Consumption, liquidity constraints, uncertainty and temptation: An international comparison

Jakob B. Madsen a,*, Michael McAleer b

a Department of Economics and Finance, Brunel University, Uxbridge, Middlesex, UB8 2PH, UK
b Department of Economics, University of Western Australia, Crawley, WA 6009, Australia

Received 18 August 1999; received in revised form 5 July 2000; accepted 16 October 2000

Abstract

Recent empirical research suggests that the rational expectations life-cycle permanent income hypothesis (LC-PIH) breaks down because consumers are liquidity constrained. This paper re-examines the liquidity constraint hypothesis against the uncertainty and the behavioural life-cycle (BLC) hypotheses using macropanel data for 22 OECD countries. The empirical results provide very strong support for the uncertainty and the BLC hypotheses and no support for the liquidity constraint hypothesis. © 2001 Elsevier Science B.V. All rights reserved.

PsycINFO classification: 3920

JEL classification: E21

Keywords: Consumption; Rational expectations; Liquidity constraints; Uncertainty; Mental accounts

*Corresponding author. Tel.: +44-1895 203182; fax: +44-1895 203384.
E-mail address: jakob.madsen@brunel.ac.uk (J.B. Madsen).
1. Introduction

The life-cycle permanent income hypothesis (LC-PIH) predicts that consumption depends on the wealth of an individual consumer over the whole life-span, so that consumption is unrelated to current income (Friedman, 1957). If rational expectations are also assumed, the LC-PIH implies that consumption follows a random walk so that only consumption in the previous period contains information which can predict current consumption (Hall, 1978). Several empirical studies have rejected the rational expectations LC-PIH model because current consumption has been found to be positively related to current income (Campbell & Mankiw, 1989, 1990, 1991; Hayashi, 1982; Madsen & McAleer, 2000). Several authors have suggested that this excess sensitivity of consumption to current disposable income can be explained by liquidity constraints, in that limited access to credit markets prevents young consumers, as well as other consumers who are experiencing a temporary income loss, from borrowing against their expected life-time incomes (Flavin, 1985; Hubbard & Judd, 1986; Jappelli & Pagano, 1989; Scheinkman & Weiss, 1986; Vaidyanathan, 1993). However, the inherent difficulties associated with measuring consumers who are liquidity constrained have prevented most authors from undertaking empirical tests of the liquidity hypothesis. An exception is Jappelli and Pagano (1989), where it is shown that excess sensitivity is positively related to liquidity constraints. However, they did not test the liquidity hypothesis against other hypotheses relating to excess sensitivity. Very little empirical research has been undertaken to examine the predictions of the uncertainty and the BLC hypotheses using aggregate data. \(^1\)

Based on both cross-section and time-series evidence, this paper re-examines the liquidity constraint hypothesis and finds that the excess sensitivity of consumption arises largely through uncertainty and the temptation to spend out of current income. Uncertainty leads both to more prudent behaviour and to higher income sensitivity in consumption: a large increase in expected income lowers the need for precautionary savings and hence increases consumption and vice versa (Blanchard & Fischer, 1989, pp. 290–291; Muellbauer & Lattimore, 1995; Hahn & Steigerwald, 1999). It follows that there is less need for precautionary savings in situations where consumers face a low degree of uncertainty, and consumers consequently tend to obey the predictions of the LC-PIH. By contrast, in situations where consumers

---

\(^1\) Based on experimental studies Karlsson, Garling, and Selart (1999) and Dittmar and Drury (2000) find evidence for the BLC hypothesis.
face a high degree of uncertainty, there is a high sensitivity of consumption to current income and consumers will not behave according to the LC-PIH.

The temptation to spend out of current income follows the behavioural life-cycle hypothesis (BLC) of Shefrin and Thaler (1988), which incorporates a trade-off between immediate satisfaction and long run benefits into the life-cycle hypothesis. Using the theory of self-control, mental accounting and framing, Shefrin and Thaler show that the propensity to spend out of current income is higher than for wealth, which is, in turn, higher than for future income. It follows that the propensity to spend out of current income is not the same as for bonuses that have the same present value, but that will be paid out later, as predicted by the LC-PIH. Hence, the BLC hypothesis predicts that excess sensitivity arises because the temptation to spend is higher for current than for permanent income.

Using the cross-section framework of Jappelli and Pagano (1989) for an expanded country sample, it is shown that the liquidity hypothesis cannot be maintained when uncertainty and the predictions of the BLC hypothesis are accommodated (Section 3). Acknowledging the limitations in the Jappelli and Pagano approach, the liquidity, the uncertainty and the BLC hypotheses are tested in Sections 4 and 5 using pooled cross-section and time-series data for 22 OECD countries over the period 1960–1993. Section 4 explains excess sensitivity in consumption after controlling for liquidity constraints, uncertainty, and temptation, and Section 5 explains the ability of the various theories to explain the path of consumer debt. In Section 6 it is concluded that the empirical evidence has important macroeconomic implications.

2. Uncertainty, liquidity constraints and excess sensitivity across countries

Following recent extensions to Hall’s (1978) rational expectations LC-PIH model, there are assumed to be two categories of consumers, namely, those who obey the LC-PIH and the rule-of-thumb consumers who do not (Campbell & Mankiw, 1989, 1990, 1991). Let the representative consumer who obeys the LC-PIH maximise the discounted expected utility given by

\[ E \left[ \sum_{t=0}^{T} U(c_{1t})/(1 + \rho)^t \right], \]

subject to \( A_{t+1} = (1 + r)(A_t + L - c_{1t}) \),

where \( \rho \) is the constant rate of time preference, \( c_1 \) the real consumption of the life-cycle consumer, \( L \) the constant labour income, \( A \) the accumulated assets,
The length of life, \( r \) the constant real interest rate earned on accumulated assets, and \( A_r \geq 0 \). Assuming the instantaneous utility function, \( U(c_{1t}) = - (\alpha - c_{1t})^2 \), the first-order conditions for an optimum are given by

\[
c_{1t} = \left[ 1 - \frac{1 + \rho}{1 + r} \right] \alpha + \left[ \frac{1 + \rho}{1 + r} \right] c_{1,t-1} + u_t
\]
or

\[
c_{1t} = \alpha_0 + \alpha_1 c_{1,t-1} + u_t,
\]

where \( \alpha_0 \) and \( \alpha_1 \) are defined implicitly, and \( u_t \) is a zero-mean, independently and identically distributed random disturbance term which is uncorrelated with all variables known to the consumer at time \( t - 1 \). Let \( c_2 \) be the real consumption of the representative rule-of-thumb consumer, who is assumed to spend all of current income, so that

\[
c_{2t} = \lambda Y_t, \quad 0 \leq \lambda \leq 1,
\]

where \( \lambda \) is the fraction of income accruing to rule-of-thumb consumers, or the so-called excess sensitivity parameter, and \( Y \) is the real disposable income. Aggregate real per capita consumption, \( C_t = c_{1t} + c_{2t} \) can then be written as follows:

\[
C_t = \alpha_0 + \alpha_1 C_{t-1} + \lambda (Y_t - \alpha_1 Y_{t-1}) + u_t.
\]

This equation shows the degree to which consumers follow the LC-PIH. For \( \lambda = 0 \), all consumers obey the LC-PIH, and for \( \lambda = 1 \) no consumer obeys the LC-PIH. Almost all empirical estimates indicate a non-zero \( \lambda \) (see, for instance, Campbell & Mankiw, 1989, 1990, 1991; Madsen & McAleer, 2000). However, the question remains whether a non-zero \( \lambda \) reflects uncertainty, liquidity constraints, or myopic behaviour. These issues are examined in the next three sections. Before turning to pooled cross-section and time-series data, the cross-country behaviour of \( \lambda \) is investigated.

### 3. Cross-section evidence on excess sensitivity

Eq. (3) is estimated for 22 OECD countries using annual data over the period from 1960 to 1993. All variables are measured in real per capita units and consumption is measured for non-durable goods, which is total private consumption expenditure minus expenditures on personal transport, furniture, and household equipment. A listing of the data and their sources is
provided in Appendix A. Non-linear 3SLS is used to estimate Eq. (3) and the following instruments lagged 1 and 2 years are used: real disposable income, real consumption of non-durables, real monetary stock, nominal interest rate, and real share prices. All instruments are lagged, even if they are exogenous, since the rational expectations LC-PIH model implies that all relevant information is incorporated in consumption in the previous period, and lagged consumption consequently becomes an important instrument. The other instruments are used to predict the current income for rule-of-thumb consumers. For a detailed discussion on the issue of estimation in the context of Eq. (3), see Jappelli and Pagano (1989).

The results of estimating Eq. (3) over the entire sample period are shown in Table 1. Estimates of $\lambda$ over the sub-samples 1962–1977 and 1978–1993 are also presented, acknowledging the fact that the economic circumstances are different both over time and across countries. The estimates of $\lambda$ vary across countries and are statistically significantly different from 0 at the 5% level for 17 countries over the entire sample period. Dividing the estimation period in two shows that the estimates of $\lambda$ are sensitive to the estimation period, as revealed by the likelihood test for structural stability. Using the 5% critical level, the likelihood ratio test is 8.82. Hence, the null hypothesis of structural stability is rejected for half of the 22 countries. As will be seen below, this change has occurred for the countries that have experienced the greatest change in their economic environment from 1962–1977 to 1978–1993. The structural breaks also suggest instability due to the absence of variables that control for liquidity, uncertainty and temptation, thereby yielding the limitations of the cross-section analysis in this section.

3.1. Explaining excess sensitivity by liquidity constraints, uncertainty and temptation

The finding that estimates of excess sensitivity are significantly different from 0 is often interpreted in the mainstream literature as an indication that

---

2 The change in the estimates of the excess sensitivity parameter over the period from 1962–1977 to 1978–1993 is consistent with the change in the macro unemployment replacement ratio. The replacement ratio is increasing in most countries for which the biggest change in the excess sensitivity occurs: Canada (46.4 to 56.9), Japan (36.2 to 28.7), Belgium (43.0 to 50.3), Denmark (56.8 to 76.6), Finland (27.4 to 48.5), Greece (19.9 to 28.7), Italy (6.9 to 4.41), Switzerland (16.7 to 56.0), and UK (33.0 to 26.1), where the numbers in parenthesis are the percentage of unemployment benefits to wages on average over the period from 1962–1977 to 1978–1993, respectively.
Table 1
Parameter estimates of the excess sensitivity parameter in Eq. (3)\(^a\)

<table>
<thead>
<tr>
<th>Country</th>
<th>̂λ</th>
<th>LM(SC)</th>
<th>LM(H)</th>
<th>̂λ(_{1962-1977})</th>
<th>̂λ(_{1978-1993})</th>
<th>LR(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can</td>
<td>0.33 (5.21)</td>
<td>3.03</td>
<td>10.7</td>
<td>0.73 (48.5)</td>
<td>0.32 (3.45)</td>
<td>6.85</td>
</tr>
<tr>
<td>USA</td>
<td>0.38 (6.65)</td>
<td>1.02</td>
<td>0.7</td>
<td>0.34 (4.03)</td>
<td>0.40 (6.60)</td>
<td>4.27</td>
</tr>
<tr>
<td>Jap</td>
<td>0.70 (79.9)</td>
<td>1.55</td>
<td>2.1</td>
<td>0.66 (41.6)</td>
<td>0.39 (2.71)</td>
<td>0.46</td>
</tr>
<tr>
<td>Aus</td>
<td>0.17 (3.08)</td>
<td>0.57</td>
<td>1.6</td>
<td>0.22 (1.92)</td>
<td>0.16 (2.44)</td>
<td>1.19</td>
</tr>
<tr>
<td>NZ</td>
<td>0.00 (0.00)</td>
<td>7.86</td>
<td>8.1</td>
<td>0.05 (0.26)</td>
<td>-0.05 (0.52)</td>
<td>6.25</td>
</tr>
<tr>
<td>Aut</td>
<td>0.20 (4.30)</td>
<td>0.69</td>
<td>2.6</td>
<td>0.18 (1.18)</td>
<td>0.18 (3.84)</td>
<td>10.43</td>
</tr>
<tr>
<td>Bel</td>
<td>0.22 (2.35)</td>
<td>0.11</td>
<td>1.7</td>
<td>0.39 (4.10)</td>
<td>0.13 (1.03)</td>
<td>11.67</td>
</tr>
<tr>
<td>Den</td>
<td>0.12 (1.20)</td>
<td>2.55</td>
<td>3.3</td>
<td>0.23 (2.28)</td>
<td>0.04 (0.26)</td>
<td>2.28</td>
</tr>
<tr>
<td>Fin</td>
<td>0.20 (2.89)</td>
<td>10.60</td>
<td>17.6</td>
<td>0.34 (3.93)</td>
<td>0.15 (1.60)</td>
<td>9.76</td>
</tr>
<tr>
<td>Fra</td>
<td>0.24 (3.75)</td>
<td>1.61</td>
<td>1.5</td>
<td>0.18 (1.50)</td>
<td>0.18 (2.63)</td>
<td>0.04</td>
</tr>
<tr>
<td>Ger</td>
<td>0.28 (4.25)</td>
<td>1.97</td>
<td>6.9</td>
<td>0.31 (3.29)</td>
<td>0.25 (2.93)</td>
<td>5.45</td>
</tr>
<tr>
<td>Gre</td>
<td>0.25 (4.86)</td>
<td>1.15</td>
<td>1.0</td>
<td>0.32 (5.69)</td>
<td>0.17 (2.32)</td>
<td>8.58</td>
</tr>
<tr>
<td>Ire</td>
<td>0.45 (8.54)</td>
<td>0.29</td>
<td>10.2</td>
<td>0.41 (5.16)</td>
<td>0.44 (9.12)</td>
<td>17.35</td>
</tr>
<tr>
<td>Irl</td>
<td>0.32 (3.89)</td>
<td>0.03</td>
<td>5.1</td>
<td>0.04 (0.41)</td>
<td>0.56 (6.13)</td>
<td>14.94</td>
</tr>
<tr>
<td>Lux</td>
<td>0.11 (1.47)</td>
<td>1.32</td>
<td>4.7</td>
<td>0.00 (0.03)</td>
<td>0.17 (1.90)</td>
<td>4.49</td>
</tr>
<tr>
<td>Net</td>
<td>0.19 (2.93)</td>
<td>2.28</td>
<td>3.7</td>
<td>0.23 (2.74)</td>
<td>0.19 (2.09)</td>
<td>6.94</td>
</tr>
<tr>
<td>Nor</td>
<td>-0.13 (0.67)</td>
<td>1.00</td>
<td>41.9</td>
<td>-0.03 (0.22)</td>
<td>-0.09 (0.37)</td>
<td>33.13</td>
</tr>
<tr>
<td>Por</td>
<td>0.29 (3.26)</td>
<td>0.70</td>
<td>3.1</td>
<td>0.64 (14.0)</td>
<td>0.15 (1.99)</td>
<td>10.41</td>
</tr>
<tr>
<td>Spa</td>
<td>0.46 (4.78)</td>
<td>0.25</td>
<td>16.8</td>
<td>0.44 (3.36)</td>
<td>0.59 (2.94)</td>
<td>5.96</td>
</tr>
<tr>
<td>Swe</td>
<td>0.06 (0.88)</td>
<td>7.63</td>
<td>21.9</td>
<td>0.09 (1.70)</td>
<td>0.04 (0.31)</td>
<td>10.10</td>
</tr>
<tr>
<td>Swz</td>
<td>0.18 (3.57)</td>
<td>1.32</td>
<td>7.5</td>
<td>0.34 (5.00)</td>
<td>0.14 (2.29)</td>
<td>10.78</td>
</tr>
<tr>
<td>UK</td>
<td>0.41 (4.42)</td>
<td>12.00</td>
<td>14.4</td>
<td>0.33 (4.87)</td>
<td>0.45 (2.70)</td>
<td>13.37</td>
</tr>
</tbody>
</table>

\(^a\) Absolute t-statistics are given in parentheses. The estimation period is 1962–1993, except ̂λ\(_{1962-1977}\) which is estimated over the period 1962–1977, and ̂λ\(_{1978-1993}\) which is estimated over the period 1978–1993. LM(SC) is the Lagrange multiplier test for single-equation first-order serial correlation, and is distributed as \(\chi^2(1)\) under the null hypothesis of no serial correlation. LM(H) is the Lagrange multiplier test for single-equation heteroscedasticity, using the regressors from the original regression, and is distributed as \(\chi^2(3)\) under the null hypothesis of homoscedasticity, and LR(S) = Likelihood ratio test for coefficient constancy over the periods 1962–1977 and 1978–1993, and is distributed as \(\chi^2(3)\) under the null hypothesis of homoscedasticity. Estimation is by non-linear 3SLS using the following instruments lagged 1 and 2 periods: real disposable income, consumption of durables, M1 deflated by consumer prices, nominal interest rate on long-term government bonds, share prices deflated by consumer prices, and the savings rate. The real share prices are omitted from the instrument set for the estimates of ̂λ\(_{1962-1977}\) and ̂λ\(_{1978-1993}\).

Consumers face a binding liquidity constraint that prevents them from smoothing out consumption over the life-cycle. Only a few authors (for instance, Summers, 1986; Campbell & Mankiw, 1989, 1990, 1991) argue that ̂λ > 0 reflects myopic behaviour, without giving a theoretical rationale for myopic behaviour. Shefrin and Thaler (1988) provide a theoretical rationale for myopic behaviour based on research from the psychology literature. They show that excess sensitivity can arise because of the lack of willpower, self-control and internal conflict. The lack of willpower and self-control enhances...
the temptation to consume from current income over the rational choice of smoothing consumption over the life-cycle. A positive $\lambda$ may also reflect uncertainty, improper aggregation, restrictions imposed on preferences, errors-in-variables, the empirical observation that permanent income is positively correlated with current income, and also that income is a random walk (Mankiw & Shapiro, 1985).

This paper focuses on three hypotheses that seek to explain the breakdown of the rational expectations LC-PIH: namely, the liquidity constraint hypothesis, the uncertainty hypothesis; and the BLC hypothesis. According to the liquidity constraint hypothesis advocated by Flavin (1985), Hubbard and Judd (1986), Jappelli and Pagano (1989) and Scheinkman and Weiss (1986), consumers are unable to smooth out their consumption over the life-cycle because they are credit rationed. However, most efforts to test the liquidity hypothesis have been limited by the availability of measures of liquidity constraints. In their influential paper, Jappelli and Pagano (1989) find support for the liquidity hypothesis by showing that the excess sensitivity is negatively related to consumer debt, namely the ratio of total consumer debt

\[ Y_t = X_{t-1}'\beta + v_t, \]

in which $X_{t-1}$ is a vector of variables known to the consumer at time $t - 1$ and $v_t$ is a white noise expectation error. The conditional expectation of current income is given by

\[ E\{Y_t|X_{t-1}\} = X_{t-1}'\beta = Y_t^p \]

and its estimated counterpart is given by

\[ \hat{E}\{Y_t|X_{t-1}\} = X_{t-1}'\hat{\beta} = \hat{Y}_t^p. \]

Regardless of whether or not $\beta$ is estimated by maximum likelihood or two-step methods, $\hat{Y}_t^p$ is a consistent estimate of permanent income. Since $X_{t-1}$ is likely to enter the information set, as represented by $X_{t-1}, Y_t^p$ and $Y_{t-1}$ are likely to be positively correlated. In a time-series context, it also follows that $Y_t^p$ and $Y_t$ will be positively correlated. Given such a positive correlation, it is unlikely that consumers who obey the LC-PIH will have zero empirical sensitivity to current income.

---

3 An errors-in-variable bias may occur because consumption and income are measured with errors which are positively correlated, as income is expenditure-based, so that $\lambda$ is biased upward. The instruments are assumed to be uncorrelated with the measurement error of real disposable income.

4 Empirical evidence supporting the excess sensitivity of consumption over the LC-PIH might arise through a positive correlation of current and permanent income. The standard decomposition of current income into its permanent and transitory components, namely $Y_t = Y_t^p + Y_t^T$, assumes that $Y_t^p$ and $Y_t^T$ are uncorrelated. However, $Y_t$ and $Y_t^p$ can be positively correlated, in which case “life-cyclers” may well consume from $Y_t$ through a positive correlation with its permanent counterpart. Estimated permanent income and current income are likely to be positively correlated, especially for time series data. In standard approaches to estimating $Y_t^p$, it is assumed that
to consumption, by a casual inspection of the estimated excess sensitivity parameters and the debt–consumption ratios for seven countries. They argue that the consumer debt ratio is a good measure of credit availability and the development of the credit market, and that the ratio does not reflect the desire to borrow.

An alternative argument is that a high level of debt partly reflects that consumers have a high incentive to borrow and perceive a low level of uncertainty. In the Scandinavian countries, for instance, a high and highly progressive tax rate, coupled with previously highly favourable tax deductibility rules for mortgage interest payments, has worked as an inducement to indebtedness. By contrast, the low income countries of the OECD, such as Ireland, Portugal, Spain, and Greece, have low income taxes and tax deductibility of interest payments up to a certain limit (OECD, 1990), thereby rendering bank lending less attractive. Instead, a large proportion of lending in these countries takes place within the family (Boleat, 1985). Although the amount of inter-family lending relative to consumption is unlikely to outstrip its official counterpart in the Scandinavian countries, family lending nevertheless gives consumers a greater opportunity to obey the LC-PIH than is suggested by official credit market statistics. Consequently, the finding of Jappelli and Pagano (1989) of a negative correlation between the consumer debt ratio and the excess sensitivity parameter may be spurious, and may reflect the fact that consumer debt is an incomplete measure of credit market sophistication.

According to the uncertainty hypothesis, consumers are less likely to obey the LC-PIH and are more likely to behave in a myopic manner, the greater the uncertainty faced (Blanchard & Fischer, 1989; Muellbauer & Lattimore, 1995; Hahm & Steigerwald, 1999): a large decrease in income increases uncertainty, and hence the need for precautionary savings, and lowers consumption. When income increases, uncertainty is decreased and the need for precautionary savings is lowered. A positive relationship between current consumption and income is established, and the relationship is an increasing function of uncertainty. Blanchard and Fischer (1989) assumed that uncertainty increased the excess sensitivity parameter under the assumption of inter-temporal optimisation. Their result is reinforced if it is

---

5 Of the seven estimated excess sensitivity parameters, those of Japan and UK can be shown to be outliers when the non-linear IV and FIML estimation methods, respectively, are used. These results notwithstanding, the significant negative relation between the estimated excess sensitivity parameters and consumer debt is still found to hold.
assumed further that consumers have adaptive expectations. In that case, consumers expect the decrease in their income to continue, which enhances their saving. Thus, the excess sensitivity parameter will increase even further.

In the following, uncertainty regarding after-tax disposable income in excess of expenses on necessities will be measured according to the chance of a decrease in income after basic-needs expenses have been met, and the support the government will provide in the event of such a decrease in income. This decomposition leads to the following uncertainty equation:

\[ X = \sum \kappa_j p_j q_j, \quad \lambda = F(X), \quad \lambda'(X) < 0, \]

where \( X \) is the level of uncertainty, \( \kappa_j \) the share of item \( j \) in the budget (which takes a negative value if item \( j \) is a source of income and a positive value if it is an expense), \( p_j \) the probability of incurring a cost, or the probability of income loss from source \( j \), and \( q_j \) is the expected income loss if \( j \) occurs. Assuming linear dependence between \( \lambda \) and \( X \), the uncertainty equation can be rewritten as

\[ \lambda = \sum \xi_j p_j q_j. \]  

Eq. (4) suggests that the excess sensitivity parameter is a linear function of expected income loss, \( p_j q_j \). In the empirical estimation to follow, \( \xi_j \) is estimated by ordinary least squares and the following alternative measures are used for \( p_j q_j \): (1) the likelihood of being unemployed (the rate of unemployment); (2) government taxes and expenditures will dampen the volatility, and hence uncertainty, attached to income after basic-needs expenses have been met. In countries with high tax rates and high welfare provision, unanticipated increases in income will be taxed, childcare and schooling will be partially funded by the government, and insurance and pensions will be typically provided by the government. Thus, the state provides a social security net for its consumers in welfare states: the state provides childcare facilities, allowances, social security, high unemployment benefits, and high pensions, and subsidises education heavily. In such situations, consumers will not be as sensitive to income fluctuations because they are guaranteed minimum living standards. There is, therefore, less need to save in downturns and to dissave in upturns.

For the government welfare provisions the degree of government involvement is needed, and hence its ability to smooth out the income volatility after basic-needs expenses have been met. To that end, we use the average tax
rate, calculated as total indirect taxes, direct taxes and other contributions, which consist largely of social security contributions, divided by nominal GDP. Not only is the average tax rate a good measure of the extent to which consumers are able to smooth their income over the life-cycle, but it is also a good measure of the inverse income loss in case of sickness, invalidity, retirement, and having children. Furthermore, high taxes imply a lower excess sensitivity because increases in profits in a high-tax country will rarely be reflected in a proportional increase in dividends due to double taxation, whereas capital gains are usually not subject to double taxation. Government expenditure on education, health, social security and welfare relative to GDP is also included since the tax rate may not entirely reflect these government activities.

According to the BLC hypothesis, an increase in the share of income going to profits increases aggregate savings, because the marginal costs of exercising willpower are inversely related to income, and because of the income smoothing character of dividend pay-outs. The latter follows from the mental accounting system of the BLC hypothesis, whereby the propensity to spend is higher out of current income than future income. We would, therefore, expect the excess sensitivity parameter to be negatively related to the share of income amount to profit.

The arguments above lead to the following cross-section estimation equation:

\[ \hat{\lambda}_i = \phi_0 + \phi_1 U_i + \phi_2 T_i + \phi_3 G_i + \gamma_4 P_i + \phi_5 (D/CP)_i + \epsilon_i, \]  

where \( \hat{\lambda}_i \) is the estimated excess sensitivity parameter for country \( i \), \( U \) the rate of unemployment, \( T \) the total indirect taxes, direct taxes and other contributions, divided by nominal GDP, \( G \) the general government expenditures relative to GDP, \( D \) the total nominal consumer debt, \( CP \) the total nominal consumption expenditure, and \( P \) is the share of profit (net operating surplus) of GDP. The unemployment rate is included as a separate argument in Eq. (5) as unemployment not only reflects the expected income loss but is also a summary measure of macroeconomic stability facing an economy. All variables are measured as annual averages covering the sample period used to estimate \( \lambda_i \) (namely, 1962–1993, 1962–1977, and 1978–1993). All variables are measured in decimal points.

Other studies have also used either expected or actual \( U \) as a proxy for uncertainty. Carroll (1992) uses survey unemployment expectation as a proxy for uncertainty. Using survey expectational data for the US, Greasley and Madsen (2000) show that consumer uncertainty is positively and sig-
nificantly related to unemployment. They also find that unemployment was influential for durable and non-durable consumption during the Great Depression.

3.2. Estimation results

Before evaluating the empirical estimates, the simple correlation patterns of the estimated excess sensitivity parameter are compared with the focus variables. In Fig. 1, the excess sensitivity is seen to be weakly negatively related to the consumer debt ratio, \((D/CP)\), as predicted by the liquidity constraint hypothesis. Japan and Norway are potential outliers, with the highest and lowest estimated excess sensitivity parameters, respectively. If these two potential outliers are disregarded, the apparent negative relationship between excess sensitivity and the consumer debt ratio becomes blurred. A stronger negative relationship between excess sensitivity and the average tax rate can be observed in Fig. 2, which is consistent with the uncertainty hypothesis. Finally, Fig. 3 shows that excess sensitivity is positively related to the rate of unemployment, which is also consistent with the uncertainty hypothesis. If one disregards the potential outlier, Japan in Fig. 3, there is a strong positive

![Graph](image-url)

**Fig. 1.** Excess sensitivity and consumer debt ratio.
relationship between the estimated excess sensitivity parameter and unemployment.
Turning to the empirical estimates of excess sensitivity, it is first tested whether the estimated $\lambda_i$ and $(D/CP)_i$ are negatively related in a larger sample than the one used by Jappelli and Pagano (1989). Since data on $(D/CP)_i$ are only available in the more recent years for most countries, $(D/CP)_i$ is measured in 1993 for all countries. White’s heteroscedasticity-consistent covariance matrix estimator is used, as recommended by Pesaran and Smith (1995), for all the estimates presented in Table 2.

Table 2

Explaining the excess sensitivity parameter $\lambda_i^a$

<table>
<thead>
<tr>
<th>Model</th>
<th>Const</th>
<th>$U$</th>
<th>$T$</th>
<th>$G$</th>
<th>$\Pi$</th>
<th>$D/CP$</th>
<th>$\bar{R}^2$</th>
<th>LM(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda_{1962-1993}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.36</td>
<td>0.17</td>
<td>0.13</td>
<td>2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5.95)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.30</td>
<td>0.08</td>
<td>0.02</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6.16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.54</td>
<td>3.89</td>
<td>0.62</td>
<td>0.53</td>
<td>0.74</td>
<td>0.01</td>
<td>0.78</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>(2.63)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.44</td>
<td>3.04</td>
<td>0.75</td>
<td>0.55</td>
<td>0.80</td>
<td>0.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda_{1978-1993}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.67</td>
<td>3.23</td>
<td>0.88</td>
<td>0.92</td>
<td>0.78</td>
<td>0.49</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.66)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.33</td>
<td>2.82</td>
<td>0.84</td>
<td>0.49</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.95)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda_{1962-1977}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0.65</td>
<td>5.78</td>
<td>1.04</td>
<td>0.13</td>
<td>0.39</td>
<td>0.44</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.32)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.43</td>
<td>5.68</td>
<td>0.89</td>
<td>0.49</td>
<td>4.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.43)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\lambda_{1962-1977}$ and $\lambda_{1978-1993}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.80</td>
<td>5.48</td>
<td>0.74</td>
<td>1.82</td>
<td>1.09</td>
<td>0.58</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$Absolute $t$-statistics are given in parentheses. $\bar{R}^2$ is the adjusted $R^2$. LM(H) is the Lagrange multiplier test for single-equation heteroscedasticity, using the regressors from the original regression, and is distributed as $\chi^2(m)$ under the null hypothesis of homoscedasticity, where $m$ is the number of regressors excluding the constant term. Models 1 and 2 are based on data for the 17 countries for which consumer debt is available (see Appendix A). Japan and Norway are excluded from Models 1–4 because the Wald test for outliers rejected the null hypothesis that Japan and Norway belong to the sample [$\chi^2(1) = 277.9$ (Japan) and $\chi^2(1) = 37.2$ (Norway) in Model 1]. Japan is excluded from Models 5 and 6 because the Wald test for outliers rejected the null hypothesis that Japan belongs to the sample [$\chi^2(1) = 5.8$ for Model 5]. Japan, Italy and Norway are excluded from Models 7 and 8 because the Wald test for outliers rejected the null hypothesis that these countries belong to the sample [$\chi^2(1) = 22.1$ (Japan), $\chi^2(1) = 48.1$ (Italy), and $\chi^2(1) = 10.2$ (Norway) in Model 7].
As predicted by the liquidity constraint hypothesis of Jappelli and Pagano (1989), the coefficient of \( (D/CP) \) is negative and statistically significant at the 10% level with a \( t \)-ratio of \(-2.10\) (Model 1). Moving from the country with the lowest excess sensitivity parameter of 0.10 (Greece) to the country with the highest of 1.44 (Denmark) leads to a decrease of excess sensitivity of 0.23. This suggests that credit constraints may be important. However, the \( t \)-ratio for the estimated coefficient of \( (D/CP) \) becomes statistically and economically insignificant for Model 2 when Japan and Norway, with highly significant \( \chi^2(1) \) test statistics of outliers of 277.9 and 37.2, respectively, are deleted from the sample.

Upon deletion of these two outliers, the results of estimating Eq. (5) are shown as Model 3 in Table 2. The estimates provide clear evidence that the uncertainty and the BLC hypotheses reject their non-nested liquidity constraint counterpart. Since the tax rate, unemployment rate, profit rate, are statistically significant, whereas the consumer debt ratio is not, the uncertainty and the BLC hypotheses reject the liquidity constraint hypothesis, but not the reverse (see McAleer, 1995 for further details). Thus, for the sample data used in this paper, the uncertainty and BLC hypotheses clearly dominate their liquidity constraint counterparts.

The coefficients of \( (D/CP) \) and \( G \) are economically and also statistically insignificant at the 10% level, and so are deleted, yielding the restricted model, which is estimated as Model 4. The economic insignificance of \( G \) stems from its low estimated coefficient and the fact that it varies within a narrow band from 0.10 (Japan) to 0.26 (Sweden). Note that deleting statistically insignificant variables leads to a pre-test bias that affects the probability of a type one error for the purpose of inference. The resultant \( t \)-statistics in the restricted estimates do not, therefore, follow strictly the standard normal distribution.

Each of the tax rate, the profit rate and the unemployment rate has the expected sign and is significant, the unemployment rate highly so. If the rate of unemployment in Switzerland increased from its average of 0.6% to the average in Spain of 9.3%, the excess sensitivity parameter would increase by 0.26. A lower, but economically significant, figure is obtained for the profit rate. The excess sensitivity parameter would increase 0.16 for Sweden if it increased its profit rate to that of Greece. Hence, an increase in the average tax rate and the profit rate, and a decrease in the rate of unemployment, lower excess sensitivity because of a decrease in uncertainty and the temptation to spend.

These results suggest that the coefficient of \( (D/CP) \) is statistically significant in Model 1 because its magnitude reflects the incentives to consumers
associated with the uncertainty and temptation in incurring debt, rather than consumers not obeying the LC-PIH through being liquidity constrained. Furthermore, the apparent significant negative relationship between \( \hat{\lambda}_i \) and \( (D/CP) \), though marginal, reflects the fact that consumers are more willing to incur debt under certainty, although such an apparent significant relationship disappears once the effects of uncertainty are accommodated in the model.

Estimates of Eq. (5) using data for the period 1978–1993 are presented as Model 5 in Table 2. All coefficients have signs that are consistent with the uncertainty hypothesis, but not the BLC hypothesis and the coefficients of the tax rate and the rate of unemployment are significant at the 10% level. Deleting the statistically insignificant variables \( G \) and \( II \) leads to Model 6, in which the coefficients of the unemployment rate and the tax rate remain highly significant.

The results of estimating Eq. (5) for the sample period 1962–1977 are shown as Models 7 and 8. Only the tax rate and the rate of unemployment are significant at the 10% level in Model 7. Deleting the insignificant variables \( G \) and \( II \) from Model 7 yields the estimates for Model 8, in which the tax rate and the rate of unemployment are of the expected signs and are significant. Note that \( (D/CP) \) has not been used in estimation for the periods 1962–1977 and 1978–1993 because the credit data are only available over a short time-span for most countries.

Estimating Eq. (5) for the pooled sample periods 1962–1977 and 1978–1993 gives some important results that are shown as Model 9. All the estimated coefficients are statistically significant at the 10% level. The introduction of the time dimension has rendered government spending and profit shares statistically quite significant, whereas the magnitude and significance of the estimated coefficients of taxes and unemployment are approximately the same as the estimates in Models 3–8. These results suggest that taxes and unemployment explain the cross-section dimension of the excess sensitivity, whereas profits and government spending explain the shift in the excess sensitivity parameter over time. The shares of government spending and profits in GDP have increased substantially over the period from 1962–1977 to 1978–1993, and, therefore, explains the general tendency for the excess sensitivity parameter to increase over the period, thus counterbalancing the effects of the increase in the rate of unemployment. Over the period \( G \) has

---

6 Note that the adjusted \( R^2 \) values for Models 5–9 are much lower than for Models 1–4 because highly significant country-dummies for Japan and Norway have been included in estimating Models 1–4.
typically increased by a factor of 0.20, which has resulted in a decrease in the excess sensitivity parameter of 0.36. II has on average increased by 0.13 over the period, which has resulted in a reduction in the excess sensitivity parameter of 0.14.

In summary, the empirical estimates provide strong support for the uncertainty hypothesis, in particular, and the BLC hypothesis, but there is no evidence that liquidity constraints have prevented consumers from behaving according to the LC-PIH. The coefficient estimates of the rate of unemployment and the average tax rate are remarkably robust in statistical and economic significance to the estimation period and the inclusion of a range of variables, and explain the cross-section variation in excess sensitivity very well. G and II, by contrast, are not particularly good at explaining the excess sensitivity parameter across countries, but are very powerful in explaining the change in excess sensitivity over the periods from 1962–1977 to 1978–1993.

4. Time-series evidence on excess sensitivity

The estimates in the previous section indicated that the finding of Jappelli and Pagano (1989), namely that excess sensitivity is due to liquidity constraints, could not be sustained when alternative hypotheses of excess sensitivity are accommodated in the model. Although the cross-section approach has the advantage of removing cyclical influences on the relationships among the variables, it nevertheless does so at a cost. In particular, conditional variables that change over time and across countries have been omitted from Eq. (3). This is reflected in the variation of coefficients over time and across countries. The small number of observations renders it difficult to accommodate conditional variables. Furthermore, the availability of only 17 cross-section observations limited the choice to only a few focus variables as regressors.

To overcome the problems that are associated with the estimates in the previous section, the estimates in this section exploit both the time and cross-section dimension of the data sample, which increases the number of observations substantially and enables tests of various aspects of the models. Before considering a model that accommodates the predictions of the liquidity, the uncertainty and the BLC hypotheses, the following simple benchmark equation is estimated using pooled cross-section and time-series data:
\[ \Delta \ln C_{it} = \gamma_0 + \gamma_1 \Delta \ln C_{i,t-1} + \gamma_2 \Delta \ln Y_{it} + \varepsilon_{it}, \]  

(6)

where \( C \) is measured as real per capita non-durable consumption, and \( Y \) is real per capita disposable income. The equation is estimated using annual pooled cross-section and time-series data for 22 OECD countries over the period 1960–1993, and orthogonality between disposable per capita income and the disturbance terms is certified by the instrumental variable method. One-year lags of real disposable income, real consumption, and M1 deflated by consumer prices, in logarithmic first differences, are used as instruments for \( \Delta Y_t \). The data are pooled for efficiency.

To gain further efficiency, the generalised instrumental variable method, where the covariance matrix is weighted by the correlation of the disturbance terms, is used. More specifically the following variance–covariance structure is assumed:

\[
E\{\varepsilon_i^2\} = \sigma_i^2, \quad i = 1, 2, \ldots N,
\]

\[
E\{\varepsilon_i, \varepsilon_j\} = \sigma_{ij}, \quad i \neq j,
\]

\[
\varepsilon_{it} = \rho \varepsilon_{i,t-1} + v_{it},
\]

where \( \sigma_i^2 \) is the variance of the disturbance terms for country \( i = 1, 2, \ldots N \), \( \sigma_{ij} \) the covariance of the disturbance terms across countries \( i \) and \( j \), and \( \varepsilon \) is the disturbance term. The variance \( \sigma_i^2 \) is assumed to be constant over time but to vary across countries and the error terms are assumed to be mutually correlated across countries, \( \sigma_{ij} \), as random shocks are likely to impact on all countries at the same time. Finally, the disturbance terms are assumed to follow a first-order autoregressive process. \( \sigma_i^2, \sigma_{ij}, \) and \( \rho \) are estimated using the feasible generalised least-squares method described in Greene (2000, Chapter 15).

The following estimates are obtained:

\[ \Delta \ln \hat{C}_t = 0.002 + 0.27 \Delta \ln C_{t-1} + 0.58 \Delta \ln Y_t, \]

(3.85) (12.3) (29.3)

where the numbers in parentheses are absolute \( t \)-statistics. The null hypothesis of cross-country coefficient constancy is rejected at conventional significance levels \( [F(44,638) = 2.04] \). However, as argued by Leamer (1978, p. 114), the likelihood of rejecting the null hypothesis grows with sample size in classical tests. Leamer suggests an alternative formula based on diffuse priors (Leamer, 1978, p. 114). Using his formula, the critical \( F \)-value is 8.21, which suggests that the null hypothesis of coefficient homogeneity cannot be rejected.
The estimated marginal propensity to spend is 0.58 in the short run and 0.70 in the long run. These estimates are consistent with the estimates in Table 1, but higher than most estimates in the literature, which are typically in the range 0.3–0.4 (see, for instance, Campbell & Mankiw, 1989, 1990, 1991). The difference likely reflects the fact that quarterly data are used in the majority of the estimates in the literature. Quarterly data are more prone to measurement errors than annual data. More importantly, the correlation between current and permanent income is higher in low than high frequency data because permanent income is easier to predict in the long run than in the short run. As discussed in footnote 3, a high correlation between the permanent income and actual income leads to a high excess sensitivity parameter that is not inconsistent with the LC-PIH.

Allowing for the conditional variables that are predicted by the theories of consumption in estimation suggests the following stochastic formulation:

\[
\Delta \ln C_{it} = \beta_0 + \beta_1 \Delta \ln C_{i,t-1} + \beta_2 S_{L}^d \Delta \ln W_{it}^d + \beta_3 S_{C} \Delta \ln \Pi_{it} \\
+ \beta_4 S_{L}^d \Delta \ln W_{it}^d + \beta_5 \Delta U_{it} + \beta_6 \Delta \ln (D/CP)_{it} + \beta_7 \Delta \ln P_{it} \\
+ \beta_8 \Delta T_{it} + \beta_9 \Delta \ln G_{it} + \epsilon_{it,2},
\]

where \(W^d\) is the after-tax real direct wages per hour worked, \(\Pi\) the after-tax per capita real net operating surplus, \(W^d\) the after tax real indirect labour costs per hour worked, which are discussed below, \(U\) the rate of unemployment, \(D\) the total consumer debt at current prices, \(CP\) the total consumption at current prices, \(P\) the consumer prices, \(T\) the total direct and indirect taxes as a percentage of GDP, and \(G\) is the general government expenditure relative to GDP. All variables are measured in decimal points. \(S_{L}^d, S_{L}^d, \) and \(S_{C}\) are the shares of income going to direct salaries, indirect labour costs, and capital, respectively. The shares are computed as the average for the 22 OECD countries over the period 1960–1993. As will become clear below, the income share parameters are crucial for tests of the BLC hypothesis versus the LC-PIH model.

The liquidity, the BLC and the uncertainty hypotheses are embedded in Eq. (7), and have the following priors:

- **Uncertainty**: \(H_0 : \beta_5 < 0, \beta_7 < 0, \beta_8 > 0, \beta_9 > 0\)
- **Liquidity constraint**: \(H_0 : \beta_6 > 0\)
- **BLC**: \(H_0 : \beta_2 > \beta_4, \beta_2 > \beta_3\)

The uncertainty hypothesis predicts that consumption is negatively related to unemployment, but positively related to taxes and government spending,
as discussed in the previous section. The hypothesis also predicts that consumption is negatively related to prices because inflation leads to uncertainty as shown in Madsen (2001) and Madsen and McAleer (2000). Inflation increases income uncertainty because consumers are uncertain as to whether they will be compensated. Furthermore, inflation increases consumers’ perception of the likelihood of financial distress. An increase in inflation will, therefore, reduce consumption growth.

The liquidity constraint hypothesis predicts that consumption is positively associated with the debt ratio. If liquidity constraints prevent consumers from obeying the LC-PIH, then increasing access to credit will increase consumption because of a reduction in the fraction of consumers who were previously credit constrained. If consumers are not credit constrained, then consumption in the previous period is the only relevant variable that contains the information about permanent income, so that the consumption function collapses to the random-walk type of Hall (1978).

The BLC predicts that the propensity to spend out of labour income exceeds that of profits, as discussed in the previous section, and that the propensity to spend out of direct wages exceeds that of indirect wages. Indirect wages comprise pension contributions, employers’ social security expenditures, bonuses and gratuities, payments in kind, costs of workers’ housing borne by employers, payroll taxes, welfare services, and non-wage benefits (International Labour Organisation, 1999). Note that indirect wages are a significant proportion of total wage costs, and direct and indirect wages are of almost equal size for some countries (International Labour Organisation, 1999). Hence, a large proportion of total wages is future income. The distinction between indirect and direct wages is unimportant in the LC-PIH because permanent income is equally affected by various sources of wealth (income). By contrast, the BLC hypothesis uses the mental accounting system, whereby wealth is divided into current income, current assets, and future income. The temptation to spend out of wealth depends on its location in the mental accounting system, with spending out of current than future income being more tempting.

To enable tests of the implications of the BLC theory, the income variables are multiplied by their share in total income. Suppose that the propensity to spend is one and is similar for direct wages, indirect wages and profits. Then the estimated coefficients from regressing consumption on the three income variables would be equal to their shares in total income. Variations of the propensity to spend out of various income sources can, therefore, only be compared when the variables are multiplied by their income shares. All
income variables, $U$, $T$ and $G$ are instrumented using one-year lags of the logarithm of real consumption, the logarithm of $M1$ deflated by consumer prices, consumer price inflation, and the dependent variable. The systems estimator and the country sample employed in the estimates of Eq. (6) are used. The results of estimating Eq. (7) are as follows:

$$
\Delta \ln \hat{C}_t = 0.02 + 0.24\Delta \ln C_{t-1} + 0.40 S_d^1 \Delta \ln W^d_t + 0.20 S_c \Delta \ln \Pi_t $

$$
+ 0.06 S_L^1 \Delta \ln W^L_t - 0.80 \Delta U_t - 0.06 \Delta \ln P_t + 0.05 \Delta T_t $

$$
- 0.01 \Delta \ln G_t
$$

$[R^2(Buse) = 0.76, \text{LM(SC)} = 0.19, \text{LM(H)} = 17.8, N = 682],$

where $R^2(Buse)$ is the Buse’s raw moment $R^2$, LM(SC) the Lagrange multiplier test for first-order serial correlation, which is distributed as $\chi^2(1)$ under the null hypothesis of no serial correlation, LM(H) the Lagrange multiplier test for heteroscedasticity, which is distributed as $\chi^2(7)$ under the null hypothesis of homoscedasticity, and $N$ is the number of observations. The LM(SC) and LM(H) tests are based on within-individual residuals to remove the influence of individual effect from the tests. From the above, the diagnostic tests at conventional significance levels do not suggest any inadequacy in the model specification. Again there is no evidence of cross-country coefficient heterogeneity ($F(176,506) = 2.25$, and Leamer’s critical $F$-value is 13.6). The variable $(D/CP)_t$ is not included in the estimates because data are only available for some of the countries and cover a shorter period than 1960–1963 for most countries (the data coverage is listed in the data Appendix A). Estimating Eq. (7) by OLS over the periods for which $(D/CP)_t$ is available leads to an estimated coefficient of $(D/CP)_t$ which was almost zero and statistically insignificant ($t = 0.31$).

The estimates are strongly supportive to both the BLC and the uncertainty hypotheses. Coefficient of direct wages is much higher than the estimated coefficients of profit income and indirect wages, thereby supporting the BLC hypothesis. The hypothesis of $\beta_2 = \beta_4$ is strongly rejected in favour of the BLC hypothesis ($\chi^2(1) = 17.5$), and so is the hypothesis of $\beta_2 = \beta_3$ ($\chi^2(1) = 119.9$). The estimates show that if direct real after-tax wage income increases by 10%, then workers’ consumption of non-durables increases by 4% in the short run and 5.3% in the long run. For indirect wages, the corresponding figures are 0.6% and 0.8%, respectively. Hence, future
income does not have much effect on contemporaneous consumption, even if it is recognised that a small proportion of the indirect wages are not directly benefiting workers, such as payroll taxes. The higher propensity to spend out of labour income than profits can arise because the willpower is more difficult to exercise for low-than for high-income earners, and because a proportion of profits are first paid out in the future. Both arguments are consistent with the BLC hypothesis.

The uncertainty hypothesis receives support from the economically and statistically significant estimated coefficients of inflation and changes in unemployment. The estimation results show that the 10% point average reduction in the rate of inflation from 1982 to 1997 in the OECD countries increased consumption growth by 0.6% per year. The disinflation in the OECD countries has, therefore, been an important factor behind the strong growth in consumer demand since the 1980–1982 recession. A 1% point increase in the rate of unemployment results in a 0.8% reduction in non-durable consumption. Although not so influential as inflation, the approximately 3% point increase in unemployment in the OECD countries from 1980 to 1982 explains a large fraction of the reduction in the growth in consumer demand over the same period.

Turning to the estimated coefficients of taxes and government expenditure, they are insignificant, which is not consistent with the uncertainty hypothesis and the estimates in the previous section. However, it is unlikely that these variables have captured uncertainty effects because they are excessively affected by the business cycle. Governmental spending and taxes are influenced more by economic fluctuations than changes in the provision of governmental services in the short run. It is, therefore, unlikely that much can be learned from including taxes and governmental expenditure in the estimates.

Lastly, the propensity to spend in the estimates of Eq. (6) has been reduced substantially by accommodating the variables predicted by the uncertainty and the BLC hypothesis. The reductions of approximately 0.2 and 0.3 in the short and in the long run, respectively, suggest that simple estimates of excess sensitivity give biased estimates because important variables have been omitted from the estimates.

5. Why do consumers incur debt?

Although Jappelli and Pagano (1989) argue that \(D/CP\) reflects the degree to which consumers are credit constrained, it may not be an adequate proxy
for credit constraints. As argued in Section 3, a high level of debt may partly reflect the fact that consumers have a high incentive to borrow and perceive a low level of uncertainty. To overcome these problems, an additional direct test which distinguishes consumer debt incidence over the business cycle is useful for testing the liquidity constraint hypothesis versus the BLC and the uncertainty hypotheses. To that end the following equation is estimated using pooled cross-section and time-series data:

$$\Delta \ln(D/CP)_{it} = \phi_0 + \phi_1 \Delta \ln Y_{it} + \phi_2 \Delta U_{it} + \phi_3 \Delta \pi_{it} + \phi_4 \Delta T_{it} + \phi_5 \Delta \ln G_{it} + \phi_6 \Delta \Pi_{it} + \phi_7 \Delta R_{it} + \phi_8 \Delta \pi_{it} + \epsilon_{it,3},$$

where $Y$ is the real per capita disposable income, $\pi$ the consumer price inflation rate, and $R$ is the nominal interest rate on long-term government bonds. The interest rate is included in the equation to allow for the possibility of inter-temporal substitution in consumption: an increase in the interest rate gives consumers an inducement to lower their consumption and to save more.

The theories of consumption have conflicting implications regarding the cyclical consumer debt. The uncertainty and the BLC hypotheses predict procyclical consumer debt. For the uncertainty hypothesis, this is because the need for precautionary savings is counter-cyclical, and for the BLC hypothesis the temptation to spend is restricted by the pro-cyclical nature of the supply of credit (Stiglitz, 1992). By contrast, the liquidity hypothesis predicts counter-cyclical consumer debt. Consumers will incur debt in a cyclical downturn because the fraction of consumers that is not liquidity constrained will act according to the LC-PIH, whereas the liquidity constrained consumers will maintain their level of consumer debt.

Following the discussion in the previous sections, the uncertainty hypothesis furthermore predicts that the coefficient of unemployment is negative and the coefficients of taxes and governmental spending are positive. As discussed below, a negative coefficient of inflation is also consistent with the uncertainty hypothesis. The BLC hypothesis predicts that the coefficient of $\Pi$ is negative because the temptation to spend declines with the share of income accruing to profits.

Inflation is accommodated in the estimates to allow for the fact that the real interest rate is the relevant discount factor in inter-temporal substitution models and, therefore, that the coefficients of nominal interest rate and inflation are the same but with the opposite sign. If, however, consumers and financial institutions fail to distinguish between nominal and real magnitudes, then only the nominal interest rate will be significant. Employing a
mean-variance model of portfolio selection, Madsen (2001) shows a strong
degree of inflation illusion among consumers, which implies that demand for
durables is negatively related to inflation. Hence, an increase in the rate of
inflation increases the precautionary saving and hence reduces debt. Fur-
thermore, institutional arrangements require interest payments to be paid
immediately after the loan is taken. Hence, banks and building societies may
become more cautious in their lending policies when the nominal interest rate
increases, since some borrowers may not be able to meet their interest
commitments. Finally, consumers will increase their savings in response to an
increase in the interest rate because the value of their personal wealth (that is,
the discounted value of future earnings) is inversely related to the nominal
interest rate.

All variables are lagged one period in Eq. (8) to allow for slow adjustment
towards equilibrium. Insignificant variables at the 5% level are deleted.
White’s heteroscedasticity consistent estimator and the Newey–West auto-
correlation consistent covariance matrix are used. Estimation of Eq. (8)
yields the following results:

\[
\Delta \ln \left( \frac{\hat{D}}{CP} \right)_t = -0.00 + 0.62 \Delta \ln \left( \frac{D}{CP} \right)_{t-1} + 0.24 \Delta \ln Y_t + 0.25 \Delta \ln Y_{t-1} \\
- 0.43 \Delta U_t - 0.86 \Delta \pi_t - 0.86 \Delta \Pi_t - 0.42 \Delta R_t - 0.44 \Delta R_{t-1}
\]

\[\bar{R}^2 = 0.47, LM(SC) = 0.97, LM(H) = 14.0, N = 318\],

where \(\bar{R}^2\) is the adjusted \(R^2\), LM(SC) the Lagrange multiplier for test-order
serial correlation, which is distributed as \(\chi^2(1)\) under the null hypothesis of no
serial correlation, LM(H) the Lagrange multiplier test for heteroscedasticity,
which is distributed as \(\chi^2(7)\) under the null hypothesis of homoscedasticity,
and \(N\) is the number of observations. The LM(SC) and LM(H) tests are
based on within-individual residuals to remove the influence of individual
effects from the tests. From the above, the diagnostic tests at the 2.5% level
do not suggest any inadequacy in the model specification.

The estimated coefficients of income are positive and significant, thereby
providing evidence in favour of the uncertainty and the BLC hypotheses and
against the liquidity hypothesis: a cyclical downturn encourages consumers
to lower their debt, whereas debt is increased in a cyclical upturn. A 10% increase in income leads to a 4.9% increase in the debt ratio after one year
and 12.9% increase in the long run. Note that first difference estimates tend to
capture the short run dynamics but are not very informative about long run relationships. Therefore, it is erroneous to interpret the estimates as showing that the debt ratio increases over time along with increasing per capita income. The estimates show rather that income is very influential for the debt ratio according to business cycle frequencies.

The negative estimate of the coefficient of the nominal interest rate may appear to be consistent with inter-temporal optimisation, in that an increase in the interest rate encourages savings. However, the negative and highly significant coefficient of inflation stands in sharp contrast to the predictions of the inter-temporal optimisation theory, whereby an increase in inflation, given the interest rate, increases consumer debt. Hence, this result is inconsistent with the assumptions of the rational consumer in Hall’s hypothesis.

An increase in inflation renders consumers more uncertain, because they perceive it as a reduction in their real income (Madsen, 2001). The effects of inflation on the consumer debt ratio are quantitatively very large, particularly when allowing for the effects of inflation on nominal interest rates. Excluding the nominal interest rate from the estimates yield short run and long run coefficients of inflation of 0.96 and 2.74, respectively. This implies that the 10% point reduction in inflation in the OECD countries on average from 1981 to 1997 has had a long run effect of a 27.4% increase in the ratio of consumer debt to consumption. Hence, inflation and income are jointly highly influential for the consumer debt path in the OECD countries.

Finally, the coefficients of unemployment and profit rate are negative and statistically significant, thus providing further evidence for the uncertainty and the BLC hypotheses. Quantitatively they are not as important in explaining the debt path as are inflation and income.

6. Concluding remarks

Liquidity constraints have long been the maintained hypothesis of the breakdown of the rational expectations LC-PIH, such that institutional constraints have prevented otherwise rational consumers from smoothing their consumption over the life-cycle. In their pioneering study Jappelli and Pagano (1989) found that excess sensitivity in consumption across countries could be explained by the debt–consumption ratio, and hence used it as evidence for the liquidity hypothesis. The estimates in this paper showed that their results are robust to an augmentation of their country sample from 7 to 17. However, the liquidity hypothesis could not be maintained when the
predictions of the uncertainty and the BLC hypotheses were accommodated in the estimates. The estimates showed that excess sensitivity in consumption across countries is sensitive to tax rates, governmental spending, the profit rate and unemployment, which is consistent with the uncertainty and the BLC hypotheses. Further evidence using pooled cross-section and time-series data for 22 OECD countries over the period 1960–1993 reinforced the findings from the cross-section analysis, namely that consumption is negatively related to unemployment and inflation and that the propensity to spend is highly sensitive to the source of income.

Explaining the dynamic path of the consumer debt also yielded results which were consistent with the uncertainty and the BLC hypotheses, but inconsistent with the liquidity constraint hypothesis. In contrast to the predictions of the liquidity hypothesis and the hypothesis of inter-temporal optimisation, the estimates showed that the consumer debt ratio is strongly pro-cyclical and negatively related to inflation. High inflation and recession both lead to high uncertainty and low temptation to spend and therefore give consumers an incentive to save. Conversely, the disinflation and the strong economic growth since the beginning of the 1980s have been mainly responsible for the strong growth in consumer debt in the 1980s and 1990s.

The empirical findings of the paper have important implications for macroeconomic policy, implications which are often contrary to the predictions of the imperfect credit market hypothesis. First, uncertainty and myopic behaviour through temptation amplify business cycles, because consumers tend to decrease their debt more in recessions and increase their in cyclical upturns. In an uncertain environment, myopic behaviour will amplify and prolong cyclical income movements. This implication explains why consumption decreased cumulatively at the onset of the Great Depression in the US in the 1930s (Greasley & Madsen, 2000). The uncertain environment that surrounded the inter-war period induced consumers to act myopically, and the decline in income in 1929 initiated the subsequent cumulative decrease in consumption. Second, our results partly explain the finding of De Long and Summers (1988) that the variance of output for a sample of OECD countries has decreased after WWII. There have been substantial increases in taxes, the size of the government sector and the share of income going to pensions, insurance and bonuses, and a decrease in the rate of unemployment, in the OECD countries in the post-WWII period. These suggest that the uncertainty and the temptations facing the consumer, and consequently the excess sensitivity parameter, have decreased. The likely decrease in the excess sensitivity parameter since WWII has lowered the income multiplier
and, therefore, the output variance implications of shocks. Third, the uncertainty and the BLC hypotheses imply that fine tuning is neither efficient nor especially necessary in a stable environment with high tax rates, high indirect wages and high government spending on health care, childcare, pensions, and schooling. In such cases, the excess sensitivity parameter is close to zero and the simple closed-economy Keynesian income multiplier approaches 1. By contrast, it is 3.5 in countries with 20% tax rates and an excess sensitivity parameter of 0.9 (see Vaidyanathan, 1993, for estimates of the excess sensitivity parameter for several low income developing countries).

Acknowledgements

Helpful comments and suggestions from two referees and seminar participants at the Bank of Japan, Chinese University of Hong Kong, City University of Hong Kong, Hiroshima University, Hong Kong University of Science and Technology, Kyoto University, Osaka University, University of Hong Kong, University of Western Australia and Yokohama National University and financial support from the Australian Research Council are gratefully acknowledged. The paper was written while Jakob Madsen was employed at the University of Western Australia.

Appendix A. Data


Direct tax rate: General government direct taxes and other contribution receipts, divided by nominal GDP for the whole economy (NA).

Direct real after-tax wages: direct hourly wages in manufacturing, ILO, Yearbook (YB), multiplied by one minus the direct tax rate, and divided by the economy-wide value added price-deflator (NA).

Indirect real hourly wages: indirect hourly wages in manufacturing multiplied by one minus the direct tax rate, and divided by the economy-wide value added price-deflator (NA). Indirect hourly wages are calculated as total hourly labour cost minus direct hourly wages. Total hourly labour cost is calculated as compensation to employees in manufacturing (NA) divided by weekly hours worked in manufacturing activities (YB) and manufacturing employment (YB).

Indirect tax rate: Indirect taxes, divided by nominal GDP for the whole economy (NA).
Net operating surplus: (NA).

Real profit income: net operation surplus, (NA), multiplied by one minus the direct tax rate, and divided by the economy-wide nominal GDP (NA) and population (YB).

Unemployment rate: OECD, Labour Force Statistics (LFS) and (YB).


M1: (IFS).

Share prices: (IFS).

Population: (YB).

Interest rates on long-term government bonds: (IFS).

Unemployment benefit replacement ratio: OECD data bank.

Real disposable income: nominal GDP – general government direct taxes and other contribution receipts + other current transfers (NA Table 8.11), divided by the economy-wide GDP deflator.

Total consumption: (NA).

Consumption of durables: (NA). If consumption of durables is not available, the consumption of furniture, furnishings, household equipment and operation and personal transport equipment is used (NA). If these statistics are not available, personal car registrations are used (OECD: Main Economic Indicators).

Consumer and mortgage debt [the data periods covered are listed in brackets]:

- Canada: Bank of Canada: Monthly Bulletin (consumer credit), (NA) for incurrence of liabilities, assuming that consumer credit is 22% of total credit in 1960 and is then accumulated [1960–1993].

- USA: The Economic Report of the President (consumer credit and outstanding mortgages on 1–4 family houses) [1960–1993].

- Japan: Bank of Japan, Economic Statistics Annual (sum of debt for consumer credit held by banking and trust accounts, mutual loans and credit banks and credit associations) [1967–1993].


- Denmark: Danmarks Statistik, Statistisk Årbog. Bank lending to wage earners and accumulated new lending of mortgage institutions, and set to 20% of bank lending in 1977 [1977–1993].
• **Finland**: \((NA)\). Accumulated incidence of liabilities. Total debt set to 20 million FIM in 1970 (or total consumption in 1970) [1969–1993].


• **Germany**: *Deutsche Bundesbank Monthly Report*. Lending to employed and other individuals (Housing loans and consumer credit) [1970–1993].


• **Norway**: *Norges Bank Bulletin* [1992–1993].

• **Spain**: Jappelli and Pagano (1989) [1961–1984].

• **Switzerland**: Schweizerische Nationalbank, *Monatsbericht* [1993].

• **Sweden**: Accumulated incidence of liabilities \((NA)\). Total debt–consumption ratio set to 117.0 in 1985 following Jappelli and Pagano (1989) [1970–1993].


**References**


