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Household Saving in France: Stochastic Income and Financial Deregulation

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Abstract

The household saving ratio in France has undergone very sharp changes over the past two decades, falling dramatically in the first part of the 1980s before rising in more recent years. This paper emphasizes two factors in the evolution of private saving in France. The first relates to perceptions of household income growth and uncertainty, which are likely to have been affected by deteriorating labor market conditions, and which may therefore help to account for the recent increase in saving. The second factor relates to financial deregulation which may have lowered saving and increased its sensitivity to interest rate changes. It is argued that both factors have played some role in the evolution of French household saving.

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### Summary

In recent years, the household saving ratio in France has increased substantially, offsetting some of the decline in the saving ratio that occurred during the 1980s. This paper investigates the roles of two factors in accounting for recent saving behavior in France. First, the deterioration in labor market conditions may have created a precautionary demand for saving by households wishing to insure themselves (by accumulating assets, or saving) against potentially large (adverse) income shocks (for example, becoming unemployed). Second, financial deregulation may have increased the sensitivity of households to movements in real interest rates, so that relatively high real rates would elicit larger increases in saving than in the past.

To investigate the first hypothesis, the paper estimates a permanent-income model of household consumption that has been augmented to include the effects of the variability of household labor income. In such a model, saving rises whenever the mean of household income is expected to decline over time ("saving for a rainy day") and whenever the variance of household income is expected to rise (precautionary saving). This augmented permanent-income model tracks recent developments in household saving remarkably well. However, the "saving for a rainy day" component of saving seems to play a much more significant role in recent developments than the precautionary motive. Specifically, reductions in expected future income growth seem to be quantitatively much more important than increases in the expected variability of income in accounting for recent saving behavior.

On the effects of financial deregulation, the paper finds support for the view that the interest rate elasticity of household saving has increased significantly as a result of deregulation. Indeed, as a quantitative matter, the results suggest that recent high levels of real interest rates in France have played a significant role in stimulating household saving.



## I. Introduction

After remaining stable for most of the 1970s, the household saving ratio in France began a steep decline at the beginning of the 1980s (see Chart 1). While a complete understanding of the factors underlying this decline is not yet available, a number of reasons have been put forward that are at least consistent with the observation of reduced saving. These include, *inter alia*, reductions in inflation, strong growth in household incomes, significant run-ups in asset prices (stock and house prices), and the process of financial deregulation and liberalization which may have permitted households that had been liquidity-constrained prior to deregulation to engage in consumer borrowing.

The negative trend in household saving that characterized most of the 1980s bottomed out by the end of 1987, by which time the household saving ratio had declined from about 19 percent of disposable income (its approximate level for most of the 1970s) to about 10 percent (Chart 1). Subsequently, the saving ratio began to increase steadily, reaching about 14 percent of disposable income by 1993. In the four-year period since 1989, the saving ratio increased by over 2 percentage points, a period during which inflation was subdued and income growth was relatively weak. Since these latter variables have tended to figure prominently in consumption/saving equations using French data, the rise in household saving over the past four years is something of a puzzle. 1/ Moreover, the issue is not merely of concern to forecasters. Given the importance of household consumption in total demand, the increase in household saving during a period of weak activity is also an issue of considerable policy relevance.

A number of different hypotheses have been put forward to explain the recent behavior of household saving in France. One possibility is that the high real interest rates that have been associated with the disinflation process may have stimulated household saving. One problem with this explanation is that it has proved difficult to identify a significant and sufficiently large effect of interest rates on saving behavior using either French data or data for other OECD countries. 2/ Nevertheless, it is possible that higher real interest rates may have elicited some increase in saving, but that such effects cannot be identified by estimating standard equations using historical data. This might reflect the fact that it is only in the relatively recent period--that is after financial deregulation--

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1/ For previous empirical studies of household saving behavior in France, see, for example, Sterdyniak (1987), Artus et. al. (1991), and Direction de la Prévision (1993).

2/ See Allard [1992] and the references therein for the French case, and Hall [1988], for example, for the United States.

that the interest elasticity of saving has turned significantly positive. 1/

A second possible explanation for the recent increase in saving might be wealth effects associated with asset price deflation. Indeed, the decline in saving during much of the 1980s was associated with a run-up in asset prices (stock and house prices), suggesting that wealth effects could have a role in explaining the more recent behavior of saving. In addition, there is some evidence that housing prices (at least in Paris) have dropped considerably since their peak in 1990, and real stock prices have also been relatively flat over this period. Thus, wealth effects may have played some role in accounting for the increase in saving over the past several years. However, an investigation of the importance of wealth effects in consumption has been hampered by a general paucity of data. While annual data on net wealth of households are available, the only wealth data available at a higher frequency appear to be stock prices. 2/

A third hypothesis that has been proposed to explain recent saving behavior relates to an increase in uncertainty which may have created a precautionary demand for saving. It has been argued that the main proximate cause of the increase in uncertainty is the sharp deterioration in labor market conditions in France. 3/ The importance of this explanation is difficult to gauge. In otherwise standard consumption equations, the unemployment rate (or rather its rate of change) has been found to have a statistically significant impact, which is consistent with the view that increases in uncertainty (proxied by the unemployment rate) lead to more saving. However, the empirical results from such regressions tend to suggest that the magnitude of the effect of this proxy for uncertainty on saving is too small to explain a sizeable proportion of the observed increase in saving in recent years.

More fundamentally, in order to investigate whether uncertainty about future income prospects has been a significant, and quantitatively important, factor in accounting for saving behavior, it is obviously important to control for other relevant factors. This is especially important because unemployment--the chosen proxy in previous empirical investigations--may affect both expectations about the variability of future income (which determines the precautionary demand for saving) as well as

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1/ Such a view might be rationalized by a model in which, prior to deregulation, consumption growth matched income growth because consumers were liquidity constrained, but following deregulation, the share of liquidity-constrained consumers fell, increasing the sensitivity of consumption and saving to changes in the interest rate (see, for example, Campbell and Mankiw [1989]).

2/ As mentioned previously, a housing price index for Paris exists, but its reliability as a proxy for house prices in France remains in doubt.

3/ Uncertainty about whether the generosity of public pensions would be reduced may also have contributed to a precautionary demand for saving.

Chart 1. France: Household saving ratio







expectations about the future *level* (or growth rate) of income. Controlling for expected future income growth is thus of primary importance in judging the importance of precautionary saving.

In this paper, a simple model of saving behavior is proposed which allows one to measure households' expectations about future income growth. The basic idea of the model is that forward-looking agents save whenever they expect their income to decline (or not grow as quickly) in the future. In other words, households save for a rainy day. If income tomorrow is expected to be much lower than today (say, because, there exists a significant probability of becoming unemployed), then saving rises today in order to maintain consumption when income drops.

An issue that is central to testing the validity of the "saving for a rainy day" hypothesis is how to capture households' expectations about future income growth. In general, it is not enough to simply project current income growth on its past values and use the resulting coefficients to forecast the future course of income. This is because households will generally have more information about the future behavior of their incomes than is contained in its own past behavior, say because they have specific information about their future employment or income prospects.

Campbell [1987] has proposed a simple way to extract a measure of the future income growth expected by households based on the notion that households save for a rainy day. Applying this methodology to French data, it is possible to recover an actual time series of expected future income growth, which can then be compared with actual data on household saving. Plotting this expectations variable over time, one can get some idea of how well it tracks actual saving behavior. In addition, one can see how correlated the two time series (actual saving on the one hand and expected future income growth on the other) are.

The results suggest that actual saving in France over the period 1970-93 has moved very closely with the expected future income growth variable generated by the model. Over the entire sample, the correlation between saving and expected future income growth is about 0.99. Moreover, a simple time-series plot of the two variables shows that the expectations variable tracks saving well even in the more recent period (since 1989), a period during which alternative models appear to have gone off track.

One problem with the approach advocated by Campbell and others is that it assumes certainty equivalence. This means that expectations about unemployment, for example, will affect saving only by changing the expected time profile of incomes, but not by changing the expected *variability* of incomes. It is changes in this expected variance that generate a precautionary demand for saving. This demand arises because risk averse individuals who expect greater variance in their income streams wish to accumulate assets (save) as a means of insuring their consumption against adverse shocks (for example, becoming unemployed).

To allow for this possibility, the model proposed below considers effects on saving coming both from expectations about the level (or growth rate) of future income, and expectations about the future variability of income. The results suggest that while increases in this expected variance have generated some increase in saving over the past few years, the increase in precautionary saving has been small. <sup>1/</sup> For example, taking the last four years of our sample (the period during which questions have been raised as to the reasons for the increase in saving), about 95 percent of the change in saving accounted for by the model is explained by changes in the expected growth rate of income, with only 5 percent being accounted for by expected changes in the variability of income.

The remainder of this paper is organized as follows. In the next section, a simple model of household saving behavior based on utility maximization under uncertainty is presented, and the testable implications of the model are spelled out. Empirical results applying this approach (referred to below as the "augmented" Campbell model--augmented to include the effects of precautionary saving) to French household saving data are given in Section 3. In view of the restrictiveness of the augmented Campbell model--according to which only the properties of the stochastic process followed by household labor income determine saving behavior, we consider in Section 4 more conventional saving equations where the explanatory variables include income, proxies for household wealth, real interest rates, inflation, etc. In presenting these results, effects of financial deregulation--which may have altered saving behavior in France over the past 10-15 years--are also considered. It is found that deregulation of financial markets has increased the sensitivity of household saving to changes in real interest rates. In the future, therefore, reductions in real interest rates are likely to elicit larger declines in the saving rate than they would have in the past, and vice-versa.

The main conclusions of this paper are presented in Section 5. The technical aspects of the discussion are included in the Technical Appendix. Data sources are provided in the Data Appendix.

## II. Analytical Framework

The assumed framework involves a representative household which maximizes the discounted sum of current and expected future utilities over an infinite horizon subject to a sequence of budget constraints (one corresponding to each time period) and a transversality condition which rules out Ponzi-type schemes. Under certainty equivalence, consumption is proportional to permanent income. Saving, in such a world, will equal the expected present value of future declines in labor income. A shock that is expected to lower future income relative to current income raises saving, and vice-versa.

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<sup>1/</sup> Statistically, the effect is insignificant.

When the assumption of certainty equivalence is abandoned, the *riskiness* of future income has an additional and distinct effect on saving over and above the effect of shocks to the *level* of future income. To see this, recall that from Hall [1978], who assumed certainty equivalence, consumption follows a process such that its first difference equals the innovation to lifetime income,  $\xi$ , given by

$$(1) \quad \xi_t = \frac{r}{(1+r)} \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} (E_t y_{t+j} - E_{t-1} y_{t+j}),$$

where  $y$  denotes real household labor income,  $r$  is the real interest rate (assumed fixed and known), and  $E_t$  denotes the expectations operator conditional on information at time  $t$ . With precautionary saving, however, the first difference of consumption will also depend on the variance of  $\xi_t$ , denoted  $\sigma_{\xi_t}^2$ . Specifically, an increase in the variance of the innovation in lifetime income creates a precautionary demand for saving. This reflects the fact that households wish to accumulate assets as a means of insuring their consumption streams against potentially large adverse shocks. As shown in the appendix, the solution for the saving function under the assumption of a constant-absolute-risk-aversion (CARA) utility function is:

$$(2) \quad s_t^* = - \sum_{j=1}^{\infty} \frac{1}{(1+r)^j} (E_t \Delta y_{t+j}) + \frac{\alpha \rho \sigma_{\xi_t}^2}{2[r+(1-\rho)]}$$

where  $s_t^*$  denotes real household saving at time  $t$ ;  $\Delta$  denotes the (backward) difference operator;  $\alpha$  denotes the degree of risk aversion; and  $\rho$  denotes the degree of persistence of the shocks to the variance of lifetime labor income.

The first term in equation (2) is the certainty-equivalent portion of saving, which is equal to the expected present value of future declines in labor income. Intuitively, if some shock causes expected future income to decline (relative to its current level), then saving increases today so that consumption can be maintained in the future. The second term in equation (2), which is absent from models which impose certainty equivalence, captures the precautionary saving motive. When there is a shock to the variance of  $\xi$ , precautionary saving increases in line with both the degree of risk aversion ( $\alpha$ ) and the persistence of the shock (summarized in the parameter  $\rho$ ). 1/ The intuition is that an increase in the variability of income creates a demand by risk averse consumers to accumulate assets as a means of insuring themselves against potentially adverse shocks in the future.

To implement the model empirically, it is necessary to estimate the expected present value of future declines in labor income (the first term in equation (2), which is denoted by  $pdv_t$  below) as well as the variance of the

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1/ Innovations to the variance process that die out quickly (low value of  $\rho$ ) will have little effect on precautionary saving, while shocks to the variance that are permanent (as in the random walk case of  $\rho = 1$ ) will have larger effects on saving.

innovation in lifetime income, denoted  $\sigma_{\xi_t}^2$ . One way of doing this would be to estimate a univariate process for labor income and obtain  $pdv_t$  and  $\sigma_{\xi_t}^2$  from the resulting parameters. One problem with such an approach is that it ignores information that households may use in forecasting the future behavior of income, other than its own past history. 1/ In particular, as Campbell [1987] showed, saving itself should be a useful predictor of the future course of income if individuals in fact "save for a rainy day."

In line with Campbell's work, the procedure followed here is to estimate a first order bivariate vector autoregression (VAR) in the first difference of labor income and the level of saving: 2/

$$(3) \quad \begin{bmatrix} \Delta y_t \\ s_t \end{bmatrix} = \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix} \begin{bmatrix} \Delta y_{t-1} \\ s_{t-1} \end{bmatrix} + \varepsilon_t$$

In equation (3), a deterministic (linear) trend is removed from the saving data to allow for "consumption-tilting" behavior in response to differences between the rate of interest and the rate of time preference. 3/ The parameter estimates from the VAR allow us to retrieve an estimate of the present discounted value of future declines in labor income (the first term in equation (2)). In addition, an estimate of the variance of the innovation to lifetime labor income (second term in equation (2)) can be obtained from the VAR residuals.

### III. Empirical Results for the Augmented Campbell Model

This section considers the role of expected future income growth in accounting for household saving behavior in France, abstracting in the first instance from the precautionary saving motive. A second part considers the empirical results for the full augmented model which includes precautionary saving.

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1/ One consequence of this would be that the extent of uncertainty (captured by  $\sigma_{\xi_t}^2$ ) would tend to be overestimated relative to the case in which forecasts were based on the complete information set of households.

2/ The Schwartz-Bayes Information Criterion (SBIC) was used to determine the order of the VAR.

3/ As pointed out by Caballero [1990], any divergence between the interest rate and the subjective rate of time preference will introduce a trend into the saving function. This deterministic trend in saving is removed prior to estimation of the VAR. Although the model identifies the trend in saving with consumption tilting dynamics related to divergences between the interest and time preference rates, more generally it could capture other deterministic factors as well.

# 1. Saving and expected future income

Abstracting from the precautionary motive, equation (2) shows that saving should be equal to the expected present value of future declines in labor income, which is denoted by  $pdv_t$ . Since by definition,

$$(4) \quad pdv_t = - \sum_{j=1}^{\infty} \frac{1}{(1+r)^j} (E_t \Delta y_{t+j}),$$

the parameters of the VAR defined by equation (3) may be used to obtain an estimate of  $pdv_t$ . Specifically, denoting the matrix of coefficients in (3) by  $\Psi$ , and defining the vector  $\mathbf{x}_t = [\Delta y_t, s_t]$ , the matrix equation (3) may be written more compactly as

$$\mathbf{x}_t = \Psi \mathbf{x}_{t-1} + \varepsilon_t.$$

The  $k$ -step ahead expectation is simply

$$E_t \mathbf{x}_{t+k} = \Psi^k \mathbf{x}_t$$

so that

$$(5) \quad pdv_t = -[1 \ 0][\Psi/(1+r)][I - \Psi/(1+r)]^{-1} \mathbf{x}_t \equiv \Gamma \mathbf{x}_t,$$

where  $\Gamma$  is thus a (nonlinear) function of the VAR parameters. 1/ The time series of  $pdv_t$  obtained in this manner can then be compared to actual data on saving to determine whether expectations of future income growth are indeed an important determinant of household saving behavior, as implied by the model.

Table 1 presents the coefficient estimates for the VAR. The main coefficient of interest in this table is the effect on (the first difference of) labor income of lagged saving. 2/ As long as households have more information about the future course of income than is contained in its past history, this coefficient should be negative and statistically significant. In other words, saving should anticipate future declines in labor income. As can be seen, the coefficient is estimated at -0.046, and thus has the sign predicted by theory. Moreover, at the 10 percent level, the coefficient is significantly different from zero. Thus, saving indeed appears to Granger-cause subsequent declines in household labor income.

1/  $\Gamma$  also depends on the interest rate,  $r$ . In all calculations, an annual real interest rate of 4 percent was assumed. The results are insensitive to annual interest rates in the range 2-6 percent.

2/ As described in the Data Appendix, the saving data used in this paper are calculated as household disposable income minus household consumption. Labor income, however, is only available on a gross basis. See Bloch and Maurel [1991] for previous estimation of Campbell's model using similar data.

Using the formula given in equation (5), one can compute the entire time series of  $pdv_t$ . Chart 2 plots both the time series of the expected present value of future declines in labor income ( $pdv_t$ ) and the detrended level of saving over the period 1970:1-1993:2. <sup>1/</sup> As can be seen, overall

Table 1. VAR Parameters and Implications for  $\Gamma$  Vector

a. VAR Parameters

(Row variable regressed on column variable)

	$\Delta y_{t-1}$	SE	$s_{t-1}$	SE
$\Delta y_t$	0.17	0.10	-0.046*	-0.025
$s_t$	0.07	0.17	0.91**	0.04

b. Implications for  $\Gamma$  Vector

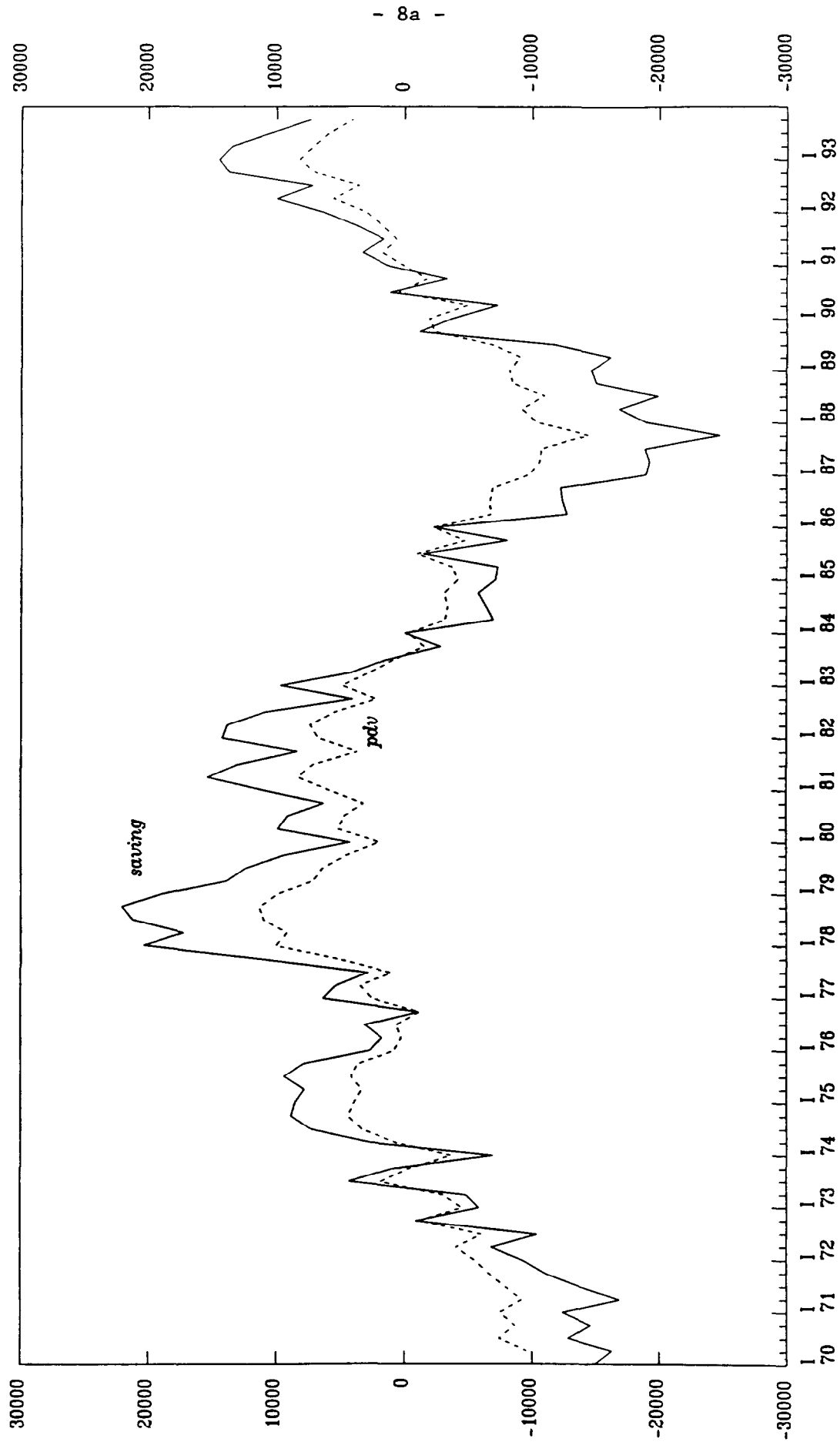
	$\Gamma_y$	SE( $\Gamma_y$ )	$\Gamma_s$	SE( $\Gamma_s$ )
	-0.15**	0.075	0.53**	0.20

Notes: Sample: 1970:3-1993:4; \* (\*\*) denotes significance of the coefficient at the 10 percent (5 percent) level.

the series labelled  $pdv$  tracks household saving reasonably well throughout the period. Indeed, the correlation between the two time series--at about 0.99--is very high, suggesting that even this simple model provides a reasonable starting point for describing household saving behavior in France. Perhaps more interesting is the fact that the expected present

<sup>1/</sup> The time series on  $pdv$  is obtained according to the formula given in equation (4) above. The results for the  $\Gamma$  vector are presented in Table 1b.

Chart 2. Detrended household saving<sup>1/</sup> and the expected present value of future declines in labor income (pdv).



1/ Household saving with a linear trend removed (see text).





value term picks up the increase in saving since 1987, and tracks the actual variable very well during the last few years, a period during which traditional saving regressions have apparently performed poorly. 1/

## 2. Incorporating precautionary saving: the augmented model

The above discussion suggested that expected future income appears to have been an important determinant of household saving behavior in France, including in the more recent period in which the increase in saving until 1993:1 has been associated with reductions in expected future income growth, and the subsequent reduction in saving in the course of 1993 has occurred alongside improved household expectations of future income and hence a reduction in "rainy-day" saving (Chart 2). 2/ These changes in expectations may reflect a number of different factors, including perceived changes in labor market conditions, or perhaps a changing assessment of productivity growth over the medium term.

In addition to the expected level of future income, it is possible that income's future variance played some role in the recent behavior of saving, along the lines of the precautionary saving hypothesis. Recalling the definition of the innovation to lifetime income ( $\xi_t$ ) given previously in equation (1), we have

$$\begin{aligned}
 (6) \quad \xi_t &= \frac{r}{(1+r)} \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} (E_t y_{t+j} - E_{t-1} y_{t+j}) \\
 &= \frac{r}{(1+r)} \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} [1 \ 0] \sum_{i=0}^j \Psi^i \varepsilon_t \\
 &= [1 \ 0] [I - \Psi/(1+r)]^{-1} \varepsilon_t
 \end{aligned}$$

where the second equality follows from the VAR. Given  $\xi$ , its instantaneous variance, period by period, may be calculated by simply squaring the

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1/ Saving began to turn down in the second quarter of 1993. This turning point is also captured by the model, and suggests that part of the reason for reduced household saving is related to an improvement in the outlook for future income, and thus to a reduction in the extent to which households are saving for a rainy day.

2/ It should be noted that an increase in pdv implies that households have reduced their forecast of the expected future growth of labor income, which causes them to increase their saving. Conversely, in the last few quarters of the sample, an improved outlook for the future course of labor income may have contributed to a reduction in household saving.

expression in (6), yielding a time series  $\sigma_{\xi_t}^2$ . 1/ Once this is done, one can run (following equation (2)) a regression of the form

$$(7) \quad s_t = a_0 + a_1 pdv_t + a_2 \sigma_{\xi_t}^2 + u_t,$$

where, under the null,  $a_1 = 1$  and  $a_2 = \frac{\alpha \rho}{2[r+(1-\rho)]} > 0$ . 2/ Thus, saving should be equal to a term which depends on expected future income growth, and a term which depends on the variability of the innovation to lifetime income, where the importance of the latter depends on the degree of risk aversion and on the persistence of the shocks to the variance.

In equation (7), the pdv variable will be correlated with the error term  $u_t$ , indicating that Ordinary Least Squares is inappropriate. To overcome this problem, an instrumental variables procedure is used, where the instruments consist of two lags each of saving and the variance, as well as the first difference of income. The following results were obtained:

$$(8) \quad s_t = 118.82 + 1.85 pdv_t + 0.000071 \sigma_{\xi_t}^2$$

(524.76) (0.023\*) (0.000047)

$$R^2 = 0.98 \quad SER = 1320.94 \quad \text{Sample: 1970:3-1993:4}$$

where the numbers below the coefficient estimates are the heteroscedastic-consistent (White) standard errors, and \* denotes significance of the coefficient at the 5 percent level.

As can be seen, both coefficients have their theoretically predicted signs, although only the pdv variable is significantly different from zero. 3/ Nevertheless, the explanatory power of the regression is high, with the regressors explaining about 98 percent of the variance in saving. It is also clear that the coefficient on pdv is significantly above unity (its value under the null), suggesting that there is some excess sensitivity

1/ An alternative way of obtaining  $\sigma_{\xi_t}^2$  would have been to estimate the VAR using an ARCH procedure. The problem with implementing this approach was that the numerical algorithm used to calculate the time-varying component of the variance did not converge.

2/ The constructed regressor,  $\sigma_{\xi_t}^2$ , depends on the coefficient estimates obtained from the VAR, which are consistently estimated even in the presence of heteroscedasticity.

3/ The interpretation would be that the role of our proxy for time-varying uncertainty in generating a precautionary demand for saving is small, possibly reflecting low persistence of variance shocks. In contrast, the role of the saving for a rainy day term--captured by pdv--is highly significant.

of household saving to movements in expected changes in labor income. 1/  
In contrast, the coefficient on the variability of income, although  
correctly signed, is small. 2/

To get some indication of the relative importance of the two variables,  
one can decompose the movement in saving into a proportion due to changes in  
the pdv variable and another due to changes in the variance. Considering  
the last four years of the sample as the period to be explained, 3/  
equation (9) reveals that about 5 percent of the explained change is  
accounted for by the precautionary saving term, and the balance (95 percent)  
is accounted for by changes in the expected growth of household income (the  
pdv term in equation (8)).

#### IV. Other Determinants of Saving Behavior

The previous section has sought to address the importance of expected  
income growth and variability within the context of an augmented permanent  
income model of consumption and saving. In such a model, saving depends  
exclusively on the stochastic properties of the underlying process for labor  
income. In alternative models, however, there is room for other variables  
to affect consumption and saving behavior. In this section, the effects on  
saving of some of these other variables are considered.

For one thing, the model of the previous section assumed an infinite  
horizon, in line with permanent income theory. In a life-cycle, overlapping  
generations (OLG) model, however, saving, in addition to its dependence on  
income growth and wealth, may be related to demographic factors. Further,  
the model of section III assumed a constant real interest rate. This  
assumption was necessary in order to obtain a closed-form solution for the  
saving function (see Caballero [1990]). More generally, however, one may  
wish to allow for an effect of interest rate changes on saving, although the  
sign of this effect is ambiguous *a priori* since it depends on the

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1/ The excessive variability of saving (excessive, that is, in light of  
actual shocks to pdv) may reflect an omitted variable. It is possible, for  
example, that, in addition to the stochastic process for labor income,  
saving behavior in France may have been influenced by a number of different  
factors, including institutional changes relating to the deregulation of the  
financial sector, which cannot easily be accommodated within the formal  
permanent income model developed in this section. This issue is  
investigated below in section IV.

2/ To the extent that time-varying uncertainty has played only a limited  
role in saving behavior in France, the relevant model would be Campbell's  
unaugmented version, as reported in Table 1. It may be noted that the  $\chi^2$   
test for the strong implications of the model (essentially the restrictions  
on the  $\Gamma$  vector reported in Table 1b) is equal to 8.23, which does not  
reject the model at the 1 percent level.

3/ All changes are relative to the average value of the variables during  
the entire sample excluding the last four years.

interaction between an income and a substitution effect. Finally, inflation is often thought to be an important determinant of household saving because households need to put aside part of their income to maintain the real value of imperfectly indexed financial assets whenever there are price increases.

In addition to income growth, wealth, the real interest rate, inflation, and demographic factors, it is plausible to argue that the behavior of saving has been influenced by the process of financial deregulation that many industrial countries undertook during the 1980s. According to one view, financial deregulation may have reduced the incidence of liquidity constraints in the economy, and hence may have contributed to an autonomous reduction in saving as previously liquidity-constrained households were able to borrow against their future labor income. In addition, as the proportion of liquidity-constrained households declines, one might expect to see an increase in the sensitivity of aggregate saving to changes in the real interest rate, since a greater proportion of households would be in a position to optimize intertemporally. 1/

Indeed, during the 1980s, France, like some other industrialized countries, undertook a number of significant reforms of its financial sector. Liberalization took place along three main tracks. The first involved the establishment and regulation of markets for new products such as futures, options, and commercial paper, the overhaul of stock exchange regulations, and the progressive liberalization of foreign exchange markets. The second track sought to modernize public debt management in order to increase the liquidity of government paper and foster the expansion of financial markets. The final track--which is perhaps the most relevant for the purpose of this paper--was aimed at households and involved the regulation of mutual funds and other saving instruments, as well as the liberalization of banking credit. 2/ 3/

In line with other life-cycle OLG models, therefore, the specification proposed in what follows allows for the traditional effects of income

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1/ For a justification of this view, see, for example, Campbell and Mankiw [1989].

2/ Changes in public debt management--particularly the practice (adopted after 1985) of auctioning public debt--also affected household saving behavior by contributing to the market-determination of interest rates.

3/ The growth of mutual funds in France dates from the early 1980s and was initially due to interest rate ceilings imposed in 1981, being strengthened over the past decade by a series of fiscal incentives (Zerah [1993]). As regards liberalization of banking, the Banking Law of 1984 removed most of the distinctions between commercial and merchant banks and was followed by the abandonment of direct credit controls (encadrement) in 1986. This liberalization had a particularly strong effect on consumer credit (crédit de trésorerie), the stock of which doubled between 1986 and 1989. For details of the financial deregulation process in France, see Pilverdier-Latreyte [1988], Vincent [1993], and Zerah [1993].

growth, wealth, interest and inflation rates, and demographic factors, as well as the less standard--but potentially no less important-- effects coming from the financial deregulation side. 1/ Following a number of authors (see, for example, Jappelli and Pagano [1994]), the proxy for financial deregulation used here is the outstanding stock of consumer credit. The hypothesis is that increases in this proxy for deregulation should be associated with decreases in saving. In addition, the possibility that financial deregulation increases the sensitivity of saving to changes in the real interest rate is also allowed for in the specification.

The proposed saving model may be written as follows: 2/

$$(9) \text{ sratio}_t = \beta_0 + \beta_1 \hat{y}_t + \beta_2 \text{dem}_t + \beta_3 \text{ap}_t + \beta_4 r_t + \beta_5 \hat{p}_t + \beta_6 d_t + \beta_7 d_t * r_t + u_t$$

where  $\text{sratio}$  is the household saving ratio; 3/  $\hat{y}$  denotes the growth of real household disposable income;  $\text{dem}$  are demographic factors measured as the sum of the population aged under 20 and aged over 60 to the total population;  $\text{ap}$  represent asset prices which are proxied by the stock index divided by the consumption deflator; 4/  $r$  is the real (short-term) interest rate;  $p$  is the inflation rate;  $d$  is the proxy for financial deregulation: it is equal to the ratio of the outstanding stock of consumer credit to GDP rescaled to vary between zero and unity; 5/ and  $u$  is a stochastic disturbance.

Given the previous discussion, our priors are that  $\beta_1, \beta_5, \beta_7 > 0$ , and  $\beta_2, \beta_3, \beta_6 < 0$ . The sign of  $\beta_4$  depends on the interaction between an income and a substitution effect, and is therefore unknown a priori. Because a number of the variables on the right hand side of equation (9) are likely to

1/ For a nice exposition of the life-cycle OLG model, see Modigliani [1986].

2/ The specification is a simplified version of the one applied to United Kingdom data by Bayoumi (1993).

3/ The dependent variable in the model of section III was the level of saving, rather than the saving ratio. This reflected mainly analytical tractability since, in the model of section III, saving (rather than the saving ratio) could be shown to be a function of the expected present value of future declines in labor income. The solution for the saving ratio in the permanent income model as a function of the expected present value of future declines in the log of labor income is only an approximation (see Campbell and Deaton [1989]).

4/ Asset prices are included here as a proxy for household wealth.

5/ The value of the proxy for deregulation peaks in 1990:4. It is assumed to be equal to its maximum value (unity) in the remaining two years of the estimation. This assumption has no significant effect on any of the results reported below. Finally, an alternative proxy for financial deregulation would be the ratio of consumer credit to total bank credit. Using this alternative proxy produced results that are virtually identical to those reported below.

be endogenous, it is necessary to use an instrumental variables procedure. The instrument set consisted of a constant, the demographic variable (assumed exogenous), the lagged stock price index, the lagged value of the proxy for financial deregulation (the rescaled consumer credit to GDP ratio), and six lags each of income growth, inflation, and the proxy for financial deregulation times the real interest rate (the interactive dummy variable appearing as the last argument in equation (9)). 1/ The following results were obtained: 2/

$$(10) \quad \text{sratio}_t = 0.29 + 0.15\hat{y}_t - 0.20\text{dem}_t - 0.00040\text{ap}_t - 0.76r_t \\ (0.21) \quad (0.08^*) \quad (0.42) \quad (0.00016^*) \quad (0.21^{**}) \\ + 0.19p_t - 0.13d_t + 2.21d_t \cdot r_t \\ (0.09^*) \quad (0.031^{**}) \quad (0.39^{**})$$

$$R^2 = 0.80 \quad \text{SER} = 0.017 \quad \text{Sample: 1971:4-1993:3}$$

$$\chi^2(\text{instruments}) = 6.56 - \chi^2(14) \quad \chi^2(\text{auto}) = 3.29 - \chi^2(4)$$

where standard errors (in parentheses below the corresponding coefficients) are (White) heteroscedastic-consistent, and \* (\*\*) denotes significance of the coefficient at the 5 percent (1 percent) level. As can be seen, all of the parameter estimates have their theoretical signs. In particular, an increase in the growth rate of real household disposable income, an increase in the ratio of the active to the total population, a decrease in asset prices and an increase in inflation all contribute to an increase in the saving ratio. Moreover, with the exception of the demographic variable, all the effects are statistically significant at standard levels. 3/ Further, the data suggest that an increase in the real interest rate in the period before deregulation lowers saving, i.e., that the income effect outweighs the substitution effect, a finding that is at least consistent with other studies using French data. 4/

The regression results also shed light on the impact of financial deregulation on saving. First, as financial deregulation (proxied by the consumer credit to GDP ratio) progressed, the autonomous component of saving fell, as shown by the negative coefficient on  $d_t$  in equation (10). In addition, financial deregulation also appears to have increased the interest sensitivity of saving. This can be seen by the fact that  $\beta_7$  in equation

1/ The adequacy of the instrument set is discussed below.

2/ Although the estimation was conducted using quarterly data, the magnitude of the coefficients on income growth, inflation, and the real interest rate reflects the fact that these variables were expressed at annual rates.

3/ The insignificance of the demographic variable was not altered by introducing as separate regressors its two components.

4/ See, for example, Bloch and Maurel [1991], who report results for the effects of interest rate changes on saving in a model which abstracts from the effects of financial deregulation.

(10) is significantly positive. Specifically, by the early 1990s, when the proxy for financial deregulation reaches its maximum value (unity), the interest (semi-) elasticity of saving rises to 1.45 (= 2.21-0.76). One possible interpretation is that financial deregulation reduced the prevalence of liquidity constraints among French households, which resulted in an increase in the responsiveness of saving to interest rate changes. 1/

Together, the determinants of saving captured in equation (10) account for about 80 percent of the variation in the dependent variable over the sample. Furthermore, a  $\chi^2$  test for (up to) fourth order serial correlation fails to reject the null of serially uncorrelated residuals. In addition, a Sargan test for the adequacy of the instruments (referred to above as  $\chi^2(\text{instruments})$ ) does not reject the null that the chosen instruments are indeed independent of the structural error term. Both of these results indicate that the simple static specification adopted in (10) is indeed sufficient to account for saving behavior over the sample.

Using the coefficient estimates, it is possible to give an indication of the relative importance of the various independent variables in accounting for changes in the saving ratio. The equation should be particularly useful in quantifying the effects of financial deregulation, which have been emphasized in explanations of developments during the 1980s. To take an example, during the 1980s, the household saving ratio fell by about 6 percentage points, from about 17 1/2 percent in 1980 to about 11 1/2 percent in 1989. Decomposing this change into its various components reveals that demographic changes contributed virtually nothing to the change in saving over this period. Much more important were wealth effects--there was a substantial run-up in stock and other asset prices--which contributed about 3 percentage points of the observed decline in saving, and the decline in inflation (which contributed about 1 1/2 percentage points of the observed decline). In addition, there was a small effect, in the opposite direction, of income growth, which contributed *positively* to saving over the period, increasing the saving ratio by about 1/2 percentage point. The remainder of the change in the saving ratio was captured by increases in real interest rates and the financial deregulation variable, both directly and via its effect in boosting the interest sensitivity of saving. 2/

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1/ Bayoumi [1993] also finds that financial deregulation in the United Kingdom raised the interest sensitivity of saving. His results suggest an interest semi-elasticity of saving above 4.0 in the period after deregulation.

2/ Recall that once the effect of financial deregulation on the interest sensitivity of saving is allowed for, the estimated effect of an increase in the real interest rate on saving is positive.

Together, the interest rate and financial deregulation variables explain about 3 percentage points of the decline in the saving ratio. 1/

#### V. Conclusions

This paper has attempted to assess the relative importance of a number of factors in the recent behavior of household saving in France. In the first part, an attempt was made to determine how household expectations about the future course of income--both its level and its variability--have influenced consumption/saving decisions. Under the permanent income theory modified to include the effects of precautionary saving, it was argued that saving should depend negatively on the expected future growth rate of labor income--the "saving for a rainy day" hypothesis--and positively on the variance of the innovation to lifetime income--the precautionary saving motive. Thus saving should increase whenever households receive information which causes them to revise downwards their view of future income growth, or when they perceive an increase in uncertainty about their future income prospects.

The resulting model of household saving was estimated using quarterly data over the period 1970-1993 and was found to fit the data reasonably well. In particular, the role of expected future income growth was emphasized, as it was shown to be highly correlated with actual saving developments over the entire sample. Thus, the model suggested that the increase in saving observed over the past few years may be due to a less optimistic outlook for expected future income, which in turn may be related to developments in the labor market. As the outlook improves, "rainy-day" saving should begin to decline, something which already appears to be occurring according to the most recent saving data for the second half of 1993. Finally, although the variability of future income (the precautionary saving effect) was found to enter the augmented saving model with the correct sign, it was not statistically significant, suggesting perhaps that the standard (unaugmented) permanent-income model may be just as good as the augmented model in accounting for saving behavior in the French case.

Although permanent-income (PI) models of consumption emphasize the role of the stochastic process for labor income in saving determination, it may be unduly restrictive to ignore the effects of institutional changes--including the important effects of financial deregulation--which are difficult to accommodate within the formal PI approach. In the second part of this paper, therefore, the role of a number of additional variables was investigated. Perhaps the most significant finding to emerge from this analysis is the important role of financial deregulation in household

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1/ As can be seen, the sum of these changes exceeds (by about one percentage point) the actual decline in saving observed over the period. Obviously, this reflects the fact that the fit of the regression is not perfect, so that the predicted decline in saving was larger than the actual decline.



saving, particularly during the 1980s. It would appear that such deregulation not only directly encouraged pro-borrowing activity by French households, but also increased the sensitivity of household saving to interest rate changes, perhaps reflecting the reduced incidence of liquidity constraints in the general population. Thus, while the consensus from previous studies using historical data has been that an increase in interest rates will have a negligible--or even perverse 1/--effect on saving, the results here suggest that these studies may have been flawed to the extent that they ignored the potential effects of financial deregulation. The decline in real interest rates that has occurred since early 1993 may therefore help to explain the fall in the saving rate that has recently occurred. In the future, reductions (increases) in real interest rates are likely to bring forth a larger drop (rise) in the saving rate than they would have in the past.

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1/ That is, the income effect outweighs the substitution effect.

Technical Appendix

The analytical framework on which the discussion in Sections 2 and 3 is based assumes a representative agent who maximizes the expected value of the discounted sum of current and future utilities subject to a series of dynamic budget constraints and a transversality condition which rules out Ponzi-type schemes. Thus, the agent maximizes:

$$(A1) \quad \sum_{t=0}^{\infty} \beta^t E\{u(c_t)\},$$

where  $\beta$  is the subjective discount factor,  $u(\cdot)$  is the instantaneous utility function, and  $c_t$  denotes consumption. In addition to the transversality condition, consumers' decisions must satisfy their dynamic budget constraints, which hold that in any period  $t$ :

$$(A2) \quad b_{t+1} = (1+r)b_t + y_t - c_t,$$

where  $b_t$  denotes financial assets at time  $t$ ,  $y_t$  denotes real labor income, and  $r$  denotes the exogenous real interest rate. For the purpose of empirical implementation, a constant-absolute-risk-aversion (CARA) form of the instantaneous utility function is adopted:

$$(A3) \quad u(c_t) = -(1/\alpha)e^{-\alpha c_t},$$

where  $\alpha > 0$  denotes the Arrow-Pratt measure of (absolute) risk aversion.

Under the simplifying assumption that the interest rate is equal to the rate of time preference, 1/ the first order necessary condition is given by:

$$(A4) \quad e^{-\alpha c_t} = E_t e^{-\alpha c_{t+1}}.$$

This condition states that the marginal utility cost of giving up one unit of consumption at time  $t$  should be equated to the expected utility gain from consuming one more unit at  $t+1$ . Alternatively, dividing the left hand side of (A4) by the right hand side, the condition states that the intertemporal marginal rate of substitution should equal the ratio of the prices of present and future consumption, which is unity here.

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1/ This assumption is not restrictive since, as indicated in the text, the effect of any difference between the rate of interest and the rate of time preference is taken into account in the estimation. Specifically, as explained in Caballero [1990], if the interest rate differs from the rate of time preference, there will be a deterministic trend in the saving function. Such a trend is taken into account in the empirical work by removing a deterministic (linear) trend from the saving data prior to estimation of the VAR.

It is assumed that the variance referred to in equation (1) follows an AR(1) process with parameter  $\rho$ . 1/ To solve for the consumption function, a "guess and verify" method is used. Our guess for the consumption process is:

$$(A5) \quad c_t - c_{t-1} = \xi_t + \Lambda_{t-1} - w_t/[r+(1-\rho)]$$

where  $\xi_t$  is the innovation in life-time labor income,

$$(A6) \quad \xi_t = \frac{r}{(1+r)} \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} (E_t y_{t+j} - E_{t-1} y_{t+j}),$$

$\Lambda_{t-1}$  is the stochastic slope of the consumption path between periods  $t-1$  and  $t$ , which depends on the variance of  $\xi_{t-1}$ , denoted  $\sigma_{\xi_{t-1}}^2$ ; and  $w_t$  is the innovation to  $\Lambda_t$ . 2/ Intuitively, under certainty equivalence, the first difference of consumption would just be equal to  $\xi_t$ . When certainty equivalence is not imposed, however, there are two additional terms, which reflect precautionary saving behavior. A high value of the variance last period raises  $\Lambda_{t-1}$ , which increases the growth rate of consumption (lowers  $c_{t-1}$ ), in line with the precautionary saving hypothesis. A positive innovation to the variance today--which implies a positive drawing for the shock  $w_t$ --lowers consumption today  $c_t$ , thereby reducing the growth rate of consumption. If  $\rho = 1$ , so that the innovation to today's variance is permanent, agents revise upward their estimate of the future variance by the full amount of the shock and, therefore, the effect on consumption growth is equal to the annuity value of the innovation  $w_t/r$ . If  $\rho < 1$ , the shock gets reversed in the future, and the effect of the innovation on consumption is accordingly smaller.

Substituting (A5) into (A4) yields: 3/

$$(A7) \quad \Lambda_t = (1/\alpha) [\log(E_t e^{-\alpha \xi_{t+1}}) + \log(E_t e^{\{\alpha/[r+(1-\rho)]\} w_{t+1}})]$$

If the innovations to labor income have a normal distribution (with mean zero), then so will  $\xi$ . If, moreover, the innovations to the variance process follow a normal distribution, then the expectations in (A7) can be evaluated to yield:

$$(A8) \quad \Lambda_t = \frac{\alpha \rho \sigma_{\xi_t}^2}{2} + \frac{\alpha \sigma_w^2}{2 [r+(1-\rho)]^2},$$

1/ The variance at time  $t$  is assumed to be in the time- $t$  information set of the representative household.

2/ It is straightforward to verify that the innovation to the  $\Lambda$  process,  $w_t$ , is proportional to the innovation to the variance process. Also, it is clear that if the variance process is an AR(1) with parameter  $\rho$ , then the  $\Lambda$  process will also be an AR(1) with parameter  $\rho$ ; see Caballero [1990].

3/ We assume that  $\xi$  and  $w$  are independent stochastic processes.

where  $\sigma_w^2$  is the (known and constant) variance of  $w$ . Clearly, with  $\Lambda_t$  as defined in (A8), the guess for the consumption process in (A5) satisfies the first order condition in (A4).

Once  $\Lambda_t$  has been obtained, a final form of the consumption function may be guessed as follows:

$$(A9) \quad c_t^* = \frac{r}{(1+r)} \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} (E_t y_{t+j}) + r b_t - \Lambda_t / [r + (1-\rho)].$$

Thus, according to (A9), consumption in any period is equal to permanent income *minus* a term in the variance of labor income. To check the guess for the consumption function, it must be shown that (A9) satisfies (A5). 1/ Note from (A9):

$$(A10) \quad \begin{aligned} c_t^* - c_{t-1}^* &= c_t^* - (1+r)c_{t-1}^* + r c_{t-1}^* \\ &= \frac{r}{(1+r)} \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} (E_t(y_{t+j}) - E_{t-1}(y_{t+j})) \\ &\quad + r[b_t - (1+r)b_{t-1} + c_{t-1}^* - y_{t-1}] - \frac{\Lambda_t + (1+r)\Lambda_{t-1}}{[r + (1-\rho)]} \end{aligned}$$

But from the budget constraint (A2):

$$(A11) \quad b_t - (1+r)b_{t-1} + c_{t-1}^* - y_{t-1} = 0$$

Substituting the process for  $\Lambda_t$  gives:

$$(A12) \quad c_t^* - c_{t-1}^* = \xi_t + \Lambda_{t-1} - w_t / [r + (1-\rho)]$$

which is (A5), as was to be verified.

By definition, saving is equal to the change in financial assets. Using the budget constraint (A2) together with the solution for the consumption function given in (A9) gives a simple expression for saving as the present value of expected *changes* in labor income *plus* a term in the variance of the innovations to labor income:

$$(A13) \quad s_t^* = - \sum_{j=1}^{\infty} \frac{1}{(1+r)^j} (E_t \Delta y_{t+j}) + \frac{\alpha \rho \sigma_{\xi_t}^2}{2[r + (1-\rho)]} + \text{constant}$$

where  $\Delta$  is the (backward) difference operator,  $\Delta x_t = x_t - x_{t-1}$ , and where, from (A8), the constant depends on the (known) variance of the shocks to the  $\Lambda$  process. Equation (A13) clearly illustrates the implications of precautionary saving for saving behavior, revealing that both risk aversion ( $\alpha$ ) and the persistence of the shocks to the variance process ( $\rho$ ) magnify the effect of the precautionary saving motive on saving.

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1/ Recall that (A5) itself satisfies the Euler condition (A4), given (A7).

Data Appendix

The main sources of data were INSEE and Wharton Econometrics (WEFA). A deflator for all nominal variables was obtained by dividing INSEE's measure of nominal household consumption by household consumption at 1980 prices. Other series obtained from INSEE were: labor income, household disposable income and saving, the latter being the difference between household disposable income and consumption. The saving ratio is household saving divided by household disposable income. Population data were obtained from several issues of l'Annuaire Statistique de la France, table B-01-1. Three month bank deposit rates and stock prices were obtained from WEFA. Data on the stock of consumer credit were provided by the French authorities and prices of apartments in Paris were taken from Taffin [1993].

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