which is the same condition as (8) and therefore the same conclusion may be drawn as in Theorem 1. To elaborate on this point, note that if the output price and the cost function are given to the firm with certainty, as in (9) and (10), the profit function becomes non-random. Therefore, the firm will select $\pi$ such as to satisfy

$$\pi(\mu) = \pi(\mu)$$

Given increasing marginal cost with respect to $x$, (9) and (10) shows that $x^* < x$. Therefore, Theorem 1 can be restated as follows:

**Theorem 2** Under uncertainty, where the output price and the cost function are random, the risk averse competitive firm produces lower output than in the case where the output price and the cost function are known with certainty.

Our argument regarding the utilization of input factors would be exactly the same as it was for the case of given output price and we will obtain the same conclusion as was reached above.

**REFERENCES**


**INTRODUCTION**

Modern business cycle theory contends that observed values of saving, consumption and labor supply represent the outcomes of dynamic optimization by economic agents. As a result, the theory claims, agents are able to substitute current saving and consumption for future saving and consumption, and current labor supply for future labor supply when they believe that such exchanges will be advantageous. This idea is known as the intertemporal substitution hypothesis (ISH). The principle that underlies this theory is that it is acting to maximize expected lifetime utility in an uncertain environment, individuals must make current decisions based on the parameters of expected future distributions. Empirical tests of the ISH have typically examined the relationship between current behavior and the means of expected future distributions. As a rule, these tests have not supported the ISH. This paper extends the ISH literature by examining the extent to which personal saving is subject to intertemporal substitution either as a result of changes in the mean of the expected future income distribution, or as a result of changes in the variance of the expected future income distribution, etcetera paribus.

The idea that personal saving may be responsive to changes in the variance of the future income distribution is not new, having been discussed approximately two decades ago in separate papers by Hayne E. Leland (1968) and Agnar Sandmo (1970). A principle conclusion that emerged from both of these papers is that under reasonable assumptions "increased uncertainty about future income leads to more saving" (Sandmo, p. 356). Direct empirical tests of this proposition have been scarce, thus perhaps the difficulties involved in measuring the uncertainty associated with future income. This paper attempts to resolve that problem by employing Robert F. Engle's (1982, 1983) model of autoregressive conditional heteroscedasticity (ARCH) to estimate the anticipated mean and variance of the future incomes distribution directly. The variance is used as a proxy for the level of expected future income uncertainty in estimated saving functions for the United States. While the estimates indicate that changes in the mean of the expected future income distribution have a negative effect on current saving, there is no support for the hypothesis that saving is subject to intertemporal substitution as a result of changes in the variance of the distribution.

The plaus of the paper is as follows. Section II outlines the basic theory of saving under uncertainty, thus establishing the principal hypotheses to be tested. In Section III data and estimates of the aggregate saving for the U.S. are presented. The paper is summarized and conclusions are drawn in Section IV.

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it is straightforward to show that a variance-constant change in the mean of $y_I$ implies that
\begin{equation}
\sigma^2[y_I] = \mu_I y_I + \sigma^2 \cdot \mu_I = 0, \tag{7}
\end{equation}
\begin{equation}
\sigma^2[y_I] = 2 \sigma^2 \mu_I = 0, \tag{8}
\end{equation}
so that, $\sigma_I = 0$ and $\mu_I = 0$. Alternatively, a mean-constant change in the variance of $y_I$ is one where
\begin{equation}
\sigma^2[y_I] = \mu_I y_I + \sigma^2 \cdot \mu_I = 0, \tag{9}
\end{equation}
\begin{equation}
\sigma^2[y_I] = 2 \sigma^2 \mu_I = 0, \tag{10}
\end{equation}
so that $\mu_I = 0$ and $\sigma_I$ is now substituted for $y_I$ in equation (4), and the period 2 indirect expected utility function at the outset of period 1 is written as
\begin{equation}
\sigma^2[y_I] = \int_0^1 \int_0^1 \left[ (1 + r)_I + y_I - h_I \right] f(y_I) dy_I. \tag{11}
\end{equation}
First order conditions, which are found after substitution of (11) into (4), are then
\begin{equation}
\sigma^2[y_I] = \left[ w_L U_I - (1 + r)_I \right] h_I = 0, \tag{12}
\end{equation}
and
\begin{equation}
\sigma^2[y_I] = \left[ w_U U_I - (1 + r)_I \right] h_I = 0, \tag{13}
\end{equation}
Substituting (3) into (13) gives
\begin{equation}
\sigma^2[y_I] = \left[ (1 + r)_I \right] U_I, \tag{14}
\end{equation}
Equation (12) says that in period 1 either labor will be supplied up to the point where the marginal rate of substitution between leisure and consumption equals the wage, or, if the wage is sufficiently low, no labor will be supplied at all. Equation (14) states that saving should occur up to the level at which the present values of the marginal utility of consumption are equal in the two periods. Comparative static results can be derived from these conditions, and it can be shown that under reasonable assumptions
\begin{equation}
d s_I/dm < 0, \text{ and } d s_I/dw_I < 0, \tag{15}
\end{equation}
The first result says that an increase in the mean of the expected future income distribution can be expected to discourage current saving, while the second result says that a higher expected level of future income uncertainty can be expected to encourage current saving. These two theoretical results, which are consistent with the notion of intertemporal substitution, form the basic hypotheses that are tested in the next section of the paper.

The intuition behind these predictions is straightforward. When future income is expected to rise, ceteris paribus, the typical individual finds current consumption more appealing, and hence substitutes current consumption for current saving. On the other hand, when the level of uncertainty associated with future income rises, ceteris paribus, a person will want to carry as much saving as possible into the future so as to avoid the more probable future income shortfall.

DATA AND ESTIMATION
Since the theory outlined above is a microeconomic theory, it would be best to test the resulting hypotheses through the use of a micro-level data set, such as panel data on individuals. Unfortunately, this is impractical since most panel data sets contain too few observations per person to allow for reliable estimation of the parameters of future income distributions, and would require separate estimation for each individual in any case. Also, as Mankiw, Romer & Summers (1985) point out,
the residuals of the last p periods. Once p has been estimated, the expected mean and variance of the series conditional on current information can be computed. As outlined by Engle (1982), a general pth order ARCH model can be expressed as
\begin{align}
\sigma_t &\sim N(\mu_t, h_t) \\
h_t &= \alpha_0 + \alpha_1 \sigma_{t-1}^2 + \cdots + \alpha_p \sigma_{t-p}^2 \\
\alpha &< h < \infty
\end{align}

where \( y_t \) is the dependent variable, \( \alpha \) includes all information available as of time \( t-1 \), \( x_t \) is a vector of explanatory variables included in \( \mu_t \), \( \alpha \) is the conditional variance of \( y_t \) and \( x_t \), and the vector \( \beta \) are parameters. Stability requires that \( \alpha_i \leq 1 \) for \( i = 1, \ldots, p \). Squaring the alpha constraints the coefficients to be nonnegative, so that negative fitted values of the conditional variance are avoided.

Two alternative specifications of the model are given in Table 1. In each case, income (YTD1) is specified as a function of two lags of the dependent variable, and one lagged value each of government purchases of goods and services (G), personal income tax receipts (T), M1, and the rate of unemployment (UNEMP), as well as the current expected rate of inflation (EXPI). The variance \( h_t \) is specified as a function of one and three lagged values of the squared residuals, respectively. Parameters of the income and variance functions are estimated through maximum likelihood estimation. The fitted values from these estimated equations are discounted using the pre-tax real interest rate on 3-month Treasury bills, and are interpreted as the means and variances of the expected future income distributions.

The remaining variables in the estimated saving functions include the after-tax real interest rate on 3-month Treasury bills, beginning-of-period household wealth, GNP gap, and the proportion of the population aged 65 or older. A ceteris paribus increase in the real after-tax interest rate is expected to have a negative effect on current saving, assuming that the purpose of saving is to smooth the level of consumption over the course of the life cycle. With income held constant, an increase in the interest rate means that a dollar of current saving will be worth more in the future than it would be at a lower rate. Hence, if the objective of the typical consumer is to accumulate enough money to allow a given level of future consumption, then a rise in the rate of interest is expected to allow a reduction in current saving.

Similarly, a ceteris paribus increase in household wealth is expected to reduce current saving since wealth provides alternative avenues for financing future consumption. Inclusion of the GNP gap is meant to account for movements in the business cycle, and is used to help distinguish between changes in expected income which are a result of variation in the business cycle and those which are not. Holding income constant, an increase in the GNP gap is expected to increase saving. Finally, the percentage of the population older than 65 is included to control for the impact of changing demographics over the sample period. This variable is expected to have a negative effect on saving. All dollar amounts are expressed in real (1982) per capita terms. To help remove the substantial collinearity that exists between variables, all equations were estimated in first-difference form, using a maximum likelihood correction for serial correlation.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>ARCH Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification 1:</td>
<td>$Y_{T,D1} = \beta_0 + \beta_1 Y_{T,D1-1} + \beta_2 Y_{T,D1-2} + \beta_3 T - \beta_4 M_1 + \beta_5 UNEMP + \beta_6 EXPI + \epsilon_t$, $h_t = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \cdots + \alpha_p \epsilon_{t-p}^2$</td>
</tr>
<tr>
<td>Specification 2:</td>
<td>$Y_{T,D1} = \beta_0 + \beta_1 Y_{T,D1-1} + \beta_2 Y_{T,D1-2} + \beta_3 T - \beta_4 M_1 + \beta_5 UNEMP + \beta_6 EXPI + \epsilon_t$, $h_t = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \alpha_2 \epsilon_{t-2}^2 + \alpha_3 \epsilon_{t-3}^2$</td>
</tr>
</tbody>
</table>
this paper can be fruitful, and that interpretation of the estimated conditional variance as a measure of the level of uncertainty faced by the typical consumer is reasonable.

Another potential problem may be the measurement of saving. The variance of saving measures used in this paper illustrate that estimates are quite sensitive to the specification of the saving variable.

A final possibility is that saving is sensitive to uncertainty with respect to wages, rather than uncertainty with respect to income. As the models in Grossberg (1989) and Blau & Grossberg (1989) indicate, saving (and labor supply) responses to variations in wage rate uncertainty are theoretically just as plausible as responses to income uncertainty.

NOTES

1. In Knight's (1921) terminology this is a situation involving risk rather than uncertainty, since the future income distribution is assumed known. This paper follows the convention used in recent literature of referring to such situations as being uncertain.

2. See, for example, Lachenbruch & Rapaport (1967) and Altrock & Bass (1968).

3. Grossberg (1989) and Blau & Grossberg (1989) have found, however, that the variance of the expected future wage distribution has a positive effect on current labor force participation rates, thus indicating that changes in the level of anticipated future uncertainty may mediate intertemporal substitution with respect to labor supply.

4. Leland (1978) and Summers (1978) both argue separability of consumption and leisure in their utility functions. The model presented in this paper retains the Leland-Summers predictions while relaxing the assumption of separability.

5. The (trendless) second period choices of consumption and leisure are simultaneous. Hence, this problem could be stated equivalently as a choice of 1, rather than 3.

6. The purpose of this definition is to allow explicit investigation of the relationship between personal saving behavior and future income uncertainty. This relationship has been the focus of much previous literature in this area, and is clearly a function of future wage uncertainty. While this paper does not present the impact of wage uncertainty on saving behavior, there are clearly some tentative hypotheses (analogous to those tested here) which would justify such an investigation. These hypotheses are left for future research.

7. These results are derived in no appendix available from the author upon request.

8. The first result requires that the utility function be concave, while the second assumes that Conc(U, y) ≤ 0.

9. These adjustments and all other data are described in an appendix available from the author upon request.

10. To identify the number of lags of the squared residual that provide significant information in the creation of the conditional variance, the Lagrange multiplier test described in Engle (1982) was used.

11. Actual values of the test statistic and results of the ARCH estimation are presented as an appendix which is available from the author upon request.

12. The p-value is used here since disposable (labour) income is already net of taxes.

13. Twelve equation were estimated: six included disposable income on the right-hand side, and six included disposable labor income. For each measure of income, equations were estimated for each of the two ARCH specifications, using each of the three measures of savings. Tables of these estimates are available from the author upon request.

14. This coefficient is large and significant only when the component of H/P saving that accounts for the difference in the timing of tax payments and accruals is included. This appears to suggest that the elderly tend to pay their taxes in the period during which they receive more income from younger people; the simple correlation between the two forecasts of the percent of population aged 65 and the timing of tax payments component of H/P saving is .34, thus making the tax distribution a good predictor of one component of H/P saving.

REFERENCES


SUMMARY AND CONCLUSIONS

This paper examines the extent to which saving is subject to intertemporal substitution. The hypothesis that current saving is a negative function of the mean of the expected future income distribution is given clear support, but there is no evidence that the level of uncertainty associated with expected future income has a positive effect on current saving. There are several potential explanations for the inability of this paper to find support for this second hypothesis. The first has to do with errors that may arise in the translation of a theory of individual consumers into an empirical model of aggregate behavior. If possible, one might prefer to use panel data on individuals to observe the effects of changes in the level of uncertainty. Unfortunately, this is impractical since most panel data sets contain too few observations per person to allow for reliable use of an ARCH model, and would require separate estimation for each individual in any case. Moreover, the use of micro data in this type of context has its own problems stemming from the heterogeneity of key variables. Also, the empirical results contained in Grossberg (1989) and Blau & Grossberg (1989) suggest that the approach used in

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Saving functions were estimated in which income was represented as the sum of disposable labor income, transfer income and capital gains income, and alternatively, as disposable income. The two sets of results are quite similar. As expected, disposable (labor) income has a strong positive effect on saving, and expected future disposable (labor) income has a significant negative effect, regardless of how saving is defined. This second result clearly indicates support for the ISH.

The effect of the variance of expected disposable (labor) income, however, is ambiguous. In the twelve equations estimated this variable has the expected positive coefficient in four cases, and a negative coefficient in the remaining eight cases. The coefficient is significant at the five percent level in only three cases, and the sign is negative each time. Clearly, any set of conclusions that one might draw from these estimates would run counter to intuition as well as to the theory outlined above. Moreover, there is no discernible pattern of results relative to the various specifications of saving, income, or the ARCH model.

The estimated effect of the real after-tax interest rate is always negative as expected, and the coefficients are significant in nine of the twelve equations. GNPG has a significant positive effect on saving when the NIPA definition is used, but becomes insignificant when either net saving or H/P saving is the dependent variable. Since both net saving and H/P saving include purchases of consumer durables, it is likely that the explanation for this discrepancy has to do with the relationship between purchases of consumer durables and the business cycle. Specifically, this appears to be an errors-in-variables problem. Assuming that purchases of consumer durables do indeed represent a form of saving, then this component must be included in the correct specification of the saving variable. When purchases of consumer durables are omitted from saving they become a part of the error term for the regression. Since GNPG and purchases of consumer durables are inversely correlated with one another (their first differences have a simple correlation of -0.63) this causes the term itself to be correlated with GNPG, with the familiar result that the estimates are both biased and inconsistent. Clearly, this suggests that estimators based on the NIPA saving series should be interpreted with extreme caution.

The percent of the population older than 65 is also sensitive to the specification of the saving variable, though the explanation for this is a bit more elusive. Its coefficient has an expected negative sign when net saving or H/P saving is the dependent variable, though it is only significant when H/P saving is the dependent variable. The magnitude of the coefficient is also strongly affected by the use of H/P saving. The estimated effect of wealth is always negative as expected, though it is only significant when NIPA saving is the dependent variable.

When disposable labor income is on the right-hand side transfer income has the expected positive effect, though it is not significant, and capital gains income has the expected negative effect, which is significant when the NIPA saving and net saving series are used.
Projected Employment Effects of a Repeal of the Glass-Steagall Act

Randall K. Filer and Bernard Shull

INTRODUCTION

The repeal of the Glass-Steagall Act has been debated among economists for some time on the basis of potential benefits to economic efficiency vs. potential costs associated with changes in the safety and soundness of commercial banks (see Litan, 1987, especially chapters 3 and 4). With the exception of occasional monetary policy considerations (Goodfriend and King, 1988), the arguments in general have been developed at a microeconomic level. It is, nevertheless, clear that improvements in microeconomic efficiency have macroeconomic implications. Improvements in underlying efficiency should result in lower borrowing costs which, in turn, should have both industry-specific and aggregate production and employment effects.

The Glass-Steagall Act creates a legal barrier to entry by commercial banks into the general business of underwriting and dealing in corporate securities. As such, it constitutes an impediment to effective competition in the securities business. Underwriting of securities in the United States is highly concentrated (see Harris, Spence, and Marks, 1983; Pugel and White, 1985, New York Federal Reserve Bank, 1986 and U.S. Congress, House Committee on Government Operations, 1987). In 1986 the largest five underwriters of corporate debt accounted for about 69 percent of the business. In fact, the degree of concentration is faced by many issuers may be even higher. While there is a national market for large corporations issuing securities, many small and medium-sized issuers without a national reputation cannot deal with the major New York City-based underwriters. These issuers face higher levels of concentration among local broker/dealers (Kaufman, 1984, p. 43 and Pugel and White, 1985, p. 125.1)

The combination of a significant regulatory barrier to entry and high concentration can be predicted to result in above-competitive prices for underwriting services to such firms.

In this paper, we estimate the potential effects on employment following a repeal of the general underwriting prohibition of the Glass-Steagall Act.1 We find that under certain conditions repeal would lead to a small but not insignificant increase in employment and international competitiveness that ought to be a part of any discussion regarding potential repeal of this act.

In the next section we discuss the mechanisms through which increased employment would occur. Section III presents estimates projecting the extent of these employment changes. These estimates are based in part on an analysis of the relevant literature and in part on a survey we conducted of chief financial officers from over 500 firms active in 1986 and 1987 in raising funds in either U.S. or overseas financial markets. On the basis of responses to our mail questionnaire, we were able to determine, among other things, the proportion of overseas activity that would likely be separated if underwriting costs in the United States fell as a result of the repeal of the Glass-Steagall Act. A detailed description of this survey can be found in the appendix to this paper.

EMPLOYMENT EFFECTS MECHANISMS

An intensification of competition leading to relatively more efficient production of underwriting services in the United States would result in lower prices (spreads) for these services and therefore an

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