates witnessed in many industrialised countries as well as their subsequent decline. These issues arise due to the fact that savings are measured in the national accounts as the residual of income and consumption. It has been noted that errors in the measurement of these components can be quite large relative to net savings. In particular, issues that may arise in the measurement of income include the underground or black economy, accounting for real capital gains or losses, and the use of nominal rather than real interest receipts. On the consumption side there is the issue of the consumption of durables and the depreciation thereof giving a net savings figure. Despite the fact that these errors may ameliorate some of the fall in savings rates since the mid-1970s peak, there is good evidence to suggest that, to a large extent, these movements have been real.[9]

In the regressions presented below we additionally consider the case where the expenditure on durable goods is defined to be a form of savings giving a "durables-adjusted savings rate". This is commonly done based on the argument that purchases of consumer durables are a form of savings (investment). Ideally we should also include an adjustment for the consumption (or depreciation) over time of the stock of consumer durables. However, given the difficulty in constructing such a series we do not include such an adjustment.

By way of introduction to the econometrics we have included graphs of the change in savings-income and savings rate-growth rate relationships in Figures 3.1 to 3.4. While not intended to serve any more than an illustrative purpose, it is immediately evident from the four graphs that, while there appears to be a definite correlation between the two series when using the standard savings rate, we can expect an improvement in the estimates when moving to the durables-adjusted series. Moreover, moving to the

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Disposable Income (c0132 1992$b sa), Personal Savings (c0131 $b sa), Personal Expenditure on Durable Goods (c0202 $b sa) and Population (c0135, millions).

[9] See for example Bovenberg and Evans [1990].

durables-adjusted series removes many of the apparent outliners which are attributable to the large fluctuations in personal savings rates between 1949:4 and 1951:2 (see Figure 1.1).

Simple OLS regressions of expressions (2.6), (2.11) and (2.12) fail Dickey-Fuller tests on residuals indicating that there may be cointergration problems in these regressions – this has the effect of, among other problems, making tests for the significance of the estimated coefficients unreliable. A remedy for this problem is to adopt an Error Correction specification; here we follow Banerjee *et. al.* [1993] who suggest a simple homogenous transformation of a first order linear autoregressive-distributed lag model. In the case of expression (2.6) this suggests the following specification:

(3.1)
$$\begin{aligned}\Delta s_t - \Delta s_{t-1} &= \omega_0 + (\omega_1 - 1)[\Delta s_{t-1} - \Delta y_{t-1}] \\ &\quad + \xi_0(\Delta y_t - \Delta y_{t-1}) + (\xi_1 + \xi_0 + \omega_1 - 1)\Delta y_{t-1} + \varepsilon_t\end{aligned}$$

Table 3.1 presents the results of OLS regressions of four forms of the solution to the model presented above: that is (2.6), (2.6) with no intercept, (2.12) and (2.11). Each regression is estimated using two samples: the standard personal savings rate series and the durables-adjusted personal savings rate series.

The first specific point to emerge from the regressions is that in the case the levels form of the solution (ie. 2.6), the specification that includes an intercept term performs substantially better than that without. Indeed the estimate of the intercept coefficient term is highly significant; that is significantly different from zero even at the 99% confidence level.

Using the estimated coefficients of the ECM specification, it is possible to derive long-run estimates of coefficients of the original equations; these are included in the table as $\hat{\beta}_0$ and $\hat{\beta}_1$. Using these we are also able to calculate the implied value of the threshold increment in income (2.7). Using the standard sample we have $\Delta^* y$ = \$66.65 and in the durables case we have $\Delta^* y$ = \$53.85. The former figure suggests that in order to maintain a constant level of personal savings, real per capita personal disposable income must increase by \$66.65 (1992 dollars) per quarter or \$266.60 per year. Using the durables-adjusted sample the estimated value of the threshold increment in income is slightly lower at $215.40 per annum.

The last four columns in Table 3.1 present the results of regressions using the savings rate form of the solution. As is expected, given that the extra simplifying assumptions we made in deriving these forms, the results of the regressions are slightly weaker than the previous specifications. Nevertheless, the results are very robust given the extremely simple specification. Using the estimated coefficients we are able to calculate a threshold rate of per capita real disposable income growth of 0.55% per quarter in the standard case and 0.56% per quarter in the durables-adjusted case. These figures contrast with the historical average growth rate of real per capita disposable income for the United States since the end of the war of 0.52% per quarter – this result in itself offers a simple explanation for the overall decline in the personal savings rate since 1947 and in particular their dramatic decline since the mid-1970s.[10]

IV. The Savings-Growth Relationship in the Empirical Literature

As we have pointed out above, a correlation between the level of the savings rate and the rate of income growth is frequently posited in the literature. There is a long history, beginning with Duesenberry [1949] that explores the idea that, through the influence of consumption habits, one’s previous level of consumption plays a role in determining current consumption. Modigliani has frequently tested for correlation between high savings rates and high growth rates as implied by the simplest forms of the Life Cycle Hypothesis. There is however a smaller although not insignificant stream in the literature that highlights the somewhat more dynamic relationship between savings rates and income growth rates that is suggested in the theory and econometrics layed out in the sections above.

Most recently, Carroll and Weil [1994] also present evidence that high income growth causes high (not higher) savings rates and propose habits as a possible explanation. However, the authors write in reference to several time-series graphs of growth and savings rates for the North East Asian economies that "…high growth seems to produce not only a high savings rate, but a constantly rising savings

[11] Williamson [1979], in a paper entitled "Why do Koreans Save 'So Little'", observed that despite the fact that Korea was well past take-off and enjoying high rates of growth, by 1970 it still only saved relatively little, therefore seemingly contradicting the traditional view of the relationship. Carroll, Overland and Weil [1995] make a similar observation for Japan. The savings rates in both of these countries (and other fast-growing East Asian economies) generally accelerated off very low bases and reached their peaks only after sustained periods of high growth. High savings rates appear not to be a prerequisite for rapid growth, but instead, an *eventual* consequence of it. Indeed, the World Bank's [1993] analysis of East Asian growth suggests that a 'virtuous cycle' may operate in which high growth leads to higher savings which in turn sustains high growth.

While these examples are restricted to the once fast growing economies of East Asia, there are further examples of observations of this type at a much broader level. Maddison [1992] concludes that there is "…a general positive relationship between the faster postwar growth in output per head and the *acceleration* in savings rates, and a similar positive relation in the post-1973 slowdown. The U.S.A., which has the smallest postwar acceleration in per capita growth, was also the country with least [positive] change in its long run savings habits."[12] In much the same way, Collins [1991] concludes her survey of savings behaviour in developing countries with the statement that "…countries with the highest savings rates in the 1980s were also the ones with the fastest real growth rates during 1960-84..."[13]

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[10] It is also instructive to look again at Table 1.1 and Figure 1.1 in light of these estimates.
[11] footnote 13, page 23.
[12] pages 193-4; (italics are mine).
[13] page 369.

At the household or personal level Deaton and Paxton [1994] find that in Taiwan "…birth cohorts that experienced the highest rates of earnings growth were the cohorts with the highest savings rates, as would be expected if consumption habits are important."[14] Deaton [1995] later noted that:

> "Habit models are also consistent with the link between savings and growth. At its crudest, consumption takes time to catch up to higher income levels, and the faster income grows, the further behind consumption lags, and the higher the savings rate. Consumption is attached to income not by an inflexible link, but is dragged behind it on a piece of elastic."[15]

Here Deaton is however referring to the traditional view that habits in consumption imply a positive relationship between levels of savings rates and growth rates. As we saw, however, these comments appear to be even more valid in explaining the link between changes in the savings rate and income growth rates as observed by the other authors above.

In addition to observations of simple correlations between the rate of income growth and changes in the savings rate, there is also a substantial literature that tests for causal links between the savings rate and growth. These typically constitute Granger causality tests of the hypotheses that high savings rates follow high rates of growth and vice versa. Examples include Carroll and Weil [1994] and the World Bank [1993] who both find evidence that growth Granger causes high savings rates with a positive sign while, contrary to the predictions of modern growth theory, failing to find any substantial link in the opposite direction.[16] These tests are however undertaken in the spirit of the traditional view of the savings-growth relationship and are therefore quite distinct from the more dynamic savings-growth relationship highlighted in the references above.[17]

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[14] quoted from Deaton (1995); page 31.

[15] Deaton (1995); page 31.

[16] The neoclassical growth model does not in fact imply that high savings cause high growth; instead sustained growth requires ever higher or accelerating savings rate. See the discussion in footnote 19.

[17] The finding of a positive relationship between lagged income growth and the present level of the savings rate is in fact highly compatible with the proposed (changes in) savings rate-growth rate relationship if there is a degree of positive serial

Finally, a further piece of anecdotal evidence, which we believe has not previously been noted, is presented in Table 4.1 which presents a break down of average real per capita GDP growth rates and gross national savings rates for eight regional groupings of countries for the years 1960 and 1990 using Penn World Tables data. Regions are ordered down the table from fastest growing to slowest. In the final column we see the changes in the average savings rates in each region over the 30 years. It is immediately evident that the high growth regions also enjoyed an acceleration in their savings rates while those that exhibited the lowest growth rates suffered a fall in their average savings rates.[18,19]

V. Conclusion

In this paper we present evidence that suggests that there exists a positive linear relationship between changes in real per capita personal savings and changes in real per capita personal disposable income. While this in itself is by no means novel, we also show that when income is stationary savings tend to fall. These findings combine to suggest that there exists a positive threshold increment to real per capita disposable income which must be sustained in order that the level of savings does not decline; while ever increments in income remain below the threshold, the level of savings will continue to decline. We believe that these findings combine to constitute a new stylised fact of personal consumption.

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correlation in the growth rate series. If so, then two consecutive periods of high growth will (according to the proposed relationship) result in a higher savings rate in the second period and therefore high growth in the first period will coincide with high savings in the second period which is precisely what Granger causality tests for and what was found by Carroll and Weil [1994] and the World Bank [1993].

[18] We acknowledge the objection of selection bias in this exercise, however it is merely intended to serve observation of the apparent broad application of the proposed savings-growth relationship.

[19] If the proposed savings rate-growth rate relationship is extended to the aggregate level, it could add credence to the World Bank's [1993] proposition of a 'virtuous cycle' where high growth causes higher savings which in turn sustain high growth. It is straight forward to show that the standard Solow-Swan growth model with Cobb-Douglas technology can generate a limited type of endogenous growth if the rate of growth of the savings rate (ie. $\ln(sr_t)-\ln(sr_{t-1})$) is strongly related to the rate of income growth. This result relies on a constant income growth rate elasticity of the rate of change in the savings rate. The theoretical solution presented in this paper however implies that this elasticity declines as the level of income climbs. This effect however could combine to suggest a hump-shaped growth rate profile. Such a growth profile has been noted widely in the literature which surveys East Asian growth dynamics; see for example Baumol, *et. al*. [1989], Dollar [1992], Easterly [1994] and Sarel [1994]. As suggested by Young [1994], this mode of growth puts capital accumulation at the centre of story of East Asian growth.

While there may be alternative behavioural explanations for these savings-income dynamics, we present a habit-augmented version of the permanent income hypothesis which, after assuming strong habit persistence and constant expectations of future changes in income, can account for the empirical findings.

We end this paper where we began: by looking more closely at recent movements in personal savings rates in the United States. Figure 5.1 illustrates the personal savings rate (standard and durables-adjusted) and the real per capita personal disposable income growth rates for the United States between the first quarter 1990 and the final quarter 1998 when the national accounts measured the personal savings rate as dropping below zero. A sixteen quarter moving average is superimposed on the income growth rate series and shows that in recent years there has been a notable acceleration in the growth rate of real per capita disposable income. Nevertheless, the moving average rate of growth continues to remain below both the historical average (0.52% per quarter since 1947), and the threshold rate of income growth which we estimated in section III (0.55% and 0.56%). The model suggests that a significant recovery in personal savings rates can not be expected until real per capita personal disposable income growth rates are sustained above the 2.2 per cent per annum threshold for a sufficient period.

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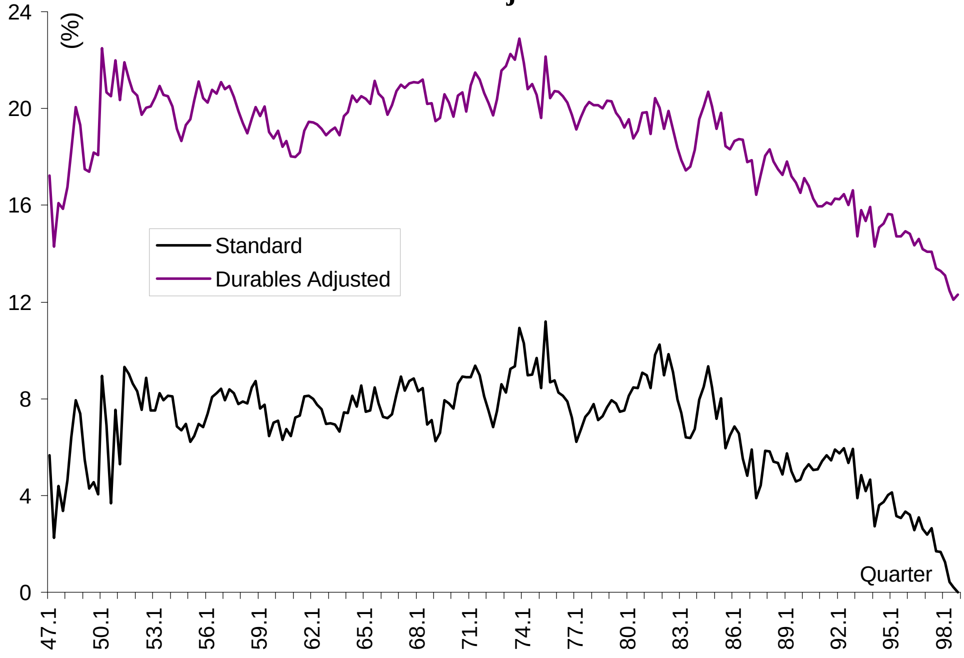
Table 1.1
Average Growth Rates of Real per capita Personal Disposable Income United States 1949:1 – 1998:4

Decade	Average Annual Growth Rate (%)
1949.1 – 1958:4	1.9
1959.1 – 1968:4	2.9
1969.1 – 1978:4	2.6
1979.1 – 1988:4	1.7
1989.1 – 1998:4	1.2

Source: NIPAQ c0132, c0135.

Figure 1.1
United States Personal Savings Rates
Standard and Durables Adjusted: 1947:1 to 1998:4



Source: NIPAQ c0126, c0131, c0202.

Figure 3.1
Change in Savings verses Change in Income (Standard)

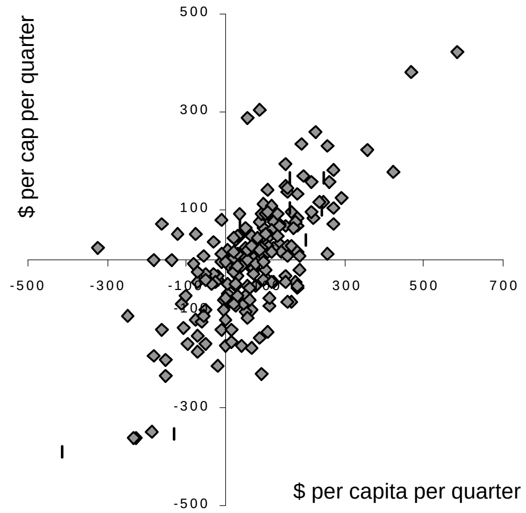


Figure 3.2
Change in Savings verses Change in Income (Durables)

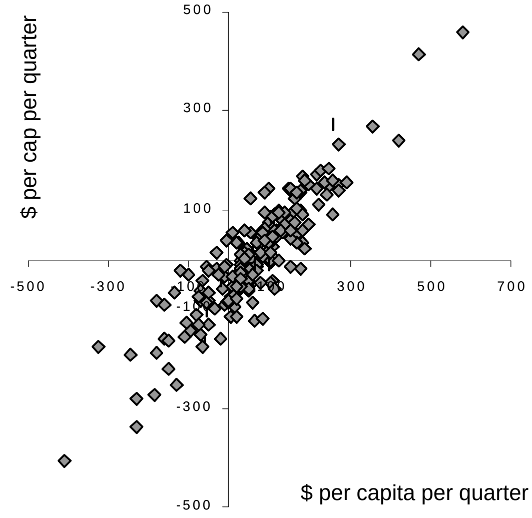


Figure 3.3
Change in Savings Rate verses Growth Rate (Standard)

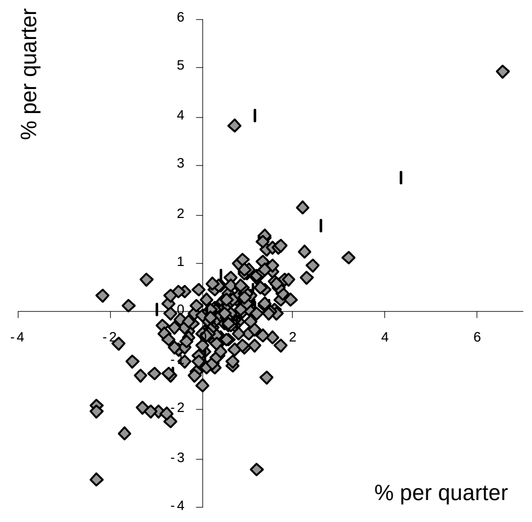


Figure 3.4
Change in Savings Rate verses Growth Rate (Durables)

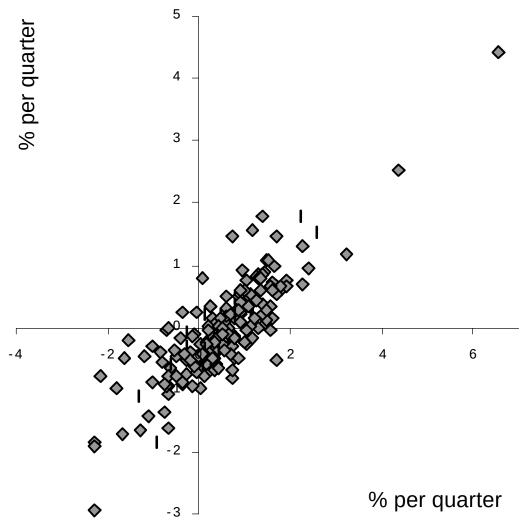


Table 3.1
Error Correction Model Estimates

Statistics [1]	Specification							
	$\Delta s_t = \beta_0 + \beta_1 \Delta y_t$		$\Delta s_t = \beta_1 \Delta y_t$		$\Delta sr_t = \beta_0' + \beta_1 \gamma_t$		$\Delta sr_t = \frac{\beta_0}{y_t} + \beta_1 \gamma_t$	
	Durables	Standard	Durables	Standard	Durables	Standard	Durables	Standard
ω_0	-0.0272 (-5.74)	-0.0329 (-4.39)	-	-	-0.2735 (-6.95)	-0.2987 (-4.62)	-	-
$\omega_1 - 1$	-0.7644 (-11.32)	-1.0245 (-14.20)	-0.5624 (-8.97)	-0.9368 (-12.95)	-0.9722 (-13.95)	-1.1752 (-16.68)	-0.9038 (-13.08)	-1.1545 (-16.42)
ξ_0	0.8170 (29.73)	0.6474 (13.16)	0.7865 (27.11)	0.5817 (11.89)	0.6149 (21.84)	0.5684 (10.95)	-187974 (-2.45)	-302671 (-2.22)
$\xi_1 + \xi_0$ $+ \omega_1 - 1$	-0.2600 (-5.91)	-0.5305 (-6.76)	-0.3025 (-6.48)	-0.6490 (-8.44)	-0.4790 (-9.37)	-0.6445 (-7.95)	0.4272 (5.28)	0.2638 (1.85)
Note 1	-	-	-	-	-	-	-2331.58 (-5.54)	-2720.34 (-3.90)
Note 1	-	-	-	-	-	-	-0.6547 (-6.98)	-0.9557 (-6.16)
$\hat{\beta}_0$	-0.0355	-0.0321	-	-	-0.2813	-0.2542	-2578.66	-2355.19
$\hat{\beta}_1$	0.6599	0.4822	0.4621	0.3073	0.5073	0.4516	0.2856	0.1722
$\Delta^* y$ or γ^*	$53.85	$66.65	-	-	0.55%	0.56%	-	-
$\overline{R}^2$	0.93	0.82	0.90	0.79	0.89	0.80	0.88	0.79
F Statistic	907.51	304.36	774.68	273.38	570.49	274.33	319.50	161.78
χ^2_{JB} *Norm (2dof)*	0.0456	20.6372	23.1266	10.8017	36.57	391.18	45.1228	388.56
Durbin Watson	2.1313	2.0767	2.3726	2.2228	2.0682	2.0427	2.1730	2.1097
BPG Hetro Test (3dof)	3.931	9.600	-	-	1.593	13.510	19.601	27.393
Ramsey RESET Spfcn Test	0.8093 0.6879 0.5660	0.0517 0.3768 0.5434	0.5412 0.3179 0.8450	3.1004 1.7097 1.3086	2.0553 4.6976 3.2594	1.8507 5.5397 3.7492	1.4549 2.4711 1.6410	1.5677 2.3256 2.3559
Chow Stat @ N/2	2.7477	1.5511	2.292	1.6733	0.9369	0.8828	3.5738	2.0733
Dicky-Fuller No Trend	-3.09 (-3.81)	-3.56 (-3.81)	-3.09 (-3.81)	-3.56 (-3.81)	-3.917 (-3.81)	-4.922 (-3.81)	-3.570 (-4.70)	-4.495 (-4.70)
Dicky-Fuller Trend	-3.92 (-4.15)	-4.23 (-4.15)	-3.92 (-4.15)	-4.23 (-4.15)	-3.669 (-4.15)	-4.457 (-4.15)	-3.511 (-4.70)	-4.495 (-4.70)
N	206	206	206	206	205	205	205	205

Note 1: the regressions in the last two columns have an extra slope coefficient resulting in two extra ECM coefficients.
[1.] *t-statistics* are in parentheses below each of the estimated coefficients.

Table 4.1
Average Growth Rates and Savings Rates by Region

Region	Average Real per capita GDP Growth (% pa)	Average Gross National Savings Rate (%)	Gross National Savings Rate [d] (%) 1960	1990	Change in Savings Rate 1960 to 1990 (%)
NE Asian Five [a]	6.2	24.6	12.4	33.6	21.2
Other East Asia [b]	3.5	18.4	12.3	24.2	11.9
OECD [c]	3.0	24.1	24.6	25.1	0.5
North Africa and the Middle East	2.5	9.5	8.4	9.0	0.6
The Sub-Continent	1.8	6.6	5.0	8.1	3.1
Central America	1.8	10.8	10.0	10.7	0.7
South America	1.0	17.7	18.4	16.7	-1.7
Sub-Saharan Africa	0.8	8.9	9.0	7.6	-1.4

Source: Summers and Heston (1991) Penn World Tables 5.6A using 96 Barro (1991) countries (less Fiji and PNG).
[a] – Japan, Hong Kong, Singapore, South Korea, Taiwan.
[b] – Philippines, Indonesia, Malaysia and Thailand.
[c] - Excluding Japan and Korea which have been included in the North East Asia set.
[d] - Three year averages: 1960-62 and 1988-90.

Figure 5.1
Recent Savings Rate and Growth Rate Dynamics
United States 1990:1 to 1998:4