

DOES SENTIMENT EXPLAIN CONSUMPTION*?

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Abstract

Carroll, Fuhrer and Wilcox (1994) studied the capacity of consumer sentiment to help explain the behaviour of consumption in the US. Their study was important for at least two reasons. Firstly, since household consumption accounts for about two thirds of US GDP, fluctuations in consumption may result in significant changes in the state of the macroeconomy. It is therefore important to develop models to explain and forecast consumption. In this regard Carroll, Fuhrer and Wilcox (1994) drew attention to the often-neglected variable ‘consumer sentiment’ and its potential role in explaining variations in consumption expenditure. Secondly, their finding that sentiment does indeed have explanatory power for consumption in the US has implications for theories of aggregate consumption, because at least one way of accounting for these findings involves some violation of the simplest certainty equivalence versions of the life-cycle and permanent-income theories.

The results of Carroll, Fuhrer and Wilcox (1994) raise important theoretical and empirical issues that deserve careful study. Our contribution to such study is twofold. Firstly, we develop a model that suggests theoretical reasons why consumer sentiment may influence consumption expenditure. Secondly, we consider empirically the question of an independent influence running from sentiment to consumption in the context of Australia using a carefully specified consumption function as the ‘test-bed’ for the analysis. We are motivated to do this because although the Carroll, Fuhrer and Wilcox (1994) analysis is stimulating, it is based on a relatively *ad hoc* specification of the aggregate consumption function, a specification that arguably suffers from omitted variable bias, something which may seriously weaken their findings. In this paper we find that consumer sentiment does have small independent explanatory power as far as aggregate consumption is concerned even when ‘standard’ macroeconomic variables are allowed to play their full role.

JEL Classification: C51, D24.

[§]This research was supported by MURG 20523147 and we are very grateful for that support. We would also like to thank Don Harding and Elizabeth Webster at the Institute of Applied Economic and Social Research within the University of Melbourne for helpful comments at the outset of our research and Michael Grady and Lynne Stoddart for research assistance during the

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1. Introduction

Consumption expenditure accounts for about two thirds of U.S. GDP and a similar proportion in other developed economies. It follows that fluctuations in consumption may result in significant changes in the state of the macroeconomy, particularly as far as productive activity and employment are concerned. It is therefore important to develop models that explain and forecast consumption, so that policy makers may be prepared to take the appropriate action in the event of likely sharp swings in consumption.

In an important study, Carroll, Fuhrer and Wilcox (1994) studied the capacity of an index of consumer sentiment to help explain the behaviour of various categories of consumption in the US. Their study was important for at least two reasons. Firstly, Carroll, Fuhrer and Wilcox (1994) drew attention to the often-neglected variable ‘consumer sentiment’ and its potential role in explaining variations in consumption expenditure. On the face of it, consumer sentiment would seem to be an ‘obvious’ variable to include in any model of consumption. Certainly financial markets, and possibly even policy makers, regard indexes of consumer sentiment as being worthy of monitoring. For instance, Alan Greenspan recently told a gathering of Wall Street investors on May 24 2001, that consumer sentiment was ‘fragile’ and that this may have implications for activity levels in the US in the future. He added however that it was sometimes hard to track the relationship between US economic activity and the various indexes of consumer sentiment¹. In similar vein, Carroll, Fuhrer and Wilcox (1994) argue

¹ Reported at web site: <http://au.us.biz.yahoo.com/smart/010525/20010525105331breanews.html>.

that the inclusion of an index of consumer sentiment in a consumption function is only justified if it can be shown: (i) that there are theoretical reasons to believe that ‘sentiment’ may influence consumption behaviour, and (ii) that sentiment has empirical explanatory power over and above the explanatory power of the standard macroeconomic variables traditionally suggested by economic theory and regularly incorporated into empirical models of consumption. Secondly, using a relatively *ad hoc* specification of the aggregate consumption function, Carroll, Fuhrer and Wilcox (1994) explore the extent to which consumer sentiment influences consumption expenditures in the US. The authors find that variations in consumer sentiment do seem to be useful in explaining and forecasting fluctuations in various categories of consumption expenditure. This finding that sentiment seems to have empirical explanatory power as far as aggregate consumption is concerned, has implications for theories of consumption. This is so because at least one way of accounting for these findings: “... involve[s] some violation of the simplest certainty equivalence versions of the life-cycle and permanent-income theories; otherwise ... sentiment would have no predictive power for future changes in spending.” Carroll, Fuhrer and Wilcox (1994; p. 1398)².

The empirical results presented by Carroll, Fuhrer and Wilcox (1994) and similar studies³, along with the implications for consumption theories that these results contain,

² In light of their findings the authors examine the capacity of one particular model, the Campbell-Mankiw model, to rationalise their results. They find that the Campbell-Mankiw model is unable to make sense of their findings, something that they believe is also true of other leading models of consumption. In particular they argue: “... we believe that at least the simplest versions of other models may also have some difficulty explaining our results.” Carroll, Fuhrer and Wilcox (1994; p. 1407).

³ Other studies which also address this question in the context of the US economy include Mishkin (1978), Throop (1992), Matsusaka and Sbordone (1995), Bram and Ludvigson (1998). In the context of the UK economy the question has been studied by Acemoglu and Scott (1994) for Hong Kong by Fan and Wong

raise important issues that deserve careful theoretical and empirical study. Our contribution to such a study is twofold. Firstly, we establish that it is possible to establish theoretical reasons why there might be an influence running from consumer sentiment to consumption expenditure. We do this by extending a model of consumer decision-making suggested by Benassy (1986). Secondly, we reconsider the empirical question raised by Carroll, Fuhrer and Wilcox (1994) of whether there is an independent influence running from sentiment to consumption in fact, *once a carefully specified consumption function is developed and used as the ‘test-bed’ for the analysis*. We are motivated to do this because although the Carroll, Fuhrer and Wilcox (1994) analysis is stimulating, it is based on a relatively *ad hoc* specification of the aggregate consumption function, a specification that arguably suffers from omitted variable bias, something which, in the limit, may invalidate their findings.

In this paper a carefully specified model of aggregate consumption in Australia is used as the baseline against which consumer sentiment is tested for independent explanatory power. We are motivated to undertake this study for Australia because apart from the unpublished study by Ha (1995), there appears to be no systematic study of the question posed by Carroll, Fuhrer and Wilcox (1994) as far as the Australian economy is concerned⁴.

(1998), for Canada by Angevine (1974), for Germany by Heilemann and Wenke (1993) and for South Africa by Stuart (1989).

⁴ The author describes her study as being essentially a replication of Carroll, Fuhrer and Wilcox (1994) when she writes: “I shall adopt a combination of techniques from Acemoglu and Scott (1994) and Carroll, Fuhrer and Wilcox (1994) and apply them to Australian data.” Ha (1995; p. 3). In particular Ha (1995) uses essentially the same *ad hoc* specification of the consumption function as that used by Carroll, Fuhrer and Wilcox (1994) and is therefore subject to the same potential weakness as that study. While it is true that the financial press in Australia from time to time carries articles which speculate on the likely direction of

In order to achieve our objectives the paper is organised as follows: Section 2 presents some preliminary data on the covariation of sentiment and consumption expenditure. It also provides some theoretical reasons why consumer sentiment and consumption expenditure may be connected. Section 3 discusses our empirical methodology and presents major empirical results. Section 4 presents some brief conclusions and suggestions for future research.

2. Some preliminary evidence and theory on sentiment and consumption

Reliable data on consumer sentiment is available in Australia from 1974 to the present. Our study therefore explores the relationship between consumer sentiment and aggregate consumption in Australia over the past twenty-five years. This is an interesting period of Australian economic history, covering as it does episodes of significant structural change and institutional reform along with large changes in inflation rates and unemployment. It is also a period during which both consumer sentiment (as measured by the Westpac-Melbourne Institute index of consumer sentiment) and aggregate real consumption expenditures have displayed considerable variation and apparent close correlation, as illustrated in Figure 1. This is similar to the situation observed by Carroll, Fuhrer and Wilcox (1994; p. 1398) for the US and suggests that a detailed exploration of a possible connection between consumption and sentiment in Australia might be as useful as those authors found it to be in the case of the US.

consumption expenditure given the apparent state of consumer sentiment, such analyses, while useful, are no substitute for a careful and systematic study of the possible connection between consumer sentiment and consumption expenditure.

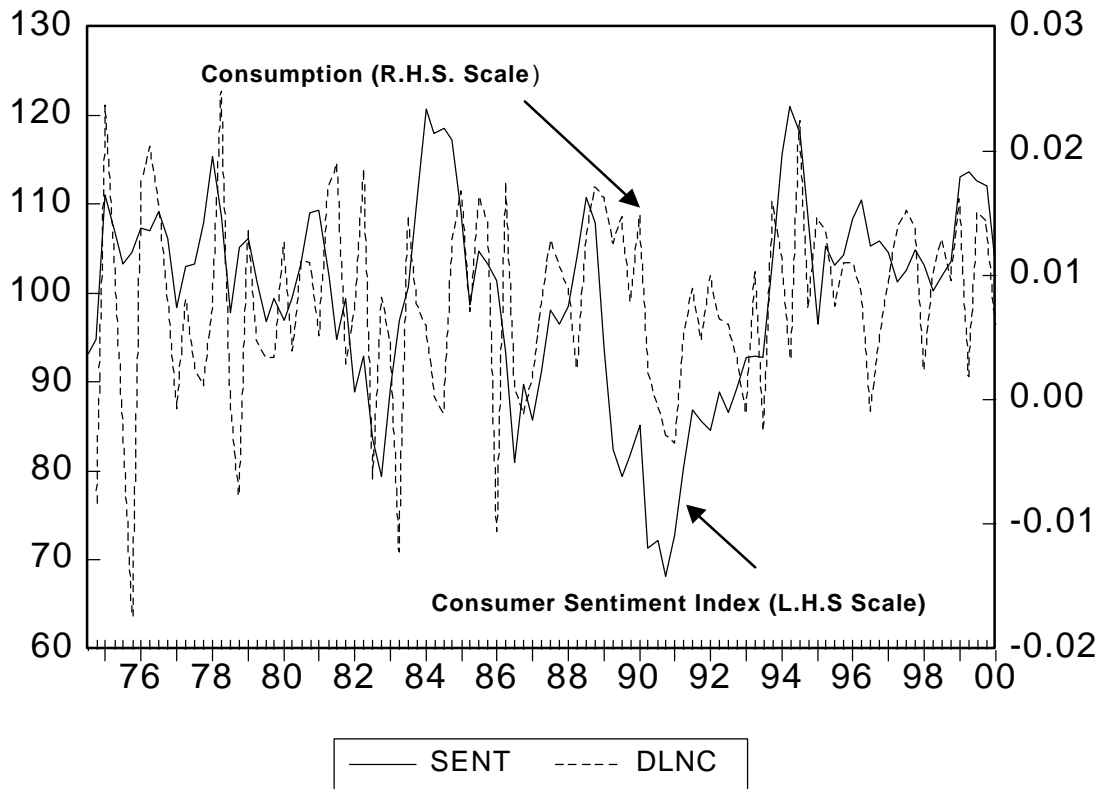


Figure 1: Consumer Sentiment Index and Percentage Changes in Aggregate Consumption

2.1 Sentiment and consumption in theory

In light of the apparent correlation between sentiment and consumption it is reasonable to ask if there are theoretical reasons why sentiment and consumption expenditure should be related. It is important to do this so that we can have some confidence that the picture presented in Figure 1. is not a mere artifact of the data.

One theoretical argument for a connection between sentiment and consumption may be found in the following extension of the macroeconomic model developed by Benassy (1986, pp. 27-29). Consider a consumer who lives for two periods, the ‘present’

and the ‘future’. Let variables reflecting the future have a superscript ‘e’ and let the unmarked case correspond to the current period. The consumer is endowed with quantities of labour l_0 and l_0^e and has a utility function over present and future consumption of the form:

$$U(c, c^e) = \alpha \log c + (1 - \alpha) \log c^e \quad (1)$$

Let p^e and w^e be expected price of goods and expected money wages and let \underline{c}^e and \underline{l}^e be any quantity constraints which the consumer expects to encounter on the goods and labour markets in the future. Let δ^e be the expected profit distribution in the future. Assume that the consumer has consumed c in the present period and has saved an amount of money m . The optimal plan for future consumption is that plan which maximises utility subject to the price, wage and quantity constraints expected to be encountered in the future. The form of the utility function in (1) implies no disutility from labour. Therefore optimal consumption in the second period is the highest that can be attained while taking into account future constraints.

Thus, c^e is the solution to the following constrained optimisation problem:

$$\begin{aligned} & \text{Max}_{c^e} \alpha \log c + (1 - \alpha) \log c^e \\ & \text{s.t. } p^e c^e \leq w^e l^e + \delta^e + m, l^e \leq l_0^e, l^e \leq \underline{l}^e, c^e \leq \underline{c}^e \end{aligned} \quad (2)$$

Solving this problem yields the following expression for future planned consumption

$$c^e = \text{Min}\{ \underline{c}^e, [m + \delta^e + w^e \min(l^e_0, \underline{l}^e)]/p^e \} \quad (3)$$

Substituting (3) into (1) yields the corresponding indirect utility function for this consumer

$$\alpha \log c + (1 - \alpha) \log (\text{Min}\{ \underline{c}^e, [m + \delta^e + w^e \min(l^e_0, \underline{l}^e)]/p^e \}) \quad (4)$$

Let y^e denote expected future income and noting that $p^e y^e = \delta^e + w^e \min(l^e_0, \underline{l}^e)$, the indirect utility function in (4) can be written as:

$$\alpha \log c + (1 - \alpha) \log (\text{Min}\{ \underline{c}^e, [m/p^e + y^e] \}) \quad (5)$$

Current consumption demands are obtained by maximising (5) subject to the budget constraint: $pc + m = py + \underline{m}$ and $m \geq 0$, where \underline{m} is the money endowment of the consumer at the beginning of the present period. On the assumption that the consumer does not expect to be constrained in the goods market (a reasonable assumption in most Western economies) and that the $m \geq 0$ constraint is not binding, current consumption is given by:

$$c^* = \alpha (\underline{m}/p + y + p^e y^e / p) \quad (6)$$

We now extend Benassy's model by incorporating consumer sentiment. To do this we suppose that consumer sentiment will improve if people believe that their economic circumstances, as represented by real income, is likely to rise in the future. This seems like a reasonable assumption considering the questions asked in the survey, which fixes the value of the consumer sentiment index in Australia, the US and other countries⁵. We formalise this idea as:

Assumption (S): Let s denote consumer sentiment in the current period. It is assumed that s is a monotonically increasing function of expected future income y^e so that $s = f(y^e)$ and $f'/f > 0$.

Theorem. *If, (i) consumers make consumption decisions on the basis of (1) – (6); (ii) assumption S holds; (iii) $\alpha > 0$, $p^e/p > 0$; and (iv) consumers don't expect to be constrained in the goods market, then current consumption is a positive function of consumer sentiment. Further, under the same conditions, planned future consumption is an increasing function of current sentiment and if consumption plans are actually carried out, current consumption will be a function of lagged sentiment.*

⁵ The questions on which the Westpac-IAESR Index of Consumer Sentiment are based are: 1. We are interested in how people are getting along financially these days. Would you say that you (and your family living there are better or worse off financially than a year ago? 2. Now looking ahead - do you think that you (and your family living there) will be better off financially or worse off, or just about the same as now? 3. Now turning to business conditions in the country as a whole - do you think that the next 12 months will have good times financially or bad times or what? 4. Looking ahead, which would you say is more likely - that the country as a whole will have continuous good times during the next five years or so, or that we will have periods of widespread unemployment or depression, or what? 5. About the big things that people buy for their homes - such as furniture, a refrigerator, stove, television and things like that. Generally speaking, do you think now is a good or bad time for people to buy major household items? See Throop (1992; p. 36).

Proof: (i) From equation (6), $\partial c^*/\partial y^e = \alpha p^e/p$.

Now $\partial c^*/\partial s = \partial c^*/\partial y^e \cdot \partial y^e/\partial s = (\alpha p^e/p) \cdot (1/f'(y^e))$

Since $\alpha > 0$ and $p^e/p > 0$ then Assumption S guarantees that $\partial c^*/\partial s > 0$.

(ii) From (3), $c^e = \min\{\underline{c}^e, y^e\}$.

Since \underline{c}^e is not binding, $\partial c^e/\partial s = \partial c^e/\partial y^e \cdot \partial y^e/\partial s = 1 \cdot (1/f'(y^e)) > 0$.

Remark. The condition that $\alpha > 0$ means that consumption has positive marginal utility (i.e. preferences are non-satiated). The condition that $p^e/p > 0$ means that consumption goods are not expected to be free in the future. Both of these conditions seem to be reasonable. The theorem therefore provides a reasonable theoretical rationalisation of a connection between consumer sentiment and consumption expenditure decisions. We now propose to see whether such a connection is empirically in Australia for the period 1974:Q3 to 2000:Q1.

3. Empirical methodology and results

In an attempt to discover whether variations in consumer sentiment can be used to explain and forecast changes in consumption in Australia we take essentially the same approach as Carroll, Fuhrer and Wilcox (1994) with one important difference, namely, we

pay particular attention to obtaining an appropriate ‘baseline’ consumption function against which the contribution of sentiment to explaining consumption is measured⁶.

Carroll, Fuhrer and Wilcox (1994, p.1399) begin by observing that a simple way to tell whether an index of consumer sentiment alone has any forecast ability “... is to examine the adjusted R²'s from regressions of the growth of various measures of household spending on lagged values of the [index of consumer sentiment].” To implement this methodology let $C_t \equiv$ aggregate real household consumption expenditure at t and $S_{t-i} \equiv$ the value of the sentiment index in period $t-i$. Then estimate the equation:

$$\Delta \log (C_t) = \alpha_0 + \sum_i \beta_i S_{t-i} + \varepsilon_t \quad (7)$$

The results of a similar estimation for Australia are in presented in Table 1. The results in Table 1 indicate that contemporaneous and four lagged values of the sentiment index account for about 2.9% of the one-quarter-ahead variation in the growth of total real household consumption expenditure over the whole sample period. An examination of the data however reveals some very aberrant changes in consumption in the late 1980's and early 1990's, something noticed also by Carroll, Fuhrer and Wilcox (1994) for the US. If the sample is split at about that time, then over the period 1975:3-1990:4 the contemporaneous and four lagged values of the sentiment account for 0.08 per cent of the one-quarter-ahead variation in the growth of total real household consumption

⁶ This step is crucial in any study which attempts to assess the explanatory and forecast capacity of an index of consumer sentiment because if the baseline consumption function is misspecified then the result of any variable addition test, such as that presented by Carroll, Fuhrer and Wilcox (1994), may generate spurious results.

expenditure and over the period 1991:2-2001:1, 12 percent of the one-quarter-ahead variation in the growth of total real household consumption expenditure. These results are comparable with those reported by Carroll, Fuhrer and Wilcox (1994; p. 1400 Table 1). For their whole sample period 1955:1-1992:3 report adjusted-R² for an estimate of equation (7) of 0.14 and for the sub-period 1978:1-1992:3 and adjusted-R² drops to 0.05.

TABLE 1. Reduced form evidence: $R(\bar{})^2$'s from simple prediction equations of the form: $D\log(C_t) = a_0 + \hat{a}_0^4 b_i S_{t-i} + \hat{a}_0^4 g_i DS_{t-i} e_t$

Dependent Variable		$\Delta\log(C_t)$				
α_0	-0.0138	-0.00760	0.00783	0.00770	-0.0138	-0.007
S_t	0.00005					
S_{t-1}	0.00008					
S_{t-2}	0.00004	0.00014				
S_{t-3}	-0.00012	0.00001				
S_{t-4}	0.00015					
ΔS_t			-0.00543		0.00006	
ΔS_{t-1}			0.00174	0.00325	0.00014	
ΔS_{t-2}			0.01308	0.00819	0.00004	0.0001
ΔS_{t-3}			-0.00274		-0.00012	0.0001
ΔS_{t-4}			-0.00274		-0.00016	
Sample period 1975:3 - 2000:1						
adj-R²	0.029	0.033	-0.019	-0.019	0.029	0.033
Sample period 1975:3 – 1990:4						
adj-R²	0.0008					
Sample period 1991:2 - 2000:1						
Adj-R²	0.12					

Our results for the overall period while not as strong as those of Carroll, Fuhrer and Wilcox (1994) for their whole sample, are much better for the sub-periods than those reported by them, and suggest that further examination of the relationship between sentiment and consumption is worthwhile.

In order to do this we follow Carroll, Fuhrer and Wilcox (1994) who note that while it is an interesting to know how much variation in consumption can be explained by variations in sentiment alone, a more interesting question to ask is: “... whether the sentiment index has any predictive ability *once one controls for information contained in other variables* available to economic forecasters.” Carroll, Fuhrer and Wilcox (1994; p. 1400, emphasis added). Answering this question provides the major empirical results of their study and is achieved by estimating the equation:

$$\Delta \log (C_t) = \alpha_0 + \sum_i \beta_i S_{t-i} + \gamma Z_{t-1} + \varepsilon_t \quad (8)$$

In equation (8), C_t and S_{t-i} are as before and Z_t is a vector of ‘other variables’ which would make (8) a ‘properly specified’ aggregate consumption function. Commenting on what these ‘other variable’ might be and the procedure behind their selection, Carroll, Fuhrer and Wilcox (1994) somewhat casually remark that: “[o]f course, the choice of

which other variables to include in the equation is inherently arbitrary.” Carroll, Fuhrer and Wilcox (1994; p. 1400, emphasis added). In the event, Carroll, Fuhrer and Wilcox (1994) included just four lags of the dependent variable along with lags in the growth of real labour income as the other explanatory variable. This selection of control variables, although crucial for the investigation and the validity of their subsequent empirical results, is guided by little or no economic or econometric theory. One of the crucial steps in the Carroll, Fuhrer and Wilcox (1994) is therefore taken in an *ad hoc* manner, a fact that has the potential to significantly weaken their major conclusion which is that: “ ...some – but not all - of the information in the [sentiment variable] is held in common with the control variables [and that] sentiment likely has some (though probably not a great deal) of incremental predictive power relative to *at least some* other indicators for the growth of spending ...” Carroll, Fuhrer and Wilcox (1994; p. 1401). This conclusion is subject to the important caveat that if the control variables are not carefully selected to give a properly specified consumption function in the first place then the results of a variable addition test of the sort presented by Carroll, Fuhrer and Wilcox (1994) may be misleading. On the other hand, if it is the case that when the controls are carefully specified it is still the case that sentiment has some independent explanatory power, then the results presented by Carroll, Fuhrer and Wilcox (1994) are reinforced and case made by against standard consumption theories, which do not allow for sentiment, is considerably strengthened.

Motivated by this observation, we now attempt to specify an appropriate baseline consumption function for Australia against which to assess the independent significance of sentiment as a variable in determining consumption. We do this in order to arrive at a

more secure conclusion about the role of sentiment in determining consumption than is possible using a relatively *ad hoc* and potentially misspecified model of consumption.

3.1 An Australian consumption function

Work on specifying an Australian consumption has a long history starting at least with Arndt and Cameron (1957) and moving through Madden and Rutledge (1974) to Lattimore (1994), Muellbauer and Lattimore (1995), Moosa (1996), Moosa and Kennedy (1998) and The Australian Treasury (1995). Arndt and Cameron (1957), Madden and Rutledge (1974), Lattimore (1994), Muellbauer and Lattimore (1995) are all concerned with selecting the appropriate economic variables to explain aggregate Australian consumption. Summarising this line of work Lattimore (1994) and Muellbauer and Lattimore (1995) argue that the following variables should appear in any fully developed consumption function: real disposable income, forecast of income growth, a measure of income uncertainty, wealth, real interest rates and demographic variables. Moosa (1996) and Moosa and Kennedy (1998) are concerned to get the dynamic specification of the consumption function correct so that a structural stability of consumption relationship is assured. They do this by modeling the stochastic seasonality of Australian consumption and income data and arrive at an equation, which when estimated for the period 1959:3 to 1993:3 yields a structurally stable consumption equation which accounts for about 86% of the variance in consumption over the period. However getting the dynamics right is only a

first step in obtaining a properly specified consumption function and as Moosa (1996) remarks it would be interesting to estimate a full-fledged Australian consumption function using the sorts of variables considered by Arndt and Cameron (1957), Madden and Rutledge (1974), Lattimore (1994), Muellbauer and Lattimore (1995).

The econometric concerns of Moosa *et al.* and the theory insights of Lattimore *et al.* have to a large extent been brought together in the recently specified model of aggregate consumption due to the Australian Treasury. The Treasury consumption equation which, will be used as the test-bed consumption function in our study, is:

$$\begin{aligned} \Delta \log(\text{con}_t) = & \text{grc}_t + (\text{qdemc}_t - \text{qdemc}_{t-1}) + a_0\{\log(c_0) + \log[(\text{ynz}_t/\text{pcon}_t) + c_1(\text{vmz}_{t-1}/\text{pcon}_t)] \\ & + \log[\text{qdemc}_{t-1}] - \text{grc}_t - \log(\text{con}_{t-1})\} + a_1(\text{rnu}_t - \text{rnu}_{t-1}) + a_2\{\log(\text{ynz}_t/\text{ynz}_{t-1}) - \\ & \log[\text{pcon}_t/\text{pcon}_{t-1}] - \text{grc}_t\} \end{aligned} \quad (9)$$

where the terms in the equation are defined as follows:

$\Delta \log(\text{con})$ = the log change in real consumption

$\log(\text{con})$ = log level of real consumption

qdemc = is a dummy variable to capture demographic effects

ynz = nominal after-tax labour income

vmz = nominal private sector wealth

rnu = the unemployment rate

grc = the long-run (steady state) growth rate of real consumption

a_0, a_1, a_2, c_0 and c_1 are parameters and $a_0\{\log(c_0) + \log[(y_{nzt}/p_{con}) + c_1(vmz_{-1}/p_{con})]\}$ is a long-run error correction term, where c_0 is the long-run propensity to consume out of labour income and wealth and c_1 is the long-run rate of return on wealth.

As Gardner (1995) notes the specification chosen here is consistent with both the Life-Cycle Hypothesis and the Permanent Income Hypothesis. According to both hypotheses consumers choose their consumption in each period in order to maximise their lifetime utility subject to an intertemporal budget constraint. As is well known, the assumption of utility maximisation and perfect capital markets means that under both theories consumption depends on total lifetime resources and income fluctuations in individual periods will not influence consumption. Empirical testing has indicated that naïve versions of the LC-PIH models are generally not successful in the Australian context and that other variables need to be incorporated into models that successfully explain consumption behaviour. This experience plus the desire to ground the consumption equation on a LC-PIH base, lead to the inclusion of the following variables in the TRYM consumption equation: labour income, demographic structure, non-human wealth, inflation, interest rates, transfer payments and unemployment. As Gardner (1995) also observes: “Confidence effects may also affect consumption. This is likely to be particularly important for the purchase of consumer durables ... [because] unemployment is often associated with low consumer confidence [TRYM] include[s] a change in unemployment term to capture confidence effects.” Gardner (1995; p.14). In our work we model confidence effects directly through a consumer sentiment index rather than using the unemployment as a proxy for that effect. It is important to note however that

unemployment is retained in our estimating equation, since as was noted above we are interested in checking the existence of an *independent* role for sentiment once the traditional influences on consumption have been allowed for.

3.2 Preliminary data analysis

We begin with some preliminary analysis of the data to be used in the estimated equation. We perform tests to determine the stationarity properties of the data, something, which is important in time series analysis, and something not reported by Carroll, Fuhrer and Wilcox (1994) in their study. We also visually display the data (see Appendix 3).

TABLE 2. Augmented Dickey Fuller and Phillips – Perron Unit Root Tests

		Stationary around a Deterministic Trend	Stationary in first differences
Sentiment	ADF	-7.331673	-7.353011
	P-P	-8.558555	-8.566358
Unemploy	ADF	-4.215901	-4.068446
	P-P	-6.280058	-6.159427
Steady state Consumption	ADF	-4.298195	-3.785460
	P-P	-13.81009	-13.58126
Wealth	ADF	-3.892521	-3.701554
	P-P	-7.967623	-7.880248
Income	ADF	-4.930096	-4.492672
	P-P	-12.88279	-12.54621
Consumption	ADF	-4.698778	-4.673209
	P-P	-10.37434	-10.31235
Price index	ADF	-2.613358	-2.016277
	P-P	-5.179289	-4.463541
Demographic	ADF	-2.672160	-1.509402

P-P -2.486128 -1.370575

*The critical values for the Augmented Dickey Fuller and the Phillips Perron tests at the 5% level of significance with trend are -3.4548 and -3.4561 respectively and without trend are -2.8925 and -2.8900 respectively. Details of these tests are available from the authors on request.

3.4 Estimating the relationship between consumption and sentiment

Given the stationarity properties of the data it is reasonable to estimate equation (9) for the period 1974:4 to 2000:1 using non-linear least squares yields the parameter estimates and summary statistics in Table 3.

TABLE 3. *Parameter estimates of the baseline consumption equation 1974:4 to 2000:1*

Parameter	Interpretation	Estimate	Standard error	t-ratio
a_0	partial adjustment	0.15310	0.030484	5.0225
c_0	long run constant	0.67094	0.030747	21.822
c_1	return on wealth	0.02234	0.002907	7.6868
a_1	Δ in unemployment	-0.0056	0.001695	-3.2963
a_2	labour income growth	0.11495	0.053771	2.1379

$AR^2 = 0.344$

Durbin-Watson statistic = 2.2062

The summary statistics indicate that this equation is reasonably well determined and considering its foundations in economic theory and econometrics it seems to be an adequate base against which to assess the independent contribution (if any) of sentiment in explaining consumption expenditure. Following the approach in Carroll, Fuhrer and

Wilcox (1994) we therefore estimate this consumption function but with the sentiment variable added in. In particular we estimate:

$$\begin{aligned} \Delta \log(\text{con}_t) = & \text{grc}_t + (\text{qdemc}_t - \text{qdemc}_{t-1}) + a_0\{\log(c_0) + \log[\text{ynz}_t/\text{pcon}_t] + c_1(\text{vmz}_{t-1}/\text{pcon}_t)\} \\ & + \log[\text{qdemc}_{t-1}] - \text{grc}_t - \log(\text{con}_{t-1})\} + a_1(\text{rnu}_t - \text{rnu}_{t-1}) + a_2(\log(\text{ynz}_t/\text{ynz}_{t-1}) - \\ & \log[\text{pcon}_t/\text{pcon}_{t-1}] - \text{grc}_t) + a_3\text{dsent}_t + a_4\text{dsent}_{t-1} + a_5\text{dsent}_{t-2} + a_6\text{dsent}_{t-3} \end{aligned} \quad (10)$$

where all the previously defined variables are as before, $\text{sent} \equiv$ the Westpac-CAI index of consumer sentiment and $\text{dsent}_t = (\text{sent}_t - \text{sent}_{t-1})$. The results of this estimation are presented in Table 3.⁷

TABLE 4. *Sentiment in an Australian consumption function 1974:4 to 2000:1*

Parameter	Interpretation	Estimate	Standard error	t-ratio
a_0	partial adjustment	0.16185	0.03324	4.8700
c_0	long run constant	0.67762	0.05135	13.196
c_1	return on wealth	0.02235	0.00279	7.9829
a_1	Δ in unemployment	-0.00579	0.00215	-2.6871
a_2	labour income growth	0.09781	0.05635	1.7358
a_3	Δ in sentiment	0.00012	0.00011	1.0225
a_4	Δ in sentiment lagged once	-0.00012	0.00009	-1.3052
a_5	Δ in sentiment lagged twice	0.00017	0.00009	1.9249
a_6	Δ in sentiment lagged thrice	-0.00007	0.00006	-1.0718

$\text{AR}^2 = 0.358$

Durbin-Watson statistic = 2.1488

⁷ Notice that our specification of the consumption function contains the unemployment rate as an explanatory variable, unlike the function used by Carroll, Fuhrer and Wilcox (1994). As unemployment is

There are at least two interesting things about the results in Table 3. Firstly, the significance of the a_5 coefficient is striking. This is the coefficient on the two-quarter lag in changes in sentiment and its significance and positive sign means that changes in sentiment seem to predict changes in aggregate consumption expenditures. So the answer to the first question asked by Carroll, Fuhrer and Wilcox (1994) is ‘yes, for this sample of Australian data, sentiment seems to help forecast consumption’. It is also interesting to note that the statistical significance and positive sign of a_5 is consistent with the theoretical model developed in Section 2 of this paper, particularly with part (ii) of the theorem proved there. This finding also supports the contention in Carroll, Fuhrer and Wilcox (1994; p. 1398) that aggregate consumption behaviour is not well explained by the simplest certainty equivalent versions of the life-cycle and permanent income theories of consumption. If these theories were true then a_5 would be statistically insignificant.

Secondly, there is the 1.4% increase in adjusted R^2 achieved as a result of the inclusion of the sentiment variable in the Treasury equation for aggregate Australian consumption. While this is not exactly comparable with the 3% increase in the adjusted R^2 reported by Carroll, Fuhrer and Wilcox (1994; Table 1) for the US, because our consumption equation is non-linear while theirs is linear, it is interesting that the results are of similar orders of magnitude. Thus it seems reasonable to conclude with them that: “[e]vidently, some – but not all – of the information in [sentiment] is held in common with the control variables [meaning that] sentiment likely has some (though probably not a great deal) of *incremental* predictive power relative to at least some other indicators for the growth in

often thought to significantly influence sentiment and is often used as a proxy of that variable if we find a

spending”. Carroll, Fuhrer and Wilcox (1994; p. 1401). It is also interesting to note that our results support a conjecture of Keynes that variations in consumer sentiment are unlikely to have a large impact on actual consumption behaviour when he wrote: “... *Changes in expectations of the relation between the present and the future level of income.* We must catalogue this factor for the sake of formal completeness. But, whilst it may affect considerably a particular individual’s propensity to consume, it is likely to average out for the community as a whole. Moreover, it is a matter about which there is as a rule, too much uncertainty for it to exert much influence.” Keynes (1936; p. 95). Because we have been somewhat more careful in our specification of the test-bed consumption function and the ‘other indicators for growth in spending’ than Carroll, Fuhrer and Wilcox (1994) were, we can be more confident in the conclusion that sentiment is likely to have some independent, if small, predictive and explanatory power as far as changes in consumption spending is concerned.

4. Conclusion

The results of our investigation of the connection between sentiment and household consumption expenditure in Australia strengthen and confirm the results presented by Carroll, Fuhrer and Wilcox (1994) of an independent predictive and explanatory role for consumer sentiment in explaining aggregate Australian consumption. As Carroll, Fuhrer and Wilcox (1994) note, these findings, as well as being of empirical and policy interest, also raise important theoretical issues, since permanent income and

contribution of sentiment even in that case we would have a very significant result.

life-cycle models of consumption are unable to account for the influence of sentiment on consumption. Empirically exploring the sorts of models that are able to account for the influence of sentiment on consumption, such as the model developed in Section 2 of this paper, is obviously one direction for future research. There are many others including the following: What is it that influences sentiment? Do the results found about the (weak) sentiment-consumption connection apply also the connection between sentiment and variations in the growth rate of GDP? What is the relative information content of different indices of consumer sentiment? Does the inclusion of an index of consumer sentiment in systems of demand equations improve the fit and regularity of such systems?

Whatever the outcome of research on these and other questions it is clear that the Carroll, Fuhrer and Wilcox (1994) study was important and successful in drawing attention to the often overlooked sentiment variable in explaining consumption. Our work has attempted to contribute to the research effort stimulated by them, and by paying particular attention to the specification of a credible set of control variables against which the influence of sentiment can be gauged, our results have reinforced their basic message that changes in sentiment are able to help explain the behaviour of consumption.

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APPENDIX 1: DATA DESCRIPTION

The variables used in this study and their definitions are listed below.

Sentiment (sent)

The index used here is the Westpac-Institute of Applied Economic and Social Research measure of consumer sentiment. This data series was downloaded from the Reserve Bank of Australia (RBA) web page (<http://www.rba.gov.au/>).

Consumption (con)

This variable is Total Private Real Consumption and is equal to net expenditure on goods and services for the purpose of consumption by persons and non-profit organisations serving households. This item excludes the purchase of dwellings and capital expenditure by unincorporated businesses and non-profit organisations and maintenance of dwellings, but includes personal expenditure on motor vehicles and other durable goods and the imputed rent of owner-occupied dwellings. The Australian Bureau of Statistics Catalogue Reference is 5206.0.

Income (ynz)

This variable is Total Labour Income and is calculated as civilian and defence force employment multiplied by average earnings, less income tax, plus personal benefits paid to residents and grants to non-profit institutions, less fees and fines. The Australian Bureau of Statistics (ABS) Catalogue Reference is 5206.0.

Wealth (vmz)

This variable is Private Wealth at Market Value and the five components of wealth are: stock of dwellings; business assets (adjusted for overseas holdings of domestic assets and Australian holdings of foreign assets: non-official holdings of government bonds and non-official holdings of currency. For details of compilation methodology see Reserve Bank of Australia (RDP) Discussion Paper 9109.

Price Deflator (pcon)

This variable is Private Consumption Prices and is calculated as the ratio of the current price to the constant price series for each variable included in the 'con' series. For details of the weighting see The Australian Bureau of Statistics (ABS) Catalogue Reference is 5206.0.

Unemployment rate (rnu)

This variable is unemployment rate and is equal to unemployed persons as a percentage of the workforce. The Australian Bureau of Statistics Catalogue Reference is 6203.0.

Demographic effects (qdemc)

The demographic variable used here is obtained by stratifying the population into four age groups: people between 20 and 34; people between 35 and 44; people between 45 and 64 and people aged over 65. The variable is an index of the relative shares of each group in the total population. See TRYM (1995) documentation.

Steady state consumption (grc)

This is calculated by solving the entire TRYM model and working out the steady state consumption growth rate on the assumption that the economy was in a steady state at the time. See TRYM (1995) documentation.

APPENDIX 2: DATA LISTING:

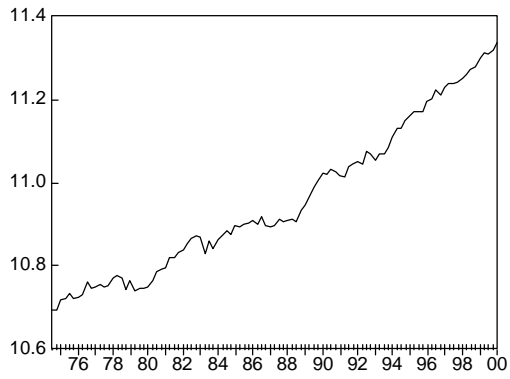
The table below contains a list of the data used in this study organised by quarter and under the appropriate mnemonic category. The data spans 1974:3 to 2000:1.

CON	YNZ	VMZ	PCON	RNU	QDEMC	GRC	SENT
41215.00	9493.38	201858.84	0.22	2.78	1.005723	0.003316	93.20
40873.00	9955.38	206020.30	0.23	3.82	1.006059	0.002993	94.70
41852.00	10501.96	218287.84	0.23	4.64	1.006395	0.002313	111.10
42316.00	10893.52	223766.41	0.24	4.94	1.006731	0.002600	106.70
42178.00	11413.07	225432.45	0.25	4.84	1.007105	0.001630	103.20
41447.00	11898.10	238743.50	0.26	5.31	1.007479	0.001303	104.50
42176.00	12283.06	253405.45	0.27	4.71	1.007853	0.001727	107.20
43043.00	12667.17	256941.50	0.28	4.61	1.008227	0.000700	107.00
43720.00	13336.11	265508.69	0.28	4.98	1.008435	0.002239	109.10
44065.00	13586.98	268132.81	0.29	4.87	1.008644	0.000623	106.10
44033.00	13919.59	277452.81	0.30	5.13	1.008853	0.001762	98.30
44390.00	14332.01	284041.81	0.31	5.75	1.009061	0.001785	102.90
44505.00	14579.16	286573.34	0.31	5.88	1.009636	0.001659	103.20
44557.00	15000.17	297938.81	0.32	5.95	1.010211	0.002474	107.90
44883.00	15414.08	308379.75	0.32	6.68	1.010785	0.005378	115.40
46012.00	15862.56	312069.81	0.33	6.22	1.011360	0.004904	108.60
46001.00	16085.99	322582.16	0.34	6.49	1.012268	0.005682	97.70
45646.00	16193.34	331709.69	0.35	6.35	1.013176	0.006210	105.20
46280.00	16826.53	345024.25	0.36	6.29	1.014084	0.005411	106.20
46495.00	16743.34	354896.59	0.36	6.21	1.014992	0.006693	101.10
46654.00	17276.60	367817.00	0.37	6.11	1.015361	0.006011	96.80
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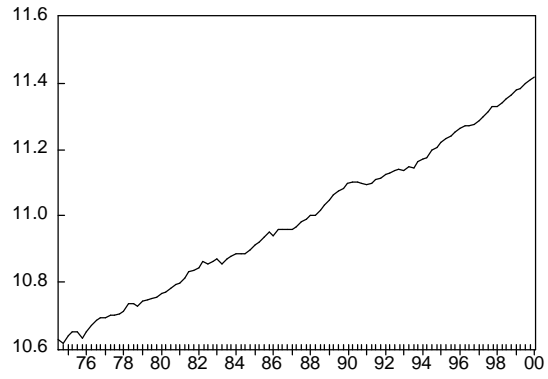
47409.00	18276.64	410698.09	0.39	6.03	1.016099	0.006011	96.90
47593.00	18960.21	424571.00	0.40	6.25	1.016468	0.006559	99.40
48124.00	19864.06	450054.31	0.41	6.17	1.016974	0.007234	103.20
48655.00	20396.29	464735.69	0.42	5.87	1.017480	0.007211	109.00
48906.00	20946.87	491866.00	0.43	5.65	1.017986	0.007961	109.30
49744.00	21878.76	509115.09	0.44	5.59	1.018491	0.008326	101.90
50700.00	22383.30	506490.50	0.45	5.85	1.018585	0.008433	94.80
50847.00	23275.17	517660.09	0.46	6.01	1.018678	0.008455	99.30
51232.00	23945.82	516002.41	0.47	6.36	1.018771	0.009165	88.90
52192.00	24900.74	521295.69	0.48	6.60	1.018865	0.008193	92.90
51858.00	26008.07	524933.63	0.50	7.01	1.019128	0.008419	83.60
52287.00	26863.66	539265.19	0.51	8.71	1.019392	0.007888	79.40
52535.00	27379.18	552186.38	0.52	9.71	1.019655	0.007985	89.30
51894.00	26760.39	574564.13	0.53	10.33	1.019919	0.008063	96.90
52667.00	27963.36	594948.63	0.54	10.22	1.019822	0.007848	100.60
53070.00	28106.08	623122.13	0.55	9.68	1.019726	0.007215	110.90
53386.00	29161.88	648660.50	0.56	9.43	1.019630	0.007707	120.60
53404.00	29754.18	660212.19	0.56	8.95	1.019534	0.007784	117.90
53347.00	30498.07	686679.13	0.57	8.84	1.019577	0.008057	118.40
54026.00	30684.35	697722.31	0.58	8.70	1.019620	0.008242	117.20
54942.00	31750.08	724856.88	0.59	8.43	1.019662	0.008038	109.30
55335.00	32393.72	743152.69	0.60	8.39	1.019705	0.008738	98.60
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61870.00	43651.78	1261798.75	0.78	6.64	1.017072	0.009593	107.80
62884.00	44861.34	1339829.50	0.79	6.66	1.016686	0.009614	93.50
63679.00	46438.28	1360447.88	0.80	6.25	1.016300	0.009260	82.40
64624.00	48040.85	1423791.00	0.81	5.96	1.015992	0.009139	79.40
65132.00	49331.13	1434107.88	0.82	5.82	1.015684	0.009055	81.60
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66246.00	51865.72	1411976.13	0.85	6.48	1.015069	0.008786	71.20
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66035.00	53933.64	1375522.75	0.88	7.96	1.013956	0.008539	68.10
65802.00	54100.26	1389245.38	0.89	8.61	1.013399	0.007660	72.70
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68576.00	59096.72	1509542.50	0.92	10.88	1.010321	0.006857	86.60
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82004.00	75584.63	2210954.75	1.00	8.59	1.000690	0.006125	102.60
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83352.00	77179.27	2275221.25	1.00	8.11	0.999770	0.005984	103.10
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89009.00	83291.53	2591799.25	1.02	7.13	0.997538	0.006063	112.60
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APPENDIX 3. GRAPHS OF THE DATA



— LRYNZ



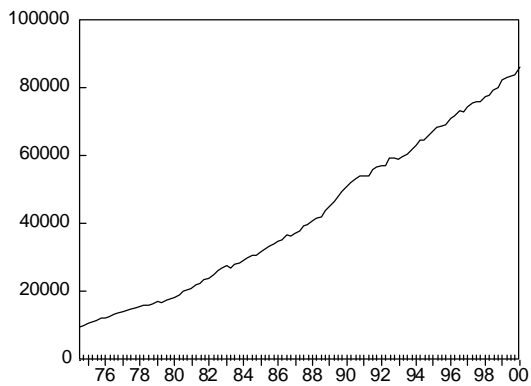
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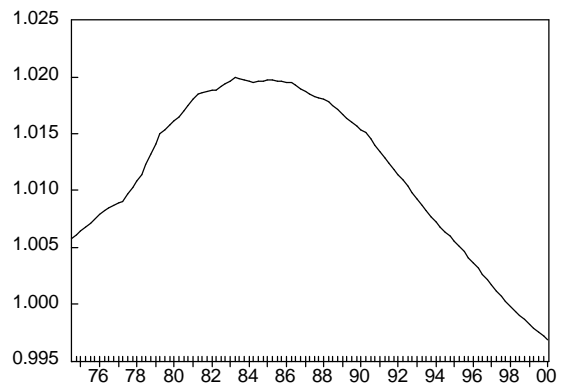
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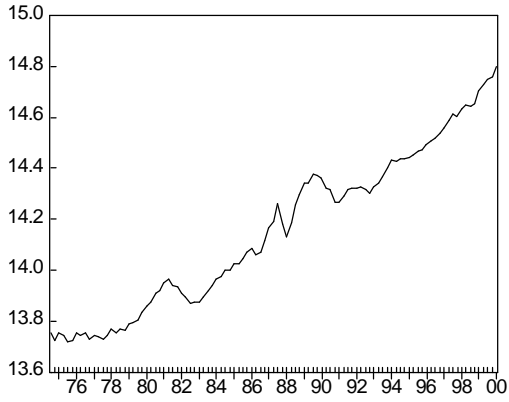
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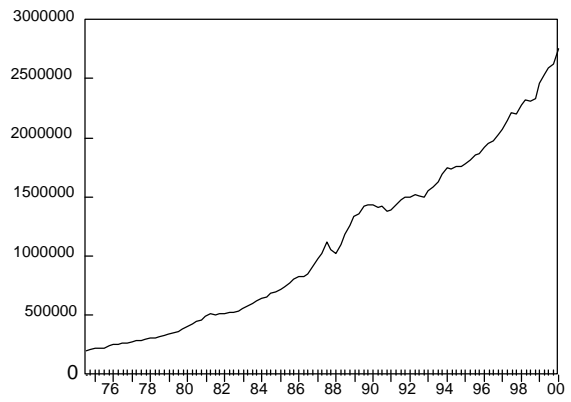
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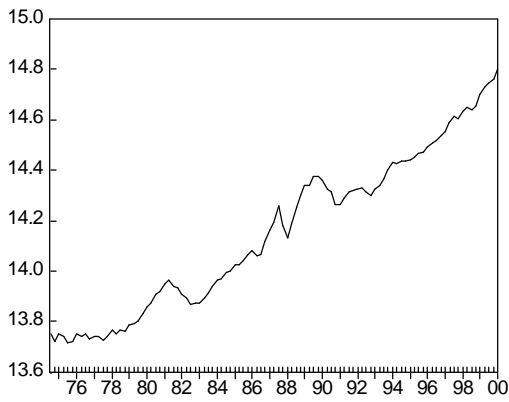
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— RVMZ1



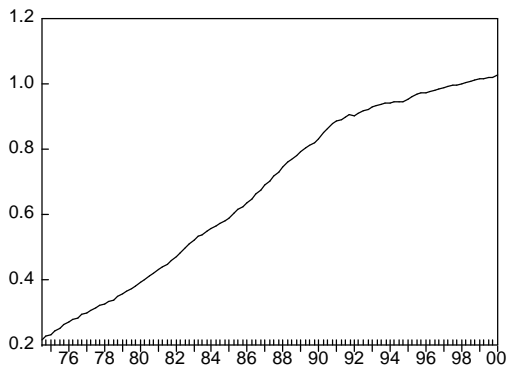
— VMZ



— RVMZ1



— GRC



— PCON