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UNEPLOYMENT AND CONSUMPTION: THE CASE OF MOTOR-VEHICLES

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Abstract

In this paper, we use U.S. quarterly data to examine whether the unemployment rate is an important determinant of expenditure on motor-vehicles. The presence of the unemployment rate in a durable goods consumption equation is justified as a predictor of changes in permanent income and/or as a measure of uncertainty regarding the realisation of future labour income. Our finding that the unemployment rate has a strong influence on consumption of motor-vehicles provides evidence against the post-Hall version of the permanent income hypothesis and questions the empirical relevance of the Ricardian equivalence hypothesis. In addition, this evidence points to the possible strength of the precautionary saving motive.

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1. *Introduction*

The main argument of this paper is that the aggregate unemployment rate conveys important information regarding the realization of future labor income and is a valuable measure of aggregate income uncertainty.[1] In the next section we show that some versions of the permanent (PI) income hypothesis and recent theories of consumption which do not adopt certainty equivalence assumptions about behaviour (i.e. theories of precautionary savings) would predict - *ceteris paribus* - that an increase in the current unemployment rate would reduce current consumption. We demonstrate that this is indeed the case with U.S. quarterly data on expenditure on motor-vechicles for the period 1959-1992.

We have chosen to concentrate on motor-vehicles consumption for two reasons. The first is due to the well known problem of simultaneous equations bias. The bias will clearly be smaller if we study the relationship between the aggregate unemployment rate and a part of aggregate consumption spending. The second reason for choosing this particular sub-aggregate is based on the work of Wilcox (1992). He has argued convincingly that due to sampling and compositional errors in the U.S. data, a more sensible disaggregation of consumption expenditure would be into (i) motor-vehicles (ii) other goods and (iii) services, rather than the usual dissaggregation into (i) durables (ii) non-durables and (iii) services. Given that spending on motor-vehicles is the smallest of the sub-aggregates suggested by Wilcox (i.e. approximately 5.5%), the problem of simultaneous equations bias will be least severe in this case.

The links between consumption and unemployment at the microeconomic level have been emphasized before by developments in implicit contract theory. Rosen (1983) pointed out that under certain conditions the economy could be thought of as providing complete insurance to all workers, thereby ensuring full consumption smoothing; in such a case the consumption of employed and unemployed workers would be identical. There are obviously many well understood reasons (moral hazard and adverse selection being two of them) why insurance would not be complete and incomes would not be equalized in the two states of nature. Dynarski and Sheffrin (1987) have adopted this stance and have tried to assess the actual changes in consumption associated with a person being unemployed. They found that the effect of unemployment (and therefore of lower income) on consumption depends on occupational characteristics, with white-collar workers reacting more to unemployment spells than blue-collar workers. Our approach differs from theirs in that we attribute an independent role to the unemployment rate as an influence on consumption. In other words, we suggest that individuals adjust their consumption in response to a change in the unemployment rate even when their income and interest rates remain constant.

At the macroeconomic level, following Hall's (1978) paper, most of the research on consumption has concentrated on testing the implications of the PI hypothesis under rational expectations (RE). In this paper we intentionally deviate from the usual post-Hall and RE practice in the consumption literature. In other words, we do not provide first-order-conditions-based-tests of the PI-RE hypothesis. Although Lucas (1976) presented a valid critique of traditional econometric practice, its implications for how theories dealing with aggregate data should be tested are flawed since the extreme assumption of the mythical representative agent is required. But as it is well known, there is no plausible formal justification for the assumption that the aggregate behaviour of utility maximising individuals is similar to the behaviour of an individual utility maximizer.[2] Moreover, even if one is willing to accept that the choices of the aggregate can be interpreted as those of the representative agent, the response of this agent to the changes in the environment may well not be the same as the aggregate response of the individual she is supposed to represent.[3] An added difficulty arises when one subjects representative agent models to testing with aggregate data. In such cases it is not clear what is the appropriate reaction when the model is rejected (or indeed when it is accepted) by the data. Rejection of the model does not necessarily imply falsification of the basic hypothesis under consideration, but it may be due to the treatment of the economy as a single individual.[4]

The above arguments do not suggest that we should ignore micro-based theories when the objective is the study of aggregate phenomena. They imply, rather, that instead of examining and testing ever more complicated dynamic optimization programs for representative agents, we should be analysing and testing the complicated aggregate dynamics arising from the interactions of heterogeneous individuals which make simple but coherent calculations. Milton Friedman's (1957) formulation of the PIH is an early example of research which pays attention to the behaviour of individuals without ever implying that aggregate time-series data should be interpreted as the solution to the intertemporally maximising representative agent's program. We follow the same approach by appealing to microeconomic reasoning for the presence of the unemployment rate in the consumption function for durable goods.[5]

The paper is organized as follows. In Section 2 we present a simple two-period model which demonstrates that even if expected future income stays constant, an increase in the current unemployment rate will reduce current consumption when there is either constant or decreasing absolute risk aversion. Section 3 outlines the estimation procedure and presents the results. These are discussed in the final section, which also offers some implications of our findings for recent theories of consumption expenditure.

2. *The Model*

In this section, we demonstrate why the unemployment rate should be expected to influence the consumption plans of individuals using a simple two-period model. For simplicity, and in conformity with the literature on consumption, we assume that preferences are described by a time separable utility function of the form

$$V = u(\alpha C_1 + \gamma K_1) + \rho u(\alpha C_2 + \gamma K_2) \tag{1}$$

where the subscripts refer to periods, u is the per-period utility function which is assumed to be increasing, concave and at least three times continuously differentiable, C stands for consumption expenditure, $\rho(=(1+\delta)^{-1})$ is the appropriate discount factor (with δ being the subjective rate of time preference), α and γ are parameters, and K is a stock or state variable which evolves according to the difference equation

$$K_{t+1} = (1-\theta)K_t + C_{t+1} \tag{2}$$

where θ is a parameter which satisfies the restriction ($0 \leq \theta \leq 1$). This model goes back to Nerlove (1957) and Stone and Rowe (1957). By choosing particular values for α and γ some special cases can be generated (see for example, Deaton, 1992). Here, for simplicity and without any loss of generality, we follow Mankiw (1982) and set α=0 and γ>0, in which case K can be interpreted as the stock of durable goods which generate utility by providing services proportional to their level. This stock is augmented by a flow of expenditure C in each period, and depreciates at a rate equal to θ. In this paper, we want to study the effects on the flow of expenditure C of changes in the unemployment rate.

We claim that the consumer's expenditure plans depend on her expected employment status. In common with the rest of the literature on consumption decisions, we ignore labour supply decisions and assume that the individual offers one unit of labour inelastically. If she is employed, she receives an exogenously given level of income Y in each period. If she is unemployed, her income will be equal to the unemployment benefit B(≤Y). In what follows we consider the case of an individual who is employed at the start of the first (current) period (needless to say, our results in no way depend on this assumption). In common with the implicit contract literature we make the crucial assumption that the current unemployment rate is the one that individuals use to formulate their probability of being out of work (=π) in the second period. If the periods are not very long, we believe that this assumption is a reasonable one because the unemployment rate series exhibits a high degree of serial correlation. (We comment later on the implications of this assumption for the PI-RE hypothesis).

Under the above mentioned assumptions, consumption expenditure in the second period can take two values: with probability (1-π) it will be equal to Y+S(1+r), i.e. second period resources when employed, and with probability π it will be equal to B+S(1+r), i.e. resources when unemployed, where S denotes first period savings ($S=Y-C_1$) and r is the (real) rate of interest. The consumer is then assumed to choose saving (or dissaving) to maximize expected lifetime utility

$$EV = u(\gamma K_1) + \rho E u[\gamma K_2] \tag{3}$$

under the constraints

$$K_1 = \bar{K} + Y - S \tag{3a}$$

$$\begin{aligned} K_2 &= \bar{K}(1-\theta) + (1-\theta)(Y-S) + Y + S(1+r) \equiv K_2^E \textit{ with probability } (1-\pi) \\ &= \bar{K}(1-\theta) + (1-\theta)(Y-S) + B + S(1+r) \equiv K_2^u \textit{ with probability } \pi \end{aligned} \tag{3b}$$

where K≥0, is the stock (exogenous) of durable goods which the consumer owns at the start of the first period. The first-order-condition of this problem can be written as

$$u'[\gamma K_1] = \rho(r+\theta)\left[(1-\pi)u'[\gamma K_2^E] + \pi u'[\gamma K_2^u]\right] \tag{4}$$

A special case arises when B=Y. Then equation (4) can be written as

$$\frac{u'[\gamma K_1]}{u'[\gamma K_2]} = \frac{r+\theta}{1+\delta}. \tag{5}$$

In the case of non-durable goods, $\theta=1$ and equation (5) is the well-known condition that the marginal rate of substitution between consumption in the two periods should equal the ratio of relative prices. If $\delta=r$, then S=0 and consumption will be equal in the two periods. However, if goods are durable ($\theta<1$), then, when $\delta=r$, $u'[\gamma K_1] < u'[\gamma K_2]$, which implies that $K_1>K_2$, or that the individual borrows to finance current consumption expenditure ($C_1>C_2$) as long as the "inherited" stock of durables K is zero. Note that if the uncertainty about future income becomes relevant (when B<Y), then durability of a good is not enough to make individuals willing to dissave when $r=\delta$ and K=0.

In order to find the effects of an increase in the unemployment rate on savings, we totally differentiate equation (4) and find that

$$\frac{dS}{d\pi} = \frac{\rho\gamma(r+\theta)\left[u'[\gamma K_2^E] - u'[\gamma K_2^u]\right]}{\gamma^2 u''[\gamma K_1] + \rho\gamma^2(r+\theta)^2\left[(1-\pi)u''[\gamma K_2^E] + \pi u''[\gamma K_2]\right]}$$

As long as B<Y, an increase in the unemployment rate will reduce current consumption. This result arises for two reasons. The first is due to the fall in expected (labour) income as the unemployment rate increases. The second is due to the increased "uncertainty" resulting from an increase in the probability of unemployment (and of low income) in the second period, even when the expected value of income stays constant. This effect is similar to the one arising in recent theories of precautionary savings (e.g. Caballero, 1990 and Kimball, 1990).[6] These theories antedate the contributions of Leland (1968), Sandmo (1970) and Dreze and Modigliani (1972). Here we follow a different approach from these authors and demonstrate the existence of the "uncertainty" effect by constraining expected income to be constant when the unemployment rate changes. Consider then a hypothetical change in, for example, the unemployment benefit B so as to keep expected income (i.e. resources) in the second period (=(1-π)(Y+S(1+r)) + π(B+S(1+r)) constant and equal to A. This implies that $B+S(1+r)=[A-(1-\pi)(Y+S(1+r))]\pi^{-1}$ and the first-order-condition now takes the form

$$u'[\gamma K_1] = \rho(r+\theta)\left[(1-\pi)u'[\gamma K_2^E] + \pi u'[\gamma K_2^A]\right] \qquad (6)$$

where K_1 and K^E_2 are defined as previously and

$$K_2^A \equiv \bar{K}(1-\theta) + (1-\theta)(Y-S) + (A-(1-\pi)(Y+S(1+r)))\pi^{-1}.$$

From totally differentiating equation (6) we can find that

$$\frac{dS}{d\pi} = \frac{\rho(r+\theta)\left[u'[\gamma K_2^E] - u'[\gamma K_2^A] + \gamma(B-Y)u''[\gamma K_2^A]\right]}{\gamma u''[K_1] + \gamma\rho(r+\theta)\left[(r+\theta)(1-\pi)u''[\gamma K_2^E] + (\pi(r+\theta)-(1+r))u''[\gamma K_2^A]\right]} \qquad (7)$$

If u'''(.) >0, then both the numerator and the denominator of (7) are negative (if B<Y) and therefore an increase in the unemployment rate will increase savings even if the expected value of income stays constant. This is because when the third derivative of the utility function is positive, the rate at which marginal utility rises when consumption falls is greater when consumption is low than when it is high. An increase in the probability of low income (and consumption) in the second period will increase the expected marginal utility of second period consumption, because there will be more weight attached to the outcome in which the marginal utility of consumption is very high. Accordingly, an increase in uncertainty provides an incentive for increased saving since C_1 must fall in order for the marginal rate of substitution to remain equal to the unchanged ratio of relative prices. Note that in the case of certainty equivalence (which is the standard assumption in PI-RE models), there will be no change as a result of increased uncertainty as long as expected income remains unchanged. This is because when the utility function is quadratic ($u=aC-bC^2$) and the marginal utility function is linear, the marginal utility of expected consumption is equal to the expected marginal utility of consumption. In terms of expression (7), it can be easily verified that when $u=aC-bC^2$ and so u'''=0, the numerator is equal to zero (even if B<Y) and so changes in the unemployment rate will have no effect on consumption, if expected income stays constant. This finding is consistent with the measure of absolute prudence proposed by Kimball (1990) which states that the quantity -u'''[.]/u''[.] is the appropriate measure of absolute prudence when utility is additively separable. The higher is -u'''[.]/u''[.], the higher will be the strength of the precautionary saving motive and the increase in savings resulting from an increase in

uncertainty. In terms of measure of absolute risk aversion, a positive third derivative implies the existence of either constant or decreasing risk aversion, which is intuitively far more appealing than the hypothesis of increasing absolute risk aversion that results from a quadratic utility function.

There is, in fact, a model in which the "as if" theoretical construction of a constant expected income when the unemployment rate changes, is exactly what would be predicted. This is the infinite horizon PI-RE certainty equivalence model, and the reasoning is as follows. Since the unemployment rate is a variable without trend over the very long-term (see Layard, Nickell and Jackman, 1991), infinitely-lived consumers know that increases in the current unemployment rate, let us say, above its average level, would be compensated later with unemployment rates below the average level. Any resulting change in the discounted value of future labour income, then, will be very small, and accordingly, consumption and saving would change by a very small amount. However, if lifetimes are finite, the shortfall in expected income during the near future may well never be compensated by higher expected incomes in the distant future (e.g. some people may find themselves on the "wrong" end of a Kondratieff cycle). Finite lifetimes therefore provide a justification for the influence of the unemployment rate on consumption even if precautionary savings motives are precluded.

At this point it should be noted that even though we have assumed that the <u>aggregate</u> unemployment rate is used by an individual as a proxy for the probability that she will be unemployed next period, nothing hinges on the assumption of a "representative" agent. It is obvious that for some consumers (e.g. tenured academics) a rise in the economy-wide unemployment rate might not signify an increase in the perception of uncertainty regarding their future incomes. But for some other consumers (e.g. construction workers) an increase in the aggregate unemployment rate is a powerful signal of individual income uncertainty. To assume that some individuals perceive their employment prospects to be more adversely affected than others as a result of an increase in the unemployment rate would actually strengthen our case. Changes in aggregate uncertainty will in fact have a bigger impact on aggregate consumption, if the uncertainty induced by unemployment falls more heavily on some individuals than others. This is a result of the fact that risk averse individuals would be prepared to increase their insurance premiums (i.e. savings) more than proportionally to a mean preserving increase in the size of income fluctuations. Consequently, if income fluctuations fall more heavily on some individuals, the aggregate effect on savings will be larger.

The arguments put forward in this section suggest that in addition to the unemployment rate, income and the interest rate will also be important determinants of durable goods consumption. However, it can be easily shown that had we not imposed the constraint that $\alpha=0$ in equation (1), then the relative price of motor-vehicles should also appear as a determinant of expenditure on motor-vehicles in our estimating equation. Having done so, in our empirical analysis, we found that relative prices were not statistically significant in either the "long-run" or "short-run" equations, and for this reason we abstain from any further discussion of this issue in the rest of the paper.

3. *Econometric Method and Results*

In this section, we establish that the unemployment rate is an important determinant of motor-vehicle consumption in the United States over the period 1959(1) through 1992(2). As a starting point for the analysis, we apply the Johansen (1988, 1991) maximum likelihood procedure for estimating cointegrating relationships. Based on the theoretical discussion in Section 2, the information set we use includes per-capita motor vehicle consumption C^m, per-capita personal disposable income Y, the real (after-tax) interest rate rr and the unemployment rate ur.[7] (See the Data Appendix for more details.)

The cointegration analysis is performed using a vector error correction model (VECM), e.g.

$$\Delta Z_t = \sum_{i=1}^{k-1} \Phi_i \Delta Z_{t-i} + \Omega Z_{t-k} + \varepsilon_t \qquad (8)$$

where, Φ_i=-I+H_1+...+H_i, Ω=-(I-H_1 -...- H_k), I is a nxn unit matrix and H is an nxn matrix of parameters with n being the number of variables.

In order to test for the existence of zero or more cointegrating vectors, the Johansen procedure concentrates on the rank (r) of the nxn matrix Ω. If r<n, then Johansen has shown that there exists a representation of Ω such that $\Omega=\alpha\beta'$, where α and β are both nxr matrices. The α matrix is comprised of factor loadings or adjustment coefficients, whereas the β matrix contains the cointegrating vector(s).

The results of the rank tests are reported Table 1 and indicate that the variables in our information set constitute a unique cointegrating vector. If we normalize this vector on consumption of motor vechicles, for the information set {lnC^m, lnY, rr, ur}, we obtain {-1, 1.44, -1.55, -2.25}. Successive tests of the restriction that each element in the cointegrating vector, with the exception of lnC^m, is equal to zero is rejected at the one percent level. The chi-square test statistics with one degree of freedom are

[48.4, 6.5, 8.5]. The lag order for the model used in the above testing and estimation was determined by application of a likelihood ratio test for successively restricting the VECM starting with six lags (see Table 2).

Table 1: Johansen Tests for the Number of Cointegrating Vectors, 1959(3)-1992(2)[a]

Information Set: {lnC^{nn}, lnY, rr, ur}			Eigenvalues: 0.408, 0.127, 0.031, 0.027		
Null	Alt	Eigenvalue	5% Level	Trace	5% Level
r=0	r=1	69.17	27.14	94.96	48.28
r≤1	r=2	17.88	21.07	25.79	31.53
r≤2	r=3	4.21	14.90	7.91	17.95
r≤3	r=4	3.71	8.18	3.71	8.18

[a] The results in Table 1 are based on a VECM of lag length equal to 1 quarter assuming trending variables, without trend in the DGP. However it should be noted that these results are robust to changes in the VECM order and to changes in the assumption regarding trend in the DGP. All of our calculations in Tables 1-5 were carried out in Microfit 3.0 and Gauss 3.01. The critical values for the test statistics can be found in Osterwald-Lenum, 1990.

Table 2: Tests of the VECM order[a]

General Model	Restricted Model	Likelihood Ratio
6	5	$\chi^2(16)$=12.21
5	4	$\chi^2(16)$=10.60
4	3	$\chi^2(16)$= 8.07
3	2	$\chi^2(16)$=18.65
2	1	$\chi^2(16)$=23.56

[a] The 5% critical value for $\chi^2(16)$ is 26.3.

In the next part of our analysis we explore whether it is valid to proceed by estimating a single dynamic equation for consumption by examining the factor loadings in all four equations of the system (see Table 3). Johansen (1989) and Hendry and Mizon (1990) argue that all equations in which the cointegrating vector enters significantly are important for inference regarding the long-run parameters. Examination of Table 3 shows that the error correction term is only significant in the consumption equation, implying that income, the interest rate and the unemployment rate are weakly exogenous. In other words, the long-run relationship is maintained only through adjustments or corrections to consumption. This implies that we will not be losing information by modelling the dynamic consumption equation in isolation.

Table 3: Error Correction Representations Based on the Cointegrating Vector Formed From the Johansen Estimation (i.e. EC = lnC^{m} - 1.44lnY + 1.55rr + 2.25ur)[a]

coefficient	Dependent Variable			
	ΔlnC^{m}	ΔlnY	Δrr	Δur
constant	-2.44* (0.58)	0.05 (0.08)	-0.04 (0.08)	-0.01 (0.03)
ΔlnC^{m}(-1)	-0.21** (0.09)	0.02 (0.14)	0.02 (0.01)	-0.003 (0.004)
ΔlnY(-1)	1.12*** (0.63)	-0.02 (0.10)	-0.03 (0.09)	-0.07** (0.029)
Δrr(-1)	-1.25*** (0.65)	0.04 (0.10)	0.04 (0.10)	0.03 (0.03)
Δur(-1)	-6.5* (2.0)	-0.11 (0.31)	-0.36 (0.29)	0.54* (0.09)
EC(-1)	-0.35* (0.08)	0.01 (0.01)	-0.01 (0.01)	-0.002 (0.003)

[a] Standard errors are in parentheses. In tables 3-5 *, ** and *** indicates significance at the 1, 5 and 10 percent levels respectively.

Before proceeding to the estimation of the dynamic consumption equation we examine several single equation estimators for the long-run cointegrating vector. These alternatives are explored in order to test the robustness of the Johansen estimates which can be sensitive to misspecification in any of the equations in the system (see Campbell and Perron, 1991). All of these estimators include either non-parametric or parametric corrections for serial correlation and endogeneity of the regressors (see, Phillips and Hansen, 1990, Stock and Watson, 1989, and Phillips and Loretan, 1991). In addition, ordinary least squares (OLS) estimates are reported in Table 4 (see Engle and Granger

(1987)) despite the well known problems of inefficiency and, for finite samples, inconsistency (see Banerjee *et al.* 1986).

The way in which we implement each estimator (including OLS) can be explained by reference to equation (9)

$$\begin{aligned} lnC_t^m &= \alpha + \beta_1 lnY_t + \beta_2 rr_t + \beta_3 ur_t + \Gamma_1(L)\Delta lnY_t + \Gamma_1^*(L^{-1})\Delta lnY_t + \\ &\Gamma_2(L)\Delta rr_t + \Gamma_2^*(L^{-1})\Delta rr_t + \Gamma_3(L)\Delta ur_t + \Gamma_3^*(L^{-1})\Delta ur_t + \\ &E(L)\left[lnC_t^m - (\alpha + \beta_1 lnY_t + \beta_2 rr_t + \beta_3 ur_t)\right] + \nu_t \end{aligned} \tag{9}$$

where, the lag polynomials are defined as $\Gamma_i(L)=\Sigma\gamma_{ik}L^k$, $\Gamma_i^*(L^{-1})=\Sigma\gamma_{ik}L^{-k}$ and $E(L)=\Sigma\varepsilon_k L^k$.[8] The first step of the Engle and Granger (1987) method, for example, is simply an OLS estimation of equation (9) under the restriction that $\Gamma_i(L)=\Gamma_i^*(L)=E_i(L)=0$. The Phillips and Hansen (1990) estimator imposes the same set of restrictions, however two non-parametric corrections are made to account for serial correlation of the residuals and endogeneity of the conditioning variables. The remaining procedures, on the other hand, employ parametric corrections. The Stock and Watson (1989) procedure, for example, is implemented by generalized least squares (GLS) estimation of equation (9) under the restriction that $E_i(L)=0$. Finally, the Phillips and Loretan (1991) method is carried out by unrestricted non-linear least squares (NLS) estimation of (9).

Table 4 indicates that lnY, rr and ur all enter the motor vehicle equation significantly and with the expected sign regardless of the estimator employed. In addition, the coefficients looks reasonably robust across all estimators and are quite close to the Johansen estimates. The coefficient on lnY is the most robust followed by the coefficients on ur and rr. In response to a one-percent increase in income, Table 4 and the

Johansen estimates reveal that C^m increases by (1.4 to 1.5) percent, whereas a one percentage-point increase in the unemployment rate and the interest rate leads to a fall in C^m by (-2.03 to -2.58) and (-1.55 to -2.40) percent respectively.

Table 4: ***Long-Run Elasticities of Consumption of Motor-Vehicles***

$\ln C^m = f[$	OLS	Stock-Watson	Phillips-Hansen[a]	Phillips-Loretan
c,	-7.41* (0.384)	-7.24* (0.556)	-7.13* (0.474)	-2.60* (0.064)
lnY,	1.50* (0.043)	1.48* (0.063)	1.47* (0.053)	1.45* (0.078)
rr,	-2.40* (0.368)	-2.01* (0.476)	-2.20* (0.454)	-1.60* (0.470)
ur]	-2.56* (0.514)	-2.58* (0.753)	-2.03* (0.635)	-2.53* (0.892)

[a] The Phillips-Hansen estimates are based on smoothing weights of lag length (L) equal to 4 quarters. It should be noted that these results are robust to changes in L from 1 through 8 quarters.

Given the reasonably good finite sample properties of long-run relationships estimated with the Johansen method (see Gonzalo, 1989) we proceed with the estimation of the short-run equation using the error correction mechanism implied by the Johansen estimates. However, it should be noted that both the estimates and diagnostics pertaining to the short-run equation (reported in Table 5) are robust to using the different error correction mechanisms implied by each estimator reported in Table 4.

The initial short-run equation for the growth in motor vehicle consumption included a constant, the error correction term and contemporaneous and lagged information for $\Delta \ln Y$, Δrr and Δur as conditioning variables. Eliminating insignificant lagged and contemporaneous regressors led to the specification reported in Table 5. These results reveal that in the short-run the change in the unemployment rate and the "disequilibrium error" are highly significant and have the expected signs. In response to a one-percentage point increase in the unemployment rate, the growth in consumption of motor vehicles decreases by approximately eleven and a half percentage-points. On the other hand, a one percent error in predicting motor vehicle consumption last period leads to a reduction in the current growth rate of consumption of approximately 0.4 percentage-points.

Table 5: Dynamic Consumption of Motor-Vehicles

$\Delta lnC^m = f[$	c	$\Delta lnC^m(-1)$	Δur	EC(-1)]
coefficient	-2.71*	-0.22*	-11.58*	-0.39*
standard error	(0.449)	(0.075)	(1.41)	(0.065)
Adjusted R^2	0.41			
Standard Error of the Regression	0.05			
Standard Deviation of ΔlnC^m	0.07			
Maximum Value of ΔlnC^m	0.24			
Minimum Value of ΔlnC^m	-0.23			
$F_{AR1-1}(1,126)$	1.26			
$F_{AR1-4}(4,123)$	1.08			
$\chi^2_{Normality}(2)$	3.12			
$F_{ARCH1-1}(1,126)$	0.24			
$F_{ARCH1-4}(4,123)$	1.78			
$F_{RESET}(1,126)$	0.68			
$F_{PREDICTIVE\ FAILURE,\ CHOW}(77,50)$	1.29			
$F_{PREDICTIVE\ FAILURE,\ CHOW}(53,74)$	1.40			
$F_{CHOW}(4,123)$	0.14			

Table 5 also reports summary diagnostic information which shows that the equations are performing satisfactorily with respect to the residual based diagnostics pertaining to first and fourth order serial correlation, normality of the errors, heteroscedasticity and functional form. In addition, the results of the Chow-tests indicate that the dynamic equation is quite stable. The break points for the Chow tests have been chosen to coincide with the two oil shocks in the 1970s.

4. *Discussion and Conclusions*

Our time-series results indicate that the unemployment rate has a significant influence on consumption spending on motor-vehicles even after the effects of income and interest rates have been taken into account. Such a finding provides evidence against the infinite horizon-perfect capital markets-PI-RE hypothesis, and should be contrasted with the findings of Bernanke (1984). His panel data results indicate that the response of automobile expenditures to transitory income changes was consistent with what would be predicted by the PI-RE model. Given that Bernanke's results were also different from previous time-series studies on durable goods expenditure (e.g. Mankiw, 1982), we will not try to "explain" the difference in results, but we will draw some implications of our findings for some recent theories of consumption expenditure.

For obvious reasons, the hypothesis that individuals choose consumption on the basis of intertemporal considerations has both theoretical and intuitive appeal. Our result that the unemployment rate is an important determinant of spending on durables should not be interpreted as evidence against this basic hypothesis. This result is only at variance with the extreme version of the theory which presupposes infinite lifetimes, unlimited access to borrowing and lending opportunities, and the absence of precautionary saving motives. The effects on the optimum consumption path when the last two assumptions are not satisfied have been the subject of many investigations during the previous decade. Flavin (1985), for example, suggested that the empirical failure of the extreme version of the model of intertemporal utility maximisation was not due to myopic (i.e. Keynesian type) behaviour, but to the presence of liquidity constraints which she approximated with the use of the unemployment rate. Although our findings cannot reject such an interpretation for the role of the unemployment rate, the present paper has argued that the unemployment rate can also be used as a predictor of changes in permanent income and/or as a measure of uncertainty regarding the realisations of future labour income. We have tied the latter role for the unemployment rate to recent theories of precautionary saving. In this sense, our finding that in the "short-run" a one percentage-point increase in the unemployment rate results in more than a ten percentage-point fall in the growth of motor-vehicle spending gives some empirical evidence for the possible strength of the precautionary saving motive which has been lacking so far.[9]

From a policy perspective, the existence of a large precautionary saving motive implies that as far as certain policies are concerned, the response of consumers to changes in income may be close to what is suggested by the Keynesian consumption function. This is in stark contrast to the certainty-equivalence PI model which predicts that cuts in current taxes, which must later increase beyond the "normal level" in order to service the accumulated debt, will be expected to have no influence on consumption. In a recent paper, Barsky, Mankiw, and Zeldes (1986) noted that, if there is a precautionary saving motive, and if taxes are progressive, then a substitution of lower current taxes for higher taxes later will reduce the uncertainty of future income and hence the need for precautionary savings. In other words, current tax cuts will lead to increased current consumption.

In view of the large influence of the unemployment rate on spending on motor-vehicles (and one suspects, on other sub-aggregates of consumption expenditure as well) in the "short-run" (or over the business cycle) and its policy implications, further investigations may prove worthwhile in order to distinguish between the liquidity constrained and precautionary saving hypotheses. Our model suggests that such a test can be based on cross-country differences in the ratio of income when unemployed to income when employed, since only if income when employed is greater than income when unemployed (B<Y), will the unemployment rate have any independent influence on consumption under the precautionary saving motive.

5. *Footnotes*

1. Although some attempts have been made to measure changes in income uncertainty, problems arise either because of the typical short time-series on individuals in panel data (see, Hall and Mishkin, 1982) or because uncertainty has been measured as the standard deviation of n-period ahead forecasts of GNP (see, Blanchard and Mankiw, 1988), which must surely be beyond the computational ability of most consumers.

2. Kirman (1992) provides a comprehensive critique of both theoretical and empirical work which assumes the existence of a representative agent. The present section borrows heavily from his work.

3. In other words, it is possible if two agents are faced with situations A and B with corresponding incomes and prices (Y_A, P_A) and (Y_B, P_B), that the aggregate representative individual prefers situation A to B, even though both individuals prefer situation B to A. Kirman (1992) provides a diagrammatic explanation of such a case.

4. Lawrence Summers (1991) provides a convincing discussion of the problems arising in the testing of representative agent models.

5. Despite the recent absence of the unemployment rate from consumption equations, unemployment was found to be a significant variable in explaining expenditure on both durables and non-durables, in many studies that were done in the 1960s and 1970s. Hadjimatheou (1987) provides a comprehensive review of these and later studies which have used either unemployment or the unemployment rate as a source of uncertainty or as a proxy for liquidity constraints.

6. Keynes (1936) included the precautionary saving motive ("to build up a reserve against unforseen contingencies...") as one of the motives which lead individuals to refrain from spending out of their incomes. But he does not seem to have related the precautionary saving motive to the unemployment rate, because in the following chapter he states "...The marginal propensity to consume is not constant for all levels of employment, and it is probable that there will be, as a rule, a tendency for it to diminish as employment increases...".

7. Despite the difficulties in distinguishing a stochastic trend variable from a stationary variable with a deterministic trend in finite samples (see e.g. Christiano and Eichenbaum, 1989 and Cochrane, 1991) and despite the fact that the degree of integratedness can change over time (see e.g. Hendry and Mizon, 1990); standard augmented Dickey-Fuller (1979) and Phillips-Perron (1988) univariate unit root tests indicated that of our data is I(1). For the interested reader these results will be provided on request.

8. In all of the lag polynomials k theoretically runs from 1 to infinity; however, in practice, insignificant lags are eliminated from the regression.

9. Efforts to measure the precautionary saving motive have so far involved only numerical simulations (see, for example, Skinner, 1988 and Zeldes, 1989).

Data Appendix

Name	Symbol	Source
1. Motor-vehicle consumption (per-capita), 1987$	C^m	NIPA, Table 2.03
2. Disposable personal income (per-capita), 1987$	Y	NIPA, Table 2.01
3. Population (mid-period)	POP	NIPA, Table 2.01
4. Discount rate, new 91-day Treasury bills (pct)	R	BCI
5. Implicit price of motor-vehicles	P^m	NIPA,Tables 2.01 & 2.03
6. Implicit consumption deflator	P	NIPA, Table 7.1
7. Civilian unemployment rate (pct)	ur	BCI
8. Real (after-tax) interest rate [R(1-0.30) - %ΔP)	rr	transformation

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