A DYNAMIC CONSUMPTION FUNCTION FOR TRINIDAD AND TOBAGO

by

Roland C. Craigwell
Research Department
Central Bank of Barbados
&
Department of Economics
University of Southampton

and

Llewyn L. Rock*
Faculty of Management
University of Toronto

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ABSTRACT

This paper employs a flexible, dynamic formulation to derive a candidate consumption function for the small open economy of Trinidad and Tobago. Cointegration tests are used to determine the variables in a Blinder-Deaton Euler Equation - Error Correction model. Vector Autoregressions are then used to decompose variables into expected and surprise components and the predictions of the standard rational expectations consumption model are evaluated against the data evidence. Results show that this decomposition is informative and that the Blinder-Deaton model, when formulated to include non-traditional regressors such as government spending and fiscal deficits, provides a good fit of the Trinidad and Tobago data.

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INTRODUCTION

The consumption function is one of the key relationships in macroeconomics. As such, it has been exhaustively studied in the developed countries of North America and Western Europe. In comparison, there has been rather limited work on the consumption function for developing countries. This same observation holds true for Caribbean economies. Our research has unearthed only a few published studies on Caribbean consumption behaviour.[1] Most of these studies, with the notable exceptions of Craigwell and Rock (1992a,b,c) and Rock *et al* (1989), have tested variants of the simple Keynesian consumption function and have generally ignored the dynamic issues emphasised by both the rational expectations version of the permanent income/life cycle hypothesis (*PIH/LCH*) and the error correction/cointegration approach. The issue of what economic factors govern dynamic consumption behaviour in the small open economies of the Caribbean is thus far from settled.

This paper attempts to contribute to the Caribbean research literature by testing a flexible, dynamic functional form for the consumption relation using Trinidad and Tobago data. The approach to modelling the consumption relation is in the spirit of Blinder and Deaton (1985) who combined the Euler equation model of Hall (1978) with the Error Correction Model first introduced by Davidson *et al* (1978).

Section II of the paper examines the historical behaviour of consumption expenditures and key related variables in the Trinidad and Tobago economy over the 1955-1990 sample period. Section III derives and critiques the standard rational expectations consumption model. Section IV of the paper then motivates the baseline consumption function to be tested while Section V describes the econometric methodolgy adopted. We discuss the data and present an analysis of the empirical results in Section VI. Conclusions and suggestions for future work are noted in Section VII.

The results of our study show that in addition to traditional variables like income and inflation, non-traditional variables such as government spending and deficits are important factors in the consumer's decision problem.

II. HISTORICAL REVIEW OF CONSUMPTION BEHAVIOUR

This section briefly reviews the behaviour of private consumption and related variables over the past few decades. In particular, the last fifteen years have witnessed remarkable events in the evolution of Trinidad and Tobago's economy. Sharp movements in the terms of trade, large negative interest rates, growing government deficits and sharp swings in growth rates have been some of the salient characteristics of recent economic experience. These have all consequences for social welfare and the behaviour of key aggregates such as consumpt expenditures.

In Trinidad and Tobago, the average propensity to consume out of disposable inco (APC) has exhibited considerable variation over the past three decades. The APC fell from average of 92.8% (1955-65) to a mean of 81.6% in the 1973-1982 boom period. It fell as as 69% in 1975. However, during the recent and protracted recessionary period, the APC risen dramatically, averaging in excess of 90%.[2] These sharp movements in APC se consistent with the view that current consumption does not fall as much as income du recessions; there is some smoothing of consumption perhaps tied to a notion of expected inco over a longer period.

The Trinidad and Tobago economy has experienced several distinct periods of econo growth since 1955 (see Figure 1). Between 1956 and 1961, real *per capita* GDP grew a average year-to-year rate of some 6%; in the 1967-1973 period, growth was a more modest 2. However, during the 1974-1982 oil boom period, real *per capita* income grew at a mean yea year rate of 5%. Since 1982, as the international oil market softened, Trinidad and Tobago experienced a continuous decline in output with real *per capita GDP* falling by over 50% s 1982.

The interest rate sensitivity of consumption and saving has been a subject of much de in the LDC literature. At the theoretical level, two period life cycle models indicate the exist of potentially offsetting income and substitution effects. A rise in the real rate of re decreases the present cost of purchasing a dollar of future consumption, making it attracti substitute for present consumption and save more. At the same time, it is no longer neces to save as much to achieve a given level of income in the future. It is possible to save less and consume more, both in the present and in the future. The income effect causes an inc in consumption. Given the theoretical ambiguity, whether or not consumption behavio interest elastic is a matter for empirical analysis.

Most of the variability in real interest rates in the Trinidad and Tobago economy has due to fluctuations in inflation rates as nominal interest rates have been fairly constant. 1973, real interest rates have been consistently negative (see Figure 2).

Given the huge contribution of the oil sector to the economy of Trinidad and Tol terms of trade fluctuations, dominated in recent times by oil price changes, have had prof consequences for the Trinidad and Tobago economy. The terms of trade had declined ste prior to the 1973/74 positive oil shock. It then rose dramatically until the oil price collap 1982, falling back to pre-1973 levels by 1990.

The government sector in Trinidad and Tobago has also experienced periods of growth and periods of severe contraction. Real *per capita* government spending had exhi an upward trend until 1982; since then it has shrunk in dramatic fashion. In the period 1973, the average rate of growth was about 4%; it was 17% during the 1974-1982 period b

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[1] Gafar (1977), Forde (1988), Persad (1975), Craigwell and Rock (1992a,b,c) and Rock *et al* (1989).

[2] It should be noted that the APC derived using total expenditures overst the true APC as one should treat part of expenditures on durables as saving r than consumption.

fallen at the average rate of 17% between 1982 and 1990. By way of comparison, real *per capita* spending was TT$637 in 1955, TT$6668 in 1982 and TT$1672 in 1990.

The fiscal deficit as a ratio of GDP hovered between 3 and 5 percent in the 1960s. Between 1974 and 1982, however, the central government ran surpluses in five out of seven years before experiencing the beginnings of a crisis which saw the ratio climb as high as 13% in 1982 and 1983. The austerity package put in place by the government and the IMF curtailed government spending and caused the deficit:GDP ratio to decline steadily to less than 2% in 1990.

What have these events meant for private consumption behaviour in Trinidad and Tobago? We now turn our attention to stating and testing an empirically relevant model of private sector consumption behaviour.

III. THE STANDARD CONSUMPTION PROBLEM

The standard intertemporal optimisation problem facing the representative economic agent under rational expectations is given by[3]

$$\max_{\{C_t\}} \quad E_{t-1}\left[\sum_{t=1}^{\infty}(1+\rho)^{1-t}U_t^{\gamma}/\gamma\right], \qquad \gamma<1 \tag{1}$$

where

$$U_t = C_t^{1-\xi}\, G_t^{\xi}, \qquad \xi \le 1$$

where $\rho > 0$ is the agent's subjective utility rate of time preference; γ is a risk-aversion parameter. E_{t-1} is the conditional expectations operator given an information set I_{t-1}. C is the agent's consumption where we allow for the possibility that the "effective" consumption of the private sector is a weighted combination of private consumption proper and government expenditures, G (see Bean (1986)). ξ measures the degree to which government spending *ex ante* 'crowds out' private consumption and is assumed to be a constant.[4] We assume that G is exogenously chosen by the government sector. U(.) is assumed to be time separable, increasing and strictly concave. The representative agent faces the following intertemporal budget constraint in each period

$$\sum_{t=1}^{\infty} D_t C_t = A_0 + \sum_{t=1}^{\infty} D_t (Y_t - \tau_t) \tag{2}$$

where $D_t = 1/\prod_{j=1}^{t}(1+R_j)$. Y_t is the representative agent's period t income; τ_t are lump-sum taxes net of transfers. A_0 is the initial (exogenously given) asset holdings of our representative agent; R_t is the period t real rate of interest.

The fully rational agent completely internalises the government budget constraint. Ignoring the explicit modelling of monetary variables for expositional convenience, we can represent the government's intertemporal budget restraint as

$$\sum_{t=1}^{\infty} D_t\, \tau_t = F_0 + \sum_{t=1}^{\infty} D_t\, G_t \tag{3}$$

where F_0 is the given initial net supply of bonds issued by the domestic government sector. The no-Ponzi game conditions that state that neither public nor private indebtedness can grow without bound have been imposed.

Substituting for τ_t, we can rewrite Equation 2 as

$$\sum_{t=1}^{\infty} D_t C_t = [A_0 - F_0] + \sum_{t=1}^{\infty} D_t [Y_t - G_t] \tag{4}$$

According to Equation 4, the entire time path of government spending is what matters for private consumption decisions rather than the specifics of its finances (taxes or debt/deficits). In this world, private agents can always neutralise the fiscal policy of government (Aschauer (1985)).

Assuming that consumption decisions are to the interior of the feasible set, maximising Equation 1 subject to the economy-wide budget constraint, Equation 4, yields the first order Euler equations. The additive separability assumption allows the characterisation of the relationship between consumption in period t and t+1 as

[3] See the Appendix for a list of the assumptions underlying the derivation of the model.

[4] $\xi > 0$ implies substitution between c_t and g_t; $\xi < 0$ implies that c_t and g_t are complements and that g_t augments rather than 'crowds out' private consumption. The tradition in empirical studies is to ignore g_t, implicity assuming $\xi = 0$.

$$E_{t-1}[(C_t/C_{t-1})^{\gamma(1-\xi)-1}(G_t/G_t-1)^{\gamma\xi}(1+R_t)] = E_{t-1}\Phi_t = (1+\rho) \quad (5)$$

Let lower case letters denote natural logarithms of variables and Δ be the difference operator such that $\Delta x = x_t - x_{t-1}$. As Hansen and Singleton (1983) show, if we assume that $\{\Delta c_t, \Delta g_t, r_t\}$ is a covariance stationary Gaussian process, then $(\phi_t - E_t\phi_t) \sim N(0, \sigma^2)$.[5,6] We can therefore write:

$$E_{t-1}\Phi_t = \exp(E_{t-1}\phi_t + \sigma^2/2) \quad (6)$$

and applying this result to Equation 5 and simplifying, one obtains (see Bean (1986, p.503)):

$$c_t = \psi_0 + \psi_1 E_{t-1}(r_t | I_{t-1}) + \psi_2 E_{t-1}(g_t | I_{t-1}) + \psi_3 g_{t-1} + \psi_4 c_{t-1} + \mu_t \quad (7)$$

where $\psi_4 = 1$ and $\psi_3 = -\psi_2$, under the null.[7] Subtracting c_{t-1} from both sides,

$$\Delta c_t = \psi_0 + \psi_1 E_{t-1}(r_t | I_{t-1}) + \psi_2 E_{t-1}(g_t | I_{t-1}) + \psi_3 g_{t-1} + \psi_5 c_{t-1} + \mu_t \quad (8)$$

μ_t is a classical disturbance term. I_{t-1} is the information set available to the agent at the start of the current period and includes variables dated t-1 and earlier. Equation 8 is the basic *PIH/LCH* model expanded to allow for the government budget.

Ignoring the government spending and interest rate variables for now, Hall (1978) showed

[5] Where r_t represents the logarithm of $(1+R_t)$. The interest rate should be the after-tax rate. As data on marginal tax rates were unavailable, we choose to work with the before-tax rate in the empirical analysis, rather than assuming an arbitrary (fixed) tax rate as other researchers have done.

[6] The results of our empirical tests indicate no statistically significant departures from normality so that this assumption may not be unreasonable. For a further discussion of this assumption, see Hansen and Singleton (1983).

[7] It is possible to explicitly impose a full set of cross-parameter restrictions derived from the Euler equation given the lognormality assumption.

that consumption follows a random walk.[8] That is, current consumption differs from p consumption only by a serially uncorrelated, zero mean error term (μ_t) reflecting n information, i.e revisions or 'surprises' in permanent income. Consequently, once lag consumption is included in the regression, Equation 7, no other variable should systematica affect consumption.[9] However, as the above model shows, if the economic agent takes acco of government expenditure when she makes her consumption decisions and interest rates stochastic, these variables can enter significantly in the regression without violating assumptions of the model.

The above Euler Equation model and its variants provide a theoretically cohe framework for modelling rational consumption behaviour in market economies. However, i generally conceded that its full implementation including the 'imposition' of the complete se restrictions implied by the model has met with frequent rejection by the data (e.g, Bean (198 For the case of Trinidad and Tobago, Rock *et al* (1989) show that within a Ricardian Equivale framework, using a full information maximum likelihood estimation procedure where a se cross-equation restrictions from the auxiliary equation predicting government expenditures explicitly imposed on the consumption function, government budgetary variables matter bey their role in predicting government spending. Craigwell and Rock (1992 a,b) also reject the b *PIH/LCH* model under rational expectations and suggest the need to consider additi regressors such as current income which may reflect the incidence of binding liquidity constr on (some) consumers.

Two things seem clear from the research on the consumption function. One, the e composition of the regressor set is far from settled (Blinder and Deaton (1985); Carroll Summers (1987)). Two, a more 'agnostic'and flexible approach than the 'textbook' E Equation model is suggested to the search for consumption functions which better fit Caribbean data.

IV. A BASELINE SPECIFICATION

Blinder and Deaton (1985) have proposed and tested a highly flexible, *empirical*, functional of the consumption relation which extends Equation (8) in two ways: (i) it allows other pote regressors such as income to be included in the consumption relation; and (ii) it pe additional dynamics by including lagged regressors. Such a model allows many altern hypotheses to be tested and it nests both the Euler equation model derived earlier as well a

[8] That is, the *polar PIH/LCH* under rational expectations imposes restriction that $\psi_5 = 0$ in Equation 8, i.e $\psi_4 = 1$ in Equation 7.

[9] Lagged information should already be incorporated in c_{t-1} and only unexpected portion of a current variable should matter; otherwise, the agent not have been forming expectations rationally (making use of all rel information available to her).

well known Error Correction Model of Davidson *et al* (1978).[10] The Blinder-Deaton model is given by

$$\Delta c_t = \beta_0 + \beta_1 c_{t-1} + q_t^e \delta + q_t^u \delta^* + z_{t-1}\gamma + \mu_t \tag{9}$$

where q^e and q^u are vectors, representing the expected and unexpected components of variables, respectively. The z_{t-1} variables are either lagged values of q variables or other variables that are part of the agent's information set at the beginning of time t. As Blinder and Deaton point out, writing Equation 9 in anticipated/unanticipated form achieves two purposes: (i) it permits one to test the "innovations only" prediction of the *polar* form of the (Euler Equation) model; and (ii) some of the q variables may be correlated with the dependent variable both directly *via* a well defined theoretical role and indirectly because the news impounded in current variables (i.e, the surprise component of a variable) may cause consumers to update their estimates of permanent income and hence alter the timing of consumption. Using instruments dated t-1 and earlier (in a first stage regression) to replace each q by its expected value in Equation 9, the separate effects of anticipated and unanticipated changes are determined by including both constructs in Equation 9.

To test the relevance of separating q into q^e and q^u, a 'no surprise' form of Equation 9 is also estimated, that is

$$\Delta c_t = \beta_0 + \beta_1 c_{t-1} + q_t \delta + z_{t-1}\gamma + \mu_t \tag{10}$$

The baseline consumption function used as the point of departure adds to the variables in Equation 8: income (y); a terms of trade variable (*tot*) reflecting the openness of the economy (see Craigwell and Rock (1992c)); money balances (m); and a government deficit variable (D).

The case for the inclusion of y can be easily motivated. One rationale is the presence of liquidity constraints: consumers who cannot borrow or can borrow only at prohibitively high rates of interest will have current consumption closely tied to income receipts (Deaton and Muellbauer (1980, p.317-18)). Conversely, the *PIH/LCH* predicts a low correlation between current income and consumption. The inclusion of m is warranted if one assumes that money balances and consumption are chosen simultaneously and that money is non-separable from consumption in the agent's utility function (see Koenig (1990)). The assumption is that consumers tend to concentrate their expenditures on consumption in periods during which holdings of liquid assets are substantial. In this context, including real money balances to capture this liquidity effect implies that real balances increase the utility of consumption at the margin.

As we have noted, previous results show a strong rejection of Ricardian Equivalence for Trinidad and Tobago: government financial variables can affect real quantities in the economy. This idea is captured by the inclusion of D. There are several probable ways in which the tax or borrow choice of financing a given level of government spending can matter for the consumption decisions of private agents. For example, suppose (quite realistically) that the local private sector is constrained on international credit markets but the government has access to such credit at interest rates below those the private sector would willingly pay to finance *viable* projects. If the government on-lends such borrowed funds to the private sector at a total cost below the interest rate the domestic private sector was willing to pay to foreign creditors, then there is an increase in private sector net wealth. Secondly, suppose that a subset of agents are constrained on domestic capital markets and thus depend on current income and accumulated assets to finance consumption. That is, they want to increase current consumption toward some optimal level but cannot effectively borrow against future labour income to accomplish this. If government chooses to borrow (run a deficit) rather than use (direct) taxes to finance a given spending level, the constrained segment of the population is made better off as its current disposable income rises relative to the case of a tax imposition. This in fact, is equivalent to a compulsory loan from unconstrained consumers to constrained consumers intermediated by the government. Depending on the relative sizes of the two groups and the marginal valuations of changes in utility, this action can have negative or positive real effects (see Barro (1978)). In consonnance with much of the literature, we shall treat D as exogenous (however, see footnote 12).

Movements in *tot* can influence consumption in several related ways: firstly, there is a direct effect through revaluation of exports and imports; secondly, there is a wealth (income) effect, as for example, increased export prices imply, *ceteris paribus* an increase in income for exporting countries. Thirdly, there is a pure substitution effect from relative price changes within and between periods.

V. ECONOMETRIC METHODOLOGY

There are two approaches that one could take in deriving surprise and expected forms of variables. On the one hand, one could use a maximum likelihood approach. A systems approach, however, is prodigal of degrees of freedom, an important consideration in small samples such as the present one. We therefore adopt the second approach - the well known Barro two-step method where, in the first stage, expected and unexpected components are proxied by the fitted values and residuals from auxiliary Vector Autoregressions (*VARs*). These proxies are then used in the second stage, the surprise model. All models are run using OLS.

The *VAR* system can be written as

[10] It is interesting to note that the Error Correction Model is not incompatible with an optimising approach. Muellbauer and Bover (1986) have shown that an Error Correction Model is consonnant with utility maximisation under liquidity constraints. One can conceptualise these liquidity constraints as giving rise to a partial adjustment process as inherent in an *ECM* formulation.

$$H_t = B\Gamma_{t-1} + v_t \tag{11}$$

where H_t is a vector containing q_t as elements. Γ_{t-1} contains lags on consumption and variables found in z_{t-1}. For generated variables to conform to the notion of rational expectations and genuine 'news' as relevant, it is essential that the auxillary equations exhibit a high degree of predictive power and no significant correlation in the residuals. The two-step procedure outlined above has several well-known advantages over systems procedures: (i) it reduces contamination of the estimated parameters in the 'structural' equation (Equation 9) due to misspecification errors in the forecasting equations: (ii) it is simpler computationally; and (iii) it also has the decided advantage of conserving degrees of freedom. These are in fact the standard arguments for favouring limited information over full information estimation methods.

However, there are some problems associated with the conventional application of the two-step procedure (see Pagan (1984, 1986), Hoffman *et al* (1984), Turkington (1985) and more recently, McAleer and Mckenzie (1991)). Difficulties arise, in particular, due to the non-spherical nature of the disturbance series, which is attributable to the fact that it is a convolution of the true disturbance term in Equation (9) and additional random terms arising from the errors made in using **OLS** fitted and residual series to approximate expected and surprise terms respectively. The standard Ordinary Least Squares estimate of the variance-covariance matrix of parameters tends to understate the true variance. Hence the test statistics in conventional two-step procedures are biased upward, causing a tendency to conclude erroneously that a statistically significant relationship exists. This paper incorporates the correction, suggested by Pagan (1984) for the presence of the generated regressors in the model; Pagan showed that while the standard errors of the coefficients of the surprise variables are correct, standard errors for the coefficients of the expected terms have to be obtained from a Two Stage Least Squares (TSLS) regression that ignores the decomposition of variables into expected and surprise terms and uses the Vector Autoregression (*VAR*) as the first stage.[11]

The recent work on cointegration/ error correction models by Engle and Granger (1987) shows that if consumption and the q variables are related as suggested by the above theoretical arguments, then they should form a cointegrating set. By testing for cointegration, one is allowing the data to determine which theoretically plausuble variables should really be included in Equations 9 and 10. This represents an improvement over arbitrarily choosing the regressors in Equations 9 and 10 as is typically done. Cointegration tests are therefore conducted determine which of the q variables in the baseline specification form a long run equilibri subspace with c.

[11] To identify the system formed by Equation (9) and Equation (11), one must assume that cov (μ_t, v_t) = 0. That is, that transitory consumption, μ_t, is orthogonal to surprises in income and other included variables, v_t. It should also be noted that the surprise consumption function, Equation (9), is observationally equivalent to a model regressing Δc_t on (past consumption), contemporaneous and lagged q variables with simultaneity affecting the q_t variables. A system with both simultaneity and surprises is therefore unidentifiable; the reader, like the author must choose one interpretation or the other - surprises or simultaneity. The surprise interpretation is adopted in this paper as is common in the empirical consumption literature (e.g, Bean (1986); Blinder and Deaton (1985); and Rossi (1988)). Readers preferring the simultaneity interpretation can disregard the coefficients of the surprise terms in Equation (9) and view the other coefficients as **TSLS** estimates of Equation (10) where elements of Γ_{t-1} are used as the instruments in the first stage.

VI. DATA AND EMPIRICAL RESULTS

Data Considerations

Data employed in this study were obtained from the Central Bank of Trinidad and Tobag *Handbook of Key Economic Statistics* and the IMF's *International Financial Statistics (II* Data used are annual observations of government spending, *GDP* and total private consumpt expenditure, all in *per capita* terms and deflated by the consumer price index (1980=1(Ideally, the consumption function should be empirically estimated using a flow measure consumption - expenditure on non-durables plus service flows from existing stocks of durabl rather than total consumption expenditures. As in practice it is very difficult, if not r impossible, to accurately determine service flows from durables, most researchers, particul: in developed countries, have compromised by using expenditures on non-durables alone to pr flow consumption, although this approach too is flawed when durables and non-durables are r separable in utility. The Trinidad and Tobago data do not readily permit this breakdown, so we work with total expenditures.[12]

The income variable used is a measure of disposable income constructed by modify *GDP* in the context of the above theoretical model: rational agents realise that governn spending is eventually payable *via* taxes and thus is not actually available to them as incc Government spending is thus subtracted from *GDP*; the resultant variable is a more accu measure of available income than that obtained by using *GDP* net of current taxes.

We split the real interest rate into its constituent parts: the inflation rate and the nominal of interest to see which variable is more directly responsible for influencing the timin consumption. Casual inspection of the data would suggest that most of the variability in the rate is due to stochastic inflation as the nominal rate of interest has remained fixed for substa periods of time. The "ordinary" savings deposit rate is the nominal rate of interest used; the of inflation was constructed from the consumer price index.

The terms of trade series (1980 = 100) is defined as the ratio of export prices to im prices. The time series on the money variable is taken from line 34 of the *IFS* and corresp to a narrow definition of money. The government deficit variable is defined as the defic *GDP* ratio where a deficit (surplus) is defined as a positive (negative) quantity for convenie We also tried using various debt measures instead of the deficit:income ratio but the 1 provided the best fits. All data were available for the 1955-1990 period.

[12] Forde runs tests using both total consumption spending and spending on durables as her consumption proxies. Non-durable consumption spending was der for the period 1966-1985 by extrapolating survey data showing the breakdown bet spending on durables and non-durables for three survey years. Forde's results not seem to hinge crucially on the precise measure of consumption used.

Empirical tests and Results

All econometric work is done using **Microfit 286 Version 3.0.** All variables are in natural logarithms except for D.[13] The empirical analysis attempts to answer several questions. Do only surprise variables matter in the consumption function as the *polar LCH/PIH* under rational expectations would suggest? Do government variables systematically affect private consumption decisions? Is expected income a key determinant of consumer spending? Is intertemporal consumption responsive to changes in interest rates and inflation? Are the implied steady state values of the consumption:income ratio and the consumption elasticity with respect to income plausible? Is the decomposition of variables into anticipated and unanticipated series informative?

The first step in the empirical analysis was to test for a cointegrating equation by first checking the time series properties of the suggested variables. All were found to be I(1) series by the standard Dickey-Fuller and Augmented Dickey-Fuller test procedures, except for the nominal interest rate which was found to be I(0) with drift. This allows the regression of a levels equation normalised on consumption with income and other q variables as righthand side variables. The standard Dickey- Fuller test showed that consumption, government spending, inflation, the fiscal deficit and income form a cointegrating equation.[14] Results of the cointegration tests are reported in Table A1 in the Appendix.

As noted, expected and unexpected variables are generated using a *VAR* system. These vector autoregressions are reported in Table A2 in the Appendix. Given the cointegration results, those variables which do not form part of the equilibrium subspace are subsequently dropped from Equations 9 and 10; that is, z_{t-1} is set equivalent to lagged q in the consumption equations proper. However, lags on variables not part of the cointegrating set are included as instruments in the *VARs* as they still form part of the information set available to the agent at time t. The *VAR* equations thus contain two lags on c, y, g, D, m and π as well a linear and a quadratic time trend and a constant term. It should be noted that the individual parameters of the *VARs* are of second order importance. The *VARs* pass autocorrelation tests as well as tests for structual stability; this plus the reasonably good fits would suggest that the *VAR* equations are acceptable *prediction* equations.

The fitted values and residuals from Equation 11 are now used to proxy expected and surprise terms in Equation 9. We run both surprise and no surprise versions; the latter are closer to traditional specifications. We started by testing the most simple version of the traditional Hall (1978) model, i.e, $\Delta c_t = \beta_0 + \mu_t$. As expected, this version of the model performed very poorly with an F - statistic of approximately zero.[15] Next, we estimated Equations 9 and 10 with y and lagged y being the only q and z_{-1} variables considered. Results are presented in Table 1 as regressions 1.1 and 1.2, respectively. The implied steady state elasticity of consumption with respect to income is not different from 1 in a statistical sense although as both models fail tests for functional form misspecification, these results cannot be considered as well established. Not surprisingly, F-tests for the inclusion of government spending, the deficit:income ratio and inflation were significant in both the surprise and no surprise case. Clearly, the more general model warrants attention at this stage.

The next step in the analysis is to investigate the role of other q_t and z_{t-1} variables in predicting the first difference of consumption. Based on the cointegration results, the focus is on current and lagged series on g, D and π. Results are stated in Table 2. To test the robustness of the cointegration results, current and lagged values of m, tot and i were also added, singly and jointly, to the regressor sets of the expanded surprise and no surprise models. In no case were any of these additions significant, lending further support to the modelling procedure adopted herein and the guidance provided by the cointegration tests.

While these expanded regressions are marked improvements over the simple consumption functions of Table 1, most of the lagged terms are insignificant in regression 2.1a and 2.1b. There is evidence of some multicollinearity and some of the lagged terms seem to convey much the same information as the corresponding expected terms. Consequently, one must be careful in dropping insignificant regressors from the regressions in Table 2. The preferred specifications were determined by a judicious application of F-tests of restrictions and non-nested model tests.[16] The chosen no surprise and surprise models are presented in Table 3. Some slightly different specifications are presented in Table A3. Some slightly different specifications are presented in Table A3. We also test the hypothesis that only surprise variables should be included in the consumption function, regression 3.2a. This hypothesis is strongly rejected by the data; a joint F-test for the inclusion of expected variables was highly significant - $F(4,25) = 7.72$, compared with a tabulated value of 4.18 at the 1 % level.

The regressions in Table 3 (and Table A3) provide an improved fit of the data. Standard errors fall by some 30 % compared with regressions 1.1 and 1.2; R^2 rises from around 0.60 to over 0.80. Variables are generally significant at the 1 % level. These models satisfy a host of

[13] Using logarithms for the interest rate and the rate of inflation is convenient in that it avoids the need for interaction terms to allow all the coefficients to depend, for example, on the interest rate (Blinder and Deaton, 1985).

[14] The cointegration tests proceeded as follows: firstly, we included all candidate variables in the cointegrating vector; secondly, we omitted all insignificant regressors. This general-to-specific strategy led to a finding of cointegration at conventional levels of significance between c, y, g, π and D. The effects of *tot* are probably subsumed in the income term. The inclusion of D in the long-run equation is justified on these grounds: even though it is theoretically more acceptable to assume that the deficit is not sustainable in the steady state equilibrium, if we interpret the cointegration equation as a long-run equation in the temporal sense, then clearly there can be a long term relationship between c and D.

[15] We also estimated Equation 8, replacing the expected interest rate by the anticipated inflation rate. This model too failed diagnostic checks.

[16] Details of these and other tests are available from the author on request.

model diagnostic checks for serial correlation,[17] normality of regression residuals, heteroscedaticity and functional form misspecification. In addition, the regressions in Table 3 and Table A3 satisfy stability checks, passing the Cusum and Cusum-squared tests. Plots of actual versus fitted values show that the regressions mimic the data rather well, especially since 1965, tracking many of the sharp movements in *per capita* real consumption expenditures (see Figures 3 and 4 below).

Table 1 **Simple Consumption Functions**

Regressors	Regressions*	
	No Surprise 1.1	Surprise 1.2
Constant	-0.077 (1.33)	-0.075 (1.18)
c_{t-1}	-0.433 (4.81)	-0.452 (4.43)
y_t	0.247 (2.02)	-----
y_{t-1}	0.184 (1.08)	0.256 (1.07)
y_t^e	-----	0.191 (1.08)
y_t^u	-----	0.299 (1.65)
R^2	0.62	0.62
F()	16.82	11.90
S.E	0.068	0.070
D.W•	2.38	2.36
LM[]	1.49	1.34
ARCH[]	0.45	0.50
NRM[]	1.58	0.57
RR[]	8.07	7.36
HET[]	0.03×10^{-3}	0.03
σ	1.00	0.99

* Dependent variable is Δc_t.

Note: Sample period is 1955-1990. S.E is the regression standard error, R^2 is the coefficient of multiple determination, RR[F(1,k+1)] is Ramsey's Reset test using the square of the fitted values, LM[F(1,k+1)] is a Lagrange Multiplier test of residual corelation, F(k-1,T-k) is the F-test for the overall significance of the regression, NRM[$\chi^2(2)$] is the Bera-Jarque (1980) test of normality of the residuals, HET[F(1,T-2)] is a test of heteroscedasticity while D.W is the Durbin-Watson "d" statistic. σ is the steady state elasticity of consumption with respect to income. It is calculated by adding the direct effect *via* income and an indirect effect based on the assumption that government spending has a unit income elasticity. k is the number of regressors, including the constant; T is the number of observations. The standard errors of the expected variables have been derived from a **TSLS** regression in line with the Pagan (1984) critique. *t*-statistics are in parentheses.

• The D.W statistic should be interpreted with caution as c_{t-1} is used as a regressor when $(c_t - c_{t-1})$ appears as the dependent variable.

[17] Tests for serial correlation up to order four were conducted in addition to the usual test for first order autocorrelation. No hint of significant serial dependence was detected.

Table 2. **Expanded Consumption Function**

Regressors	Regression*			
	No surprise		Surprise	
	2.1a	2.1b	2.2a	2.2b
Constant	0.033 (0.24)	0.092 (0.76)	-0.002 (0.01)	0.207 (1.32)
c_{t-1}	-0.763 (4.63)	-0.939 (4.90)	-0.785 (4.52)	-0.973 (4.41)
y_t	0.320 (2.80)	0.542 (4.25)	-----	-----
y_{t-1}	0.079 (0.53)	0.036 (0.18)	-0.007 (0.03)	-0.139 (0.47)
g_t	0.190 (2.00)	0.065 (0.68)	-----	-----
g_{t-1}	0.065 (0.64)	0.151 (1.60)	0.132 (1.08)	0.123 (1.11)
π_t	-0.056 (2.90)	-0.039 (2.26)	-----	-----
π_{t-1}	-0.024 (1.14)	-0.008 (0.41)	-0.021 (0.93)	-0.007 (0.33)
D_t	-----	1.172 (3.38)	-----	-----
D_{t-1}	-----	-0.253 (0.60)	-----	-0.576 (1.10)
y_t^e	-----	-----	0.422 (2.55)	0.698 (3.30)
y_t^u	-----	-----	0.134 (0.66)	0.554 (1.85)
g_t^e	-----	-----	0.140 (1.06)	0.096 (0.74)
g_t^u	-----	-----	0.351 (2.05)	0.028 (0.12)
π_t^e	-----	-----	-0.071 (2.65)	-0.022 (0.67)
π_t^u	-----	-----	-0.040 (1.29)	-0.045 (1.64)
D_t^e	-----	-----	-----	1.860 (2.43)
D_t^u	-----	-----	-----	1.07 (1.75)
R^2	0.77	0.84	0.79	0.86
F()	12.57	14.78	8.44	9.16
S.E	0.057	0.049	0.059	0.052
D.W•	1.95	2.01	2.05	2.00
LM[]	0.02	0.07	0.06	0.01
ARCH[]	0.18	0.25	0.16	0.22
NRM[]	2.22	1.04	0.99	0.57
RR[]	3.23	0.65	3.02	0.39
HET[]	0.16	0.46	0.44	0.81
σ	0.86	0.85	0.88	0.80

* Dependent variable is Δc_t. Also, see previous Note to Table 1.

Table 3 Chosen Consumption Functions

Regressions*

Regressors	No Surprise 3.1a	3.1b	Surprise 3.2a
Constant	0.079(0.72)	0.042(0.38)	0.213(1.91)
c_{t-1}	-0.911(6.69)	-0.965(7.14)	-1.014(6.03)
y_t	0.588(8.34)	0.640(10.07)	-----
y_t^e	-----	-----	0.664(6.15)
y_t^u	-----	-----	0.583(3.98)
g_{t-1}	0.190(3.63)	0.198(3.72)	0.155(3.17)
π_t	-0.038(2.40)	-0.044(2.75)	-----
π_t^e	-----	-----	-----
π_t^u	-----	-----	-0.045(1.82)
D_t	1.292(4.49)	1.186(4.14)	-----
D_t^e	-----	-----	2.191(4.21)
D_t^u	-----	-----	1.124(3.16)
D_{t-1}	-0.375(1.56)	-----	-0.625(2.35)
R^2	0.84	0.82	0.85
F()	24.22	27.24	17.32
S.E	0.047	0.048	0.048
D.W*	2.12	1.85	2.12
LM[]	0.33	0.11	0.30
ARCH[]	0.28	1.07	0.01×10^{-3}
NRM[]	0.60	0.86	0.20
RR[]	0.81	0.74	0.17
HET[]	0.37	0.81	1.05
σ	0.85	0.85	0.81

* Dependent variable is Δc_t. Also, see previous Note to Table 1.

To test for structual break, the sample was split at 1973, 1979 and 1982[18] - the first two dates correspond to the first and second positive oil shocks while the third corresponds to the collapse in oil prices. Results of Chow tests indicate no significant structural breaks: for example, for regression 3.1b, the no surprise model, $F(6,23) = 1.02$ (0.89; 0.65) for 1973 (1979; 1982). The 5 % critical value of the test is 2.53. The surprise model, regression 3.2a also satisfied the Chow tests for breaks at 1973 and 1979: the corresponding calculated values were $F(9,16) = 1.14$ (0.65) compared with a tabulated value of 2.54 at the 5 % level. Similar results held for the other models in Tables 3 and A3.

We also tested the various versions of the no surprise regressions in Tables 3 and A3 for predictive accuracy using Chow's second test, by re-estimating the model over the 1955 - 87 sub-period with three observations saved for the tests. The derived test statistics were $F(3,26) =$ (0.86, 1.27) and $F(3,25) =$ (0.86, 0.95) for regressions (3.1d, 3.1b) and (3.1c, 3.1a), respectively, supporting the null of predictive accuracy. It does not make sense to perform a similar check for the surprise model as construction of the *VARs* used in deriving time series of expectational variables necessarily involves using data for the forecast period, thus contaminating the prediction tests.

All the regressions in Tables 3 and A3 can be treated as well specified in a statistical sense. From here on, the analysis focusses solely on these equations. In particular, we focus on the regressions in Table 3, our 'best' regressions.[19] In the no surprise case, income, lagged consumption, government deficit and spending variables and inflation are significant regressors. Simplification of the general surprise model, model 2.2b, led to much the same findings. However, the decomposition of variables into anticipated and unanticipated terms produced some interesting results. Regression 3.2a indicates that both expected and unexpected income are important regressors; the significance of y_t^e contradicts the *PIH/LCH* hypothesis under rational expectations. This finding is common in the literature for LDCs (see Craigwell and Rock (1992a,b); Zuehlke and Payne (1989); Rossi (1988)). However, only unanticipated inflation seems to matter; increases in inflation not forecasted by economic agents serve to depress current consumption. The negative sign obtained may reflect what Deaton (1977) refers to as the 'price confusion effect' whereby consumers mistake movements in nominal prices for movements in real prices when inflation is unanticipated. There are other ways in which inflation may influence the saving-consumption decision: when inflation raises uncertainty regarding future incomes, risk averse individuals may save more (Sandmo (1970)). One may conjecture that

[18] We also split the sample at 1974, 1979 and 1983 as it is difficult to accurately pin down the timing of the break for events that may spill over from one period to another. There was no evidence of a break in either model. There were insufficient data to perform the Chow test for the surprise model for a break at 1982/83, the date of the international oil price collapse which so destablised the Trinidad and Tobago economy. However, the Cusum and Cusum-squared plots provide indirect evidence that the model was stable during this period.

[19] Note that in the no surprise model with g_t instead of g_{t-1}, coefficient values decrease somewhat as does R^2 while S.E increases marginally. However, nothing important in the interpretation of the results change. In the corresponding surprise model, replacing lagged spending by its current expected term left coefficient values virtually unchanged.

unexpected inflation would have a stronger impact in this regard than expected inflation. Additionally, when (non-indexed) long term contracts exist, unanticipated inflation may cause agents to revaluate real labour income downward, over the life of the contract (even if there is no significant change in permanent income). Due to the presence of binding liquidity constraints, current consumption falls adjusting to the decline in real income.

The insignificance of expected inflation in regression 3.2a and the lack of significance of the nominal interest rate in the cointegration equation seem to imply that the role played by the real rate of interest in the intertemporal substitution of consumption is relatively unimportant.

In the several regressions estimated, lagged consumption is always highly significant; this can be thought of as summarising the effects of habit formation. The adjustment toward equilibrium is 90-100 percent *per* year; that is, consumption adjusts to its desired level within the period. This value is close to that previously derived by Craigwell and Rock (1992c) using a somewhat different model and econometric methodology.

Both the expected and surprise components of government deficits influence the timing of consumption. The significance of the unexpected term may reflect the consumer's inability to accurately predict the government deficit. This latter conjecture is not hard to accept despite the annual budgetary announcement process given government's own inability to accurately forecast revenue and expenditure flows as evidenced by the usually substantial divergence of budget estimates and reality. Given the findings of Rock *et al* (1989), these results would indicate that government debt is considered as net wealth of the private sector. Private consumption increases with the current deficit; however, the coefficient on the expected term is almost twice that on the unexpected term. While the lagged deficit variable is marginally insignificant in the no surprise regression 3.1a, it is highly significant in the surprise model and again has a negative effect on current consumption. How do we rationalise these different signs of current and lagged deficits? One posssible explanation is that in the 'short-run', the deficit works directly *via* the alleviation of liquidity constraints on consumption; these direct influences move swiftly through the system. Recall, the unit coefficient on lagged consumption suggests that consumption adjusts to desired levels within the period. In the 'long-run', the negative effect may be felt indirectly *via* an effect on output and income. If the government mismanages (relative to the private sector) borrowed funds extracted from the private sector through deficit financing, this would retard economic growth, *ceteris paribus*. Conceivably, output responds less quickly than consumption in this case. Also, it would take more than one period for the deficit (coupled with, say, foreign exchange problems) to influence the country's creditworthiness and hence negatively affect its output.

As noted previously, current and lagged government spending terms are highly correlated; it is thus difficult to determine the separate influences of each in equations with both lagged and contemporaneous terms. Results are basically the same in both cases (see Table A3). However, non-nested tests suggest a definite preference for the model with lagged g, implying some additional importance over its role in simply proxying for the current terms. Our results therefore suggest that government spending has a delayed influence on consumption. The positive coefficient implies that government spending complements rather than substitutes for private consumption. This result can be explained in the following manner: government outlays are productive inputs in agents' output functions. Government spending can influence consumption over time *via* its role in the provision of health, education and law enforcement services which can positively impact on the marginal productivity and hence the real income of consumers (
Downes *et al* (1990)). Consumption behaviour is thus altered as (labour) income grows alc
a higher time path.[20] Does this imply that the central government in Trinidad and Toba
should increase its spending? Not necessarily. There are costs to increased spending
captured by the model. For example, increased spending financed by deficits may make
country and consumer worse off if deficits are financed by money creation. Depending on
country's ability to earn foreign currency, this may increase the perceived riskiness of the cour
on international credit markets and lead to a binding liquidity constraint in external cap
markets. To the extent that the domestic economy needs foreign currency to pay for consumpt
goods, domestic consumers can be made worse off. Also, in the final analysis, governm
spending subtracts from resources available to the private sector who may be able to m
efficiently perform some transactions now conducted by government. In this case, these ty
of expenditures can actually reduce private welfare.

One further finding is that there seems to be some merit to decomposing variables
anticipated and unanticipated series. Firstly, only the unexpected inflation rate is significar
the surprise model. Secondly, a Wald test for the equality of the parameters of D^e and D^u rej
the null hypothesis of equality at around the 6 percent level.[21]

Thirdly, when we substitute g^e and g^u for lagged g, only g^e is significantly different from z

Another advantage of the Blinder-Deaton formulation is that the steady state value of
average propensity to consume can be explicitly solved for to test whether the regression re
are plausible. The steady state consumption relation implied by regressions 3.1b and 3
respectively, is given by

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[20] A similar finding of complementarity is found for the USA by Blinder
Deaton (1985) and by Craigwell and Rock (1993) for Canada. There is howev
caveat to be applied here: technically, as g_t^e is a linear combination of g_{t-1}
other lagged terms from the *VAR* equations, the presence of g_{t-1} might als
capturing the influence of g_t^e. Indeed, the two variables are highly correla
Consequently, the coefficient on the lagged term may depend in a non-linear fas
on the coefficients on g_t^e and g_{t-1} in Equation 9 as well as the parameter on
lagged government spending variable in the *VARs* for g_t. When g_{t-1} is replaced by
the coefficient on the expected government spending variable is very similar to
of the lagged spending term, again implying a complementary relationship. Howe
the expected term is made insignificant when we include g_{t-1} in the regression.
may suggest that the lagged government spending variable reflects some adjust
lag in the system. It should be noted that the coefficient on the goverr
variable in the long-run cointegration equation is also positive (see Table A

[21] Despite the large differential in the point estimates for g^e and g^u,
standard errors are large enough to raise the marginal significance level of
test. This is essentially a small sample problem. It should be noted that the
statistic may depart from its limiting theoretical distribution in finite sar
and in the case of non-linear parameters.

$$C = 1.04\, Y^{0.66} G^{0.21} e^{(-0.05\pi)}$$

and

$$C = 1.23\, Y^{0.65} G^{0.15}$$

where it is assumed that in the steady state, all variables are perfectly predictable, i.e, $x^u = 0$ and that the government budget must balance. Using period averages of variables, elementary manipulations of the results in Table 3 show that the consumption:income ratio is 0.81 and 0.91 for regressions 3.1b and 3.2a, respectively. If we consider this to be a quantification of the generic theoretical model, $C^* = \alpha Y^*$, underlying the *LCH/PIH* model, then $\alpha = 0.81\ (0.91)$ is quite reasonable (Spanos (1989, p.167)). Recall, upper case letters refer to the untransformed levels of variables. The corresponding steady state income elasticities of consumption are found to be 0.85 and 0.81 which a Wald test shows to be statistically different from unity. This highlights the problems of trying to infer long run properties using short data series.

VII. CONCLUSION

This paper estimates surprise and no surprise consumption functions along the lines of Blinder and Deaton (1985) for the small open economy of Trinidad and Tobago. Both models fit the data well and fulfill many diagnostic criteria for a well behaved statistical model.

The data support the decomposition of variables into anticipated and unanticipated series. Thus, previous attempts at modelling the consumption function for Trinidad and Tobago such as Forde (1988) may have suffered from the omission of dynamics and determinants not part of the traditional simple Keynesian models typically estimated.

Some important findings are: (i) anticipated income is highly significant. This is usually interpreted as evidence of borrowing constraints. Unexpected income is also a significant factor in agents' information sets; (ii) government spending complements private consumption; (iii) government deficits influence consumption both directly and indirectly; (iv) inflation influences consumption only indirectly *via* its role in updating agents' information sets; it would seem that inflation effects account for the perceived effects of the real rate of interest on the timing of consumption expenditures; the nominal interest rate is not a significant factor. In fact, while the real rate of interest forms a cointegrating vector along with c, y, g, and D, the nominal rate is insignificant when added to the cointegrating regression reported in Table A1.

We investigated the role of other theoretically plausible variables but found no support for such additional variables.

How do our findings compare with those of other researchers? Rossi (1988), Zuehlke and Payne (1989) and Craigwell and Rock (1992b) find that expected income is significant in consumption regressions for a wide range of LDCs. Contrastingly, Blinder and Deaton (1985) cannot reject the hypothesis that anticipated wealth and income are irrelevant to growth in US consumption. Craigwell and Rock (1992b) also note that government spending and real interest rates (inflation) are important regressors though not uniformly so for four out of seven Latin American and Caribbean countries.

Econometric research is an iterative process. As such, the above results for a consumption prediction equation should be viewed as another step in the process. Future work on other Caribbean and Latin American countries is needed to see if the Trinidad and Tobago results are more general. The role of openness in influencing consumption and saving behaviour needs further refinement and study.

Finally, it is evident that the Barro two-step method for deriving rational expectations variables is far from ideal. Survey data can provide econometricians with a truer picture of agents' *ex ante* forecasts. However, obtaining such survey data is expensive and little effort has been made by Caribbean authorities in this regard and in these current recessionary times, it may not be possible for economists to convince them to finance the effort.

APPENDIX

Consumer's intertemporal budget constraint

The intertemporal budget constraint of the economic agent in a Small Open Economy can be derived under the following set of sufficient assumptions: (i) a representative, infinite lived economic agent faced with exogenously determined interest rates and prices on perfect domestic and international markets; (ii) perfect capital mobility; (iii) all bonds are single period; government bonds are lump-sum tax financed and interest income is not taxed.

The nominal flow budget constraint of the agent in each period is given by

$$P_tY_t + (1 + I_t)\, P_{t-1}B_{t-1} + (1+I_t^*)\, P_{t-1}^*B_{t-1}^*\epsilon_t = P_tC_t + P_tB_t + \epsilon_tP_t^*B_t^* + P_t\tau_t \tag{1A}$$

where P is the price level, B is the agent's bond holdings and ϵ is the exchange rate. * denotes a foreign variable.

Uncovered interest rate parity together with purchasing power parity and the Fisher conditions imply that $R_t = R_t^*$ and noting that $1 + \pi_t = P_t/P_{t-1}$; $1+\pi_t^* = P_t^*/P_{t-1}^*$ and dividing through Equation 1A by P_t

$$Y_t + [(1+I_t)/(1+\pi_t)]\,B_{t-1} + [(1+I_t^*)/(1+\pi_t^*)]\,B_{t-1}^* = C_t + B_t + B_t^* + \tau_t \tag{2A}$$

i.e,

$$A_{t-1} = [C_t + A_t - Y_t + \tau_t]\,(1 + R_t)^{-1} \tag{3A}$$

where $A_{t-1} = (B_{t-1} + B_{t-1}^*)$, $(1+R_t) = (1+I_t)/(1+\pi_t)$.

By continuous recursive substitution forward, the intertemporal budget constraint is obtained

$$A_0 + \sum_{t=1}^{\infty} (1/\prod_{j=1}^{t} 1+R_j)\,(Y_t - \tau_t) = \sum_{t=1}^{\infty} (1/\prod_{j=1}^{t} 1+R_j)\,C_t \tag{4A}$$

where the transverslity condition that $\lim_{t\to\infty} (1/\prod_{j=1}^{t} 1+R_j)\,A_t \to 0$ has been assumed.

The intertemporal government budget is similarly derived from the period-by-period budget restraint

$$P_tG_t + (1+I_t)\,B_{t-1}^g + (1+I_t^*)\,\epsilon_tP_{t-1}^*B_{t-1}^{g*} = P_t\tau_t + P_tB_t^g + \epsilon_tP_t^*B_t^{g*} \tag{5A}$$

The expression for the government's intertemporal budget restraint is given by

$$F_0 + \sum_{t=1}^{\infty} (1/\prod_{j=1}^{t} 1+R_j)\,G_t = \sum_{t=1}^{\infty} (1/\prod_{j=1}^{t} 1+R_j)\,\tau_t \tag{4}$$

where $F_0 = (B_0^{g*} + B_0^g)$. Substituting for τ_t in Equation 4A yields the economy-wide bu[dget] condition, Equation 4 in the text, where the solvency requirement $\lim_{t\to\infty} (1/\prod_{j=1}^{t} 1+R_j)\,F_t \to$ [0 is] imposed.

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Table A1. **Cointegrating Regression**

		Regressors			
Dependent Variable	Constant	y_t	g_t	π_t	D_t
c_t	0.220 (2.56)	0.542 (9.02)	0.248 (6.71)	-0.039 (2.46)	1.234 (4.85)

$R^2 = 0.98$ CRDW = 1.98 DF = -5. 77

Note: Sample period is 1955-1990. *t*-statistics are in parentheses. R^2 is the coefficient of multiple determination. CRI is the cointegrating equation Durbin-Watson statistic. DF is the Dickey-Fuller statistic with critical value of -4.83 for case of 36 observations and a 5 % significance level.

Table A2. **Vector Autoregressions**

Regressors	Dependent Variables: D_t	y_t	g_t	π_t
Constant	1.146(1.25)	-2.222(2.16)	-5.539(1.14)	0.151(0.42)
Time	0.044(1.76)	0.022(0.80)	0.464(3.49)	-0.015(1.53)
Timesq($x10^3$)	-1.104(2.30)	0.027(0.05)	-6.275(2.45)	0.166(0.88)
c_{t-1}	-0.621(1.65)	-0.280(0.66)	-3.601(1.80)	0.223(1.51)
c_{t-2}	0.061(0.17)	0.613(1.53)	-4.392(2.31)	0.034(0.24)
y_{t-1}	1.466(3.37)	1.207(2.47)	6.263(2.70)	-0.407(2.38)
y_{t-2}	-0.630(1.42)	0.090(0.18)	-0.079(0.03)	0.104(0.60)
g_{t-1}	0.006(0.02)	-0.153(0.48)	-2.524(1.68)	0.098(0.89)
g_{t-2}	-0.119(0.42)	0.099(0.31)	-1.073 (0.71)	0.143(1.29)
π_{t-1}	0.017(0.41)	-0.013(0.28)	-0.209(0.95)	0.003(0.17)
π_{t-2}	0.061(1.64)	0.030(0.71)	-0.249(1.25)	-0.011(0.74)
D_{t-1}	1.215(1.15)	1.408(1.18)	8.010(1.42)	-0.188(0.45)
D_{t-2}	-1.489(1.53)	-1.341(1.22)	4.176(0.80)	0.004(0.01)
m_{t-1}	-0.121(0.38)	0.130(0.37)	2.399(1.42)	0.042(0.34)
m_{t-2}	0.646(2.33)	-0.098(0.31)	3.910(2.65)	-0.241(2.21)
R^2	0.96	0.98	0.84	0.75
F(14,19)	29.31	101.87	7.00	4.03
LM[F(4,20)]	0.79	0.65	0.89	1.66

Note: Sample period is 1955-1990. t-statistics are in parentheses. R^2 is the coefficient of multiple determination. F() is the F - test for the overall significance of the regression; LM[] is a Lagrange Multiplier test for serial correlation up to order four. Time and timesq are linear and quadratic time trends, respectively.

Table A3. **Alternative Estimates of the No Surprise Model, Regression 3.1**

Regressors	Regressions*: No Surprise 3.1c	No Surprise 3.1d	Surprise 3.2b
Constant	0.074(0.63)	0.070(0.60)	0.239(1.94)
c_{t-1}	-0.772(6.59)	-0.807(7.74)	-0.973(6.00)
y_t	0.482(6.84)	0.501(7.82)	-----
π_t	-0.035(2.11)	-0.039(2.50)	-----
g_t	0.170(3.14)	0.182(3.61)	-----
D_t	1.036(3.38)	0.973(3.36)	-----
D_{t-1}	-0.185(0.70)	-----	-0.403(1.48)
y_t^e	-----	-----	0.603(5.67)
y_t^u	-----	-----	0.583(3.93)
g_t^e	-----	-----	0.164(2.54)
π_t^u	-----	-----	-0.045(1.80)
D_t^e	-----	-----	2.063(3.88)
D_t^u	-----	-----	1.124(3.12)
R^2	0.83	0.82	0.84
F()	21.90	26.65	16.88
S.E	0.049	0.048	0.048
D.W*	2.25	2.12	2.16
LM[]	0.92	0.19	0.49
ARCH[]	0.01	0.20	0.14
NRM[]	0.27	0.22	0.13
RR[]	1.36	1.87	0.58
HET[]	0.29	0.32	0.41
σ	0.84	0.85	0.79

* Dependent variable is Δc_t.
Note: See previos Note to Table 1.

FIGURE 1: Annual Growth Rates of Real Per Capita GDP and Consumption

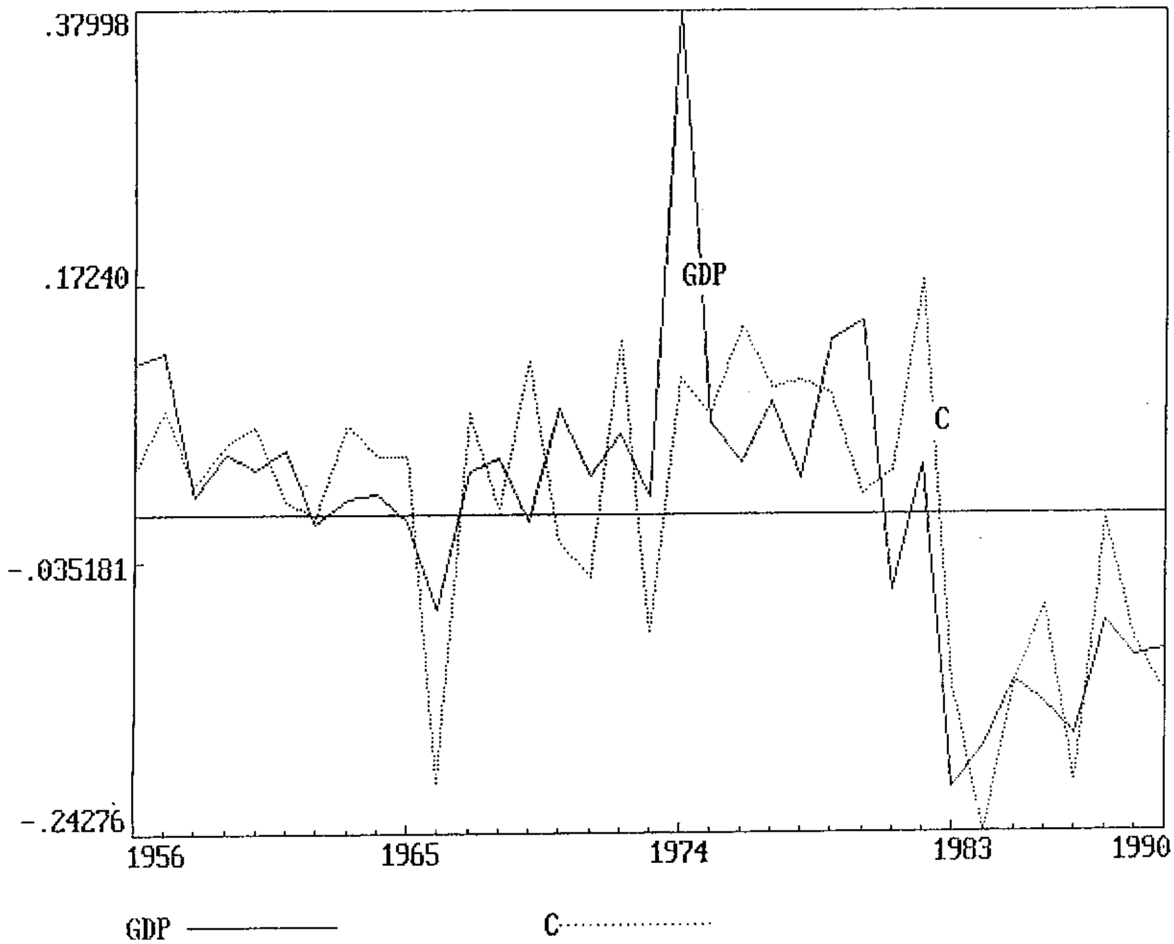

FIGURE 2: Nominal Interest Rate (I), Real Interest Rate (R) and Inflation Rate (PI)

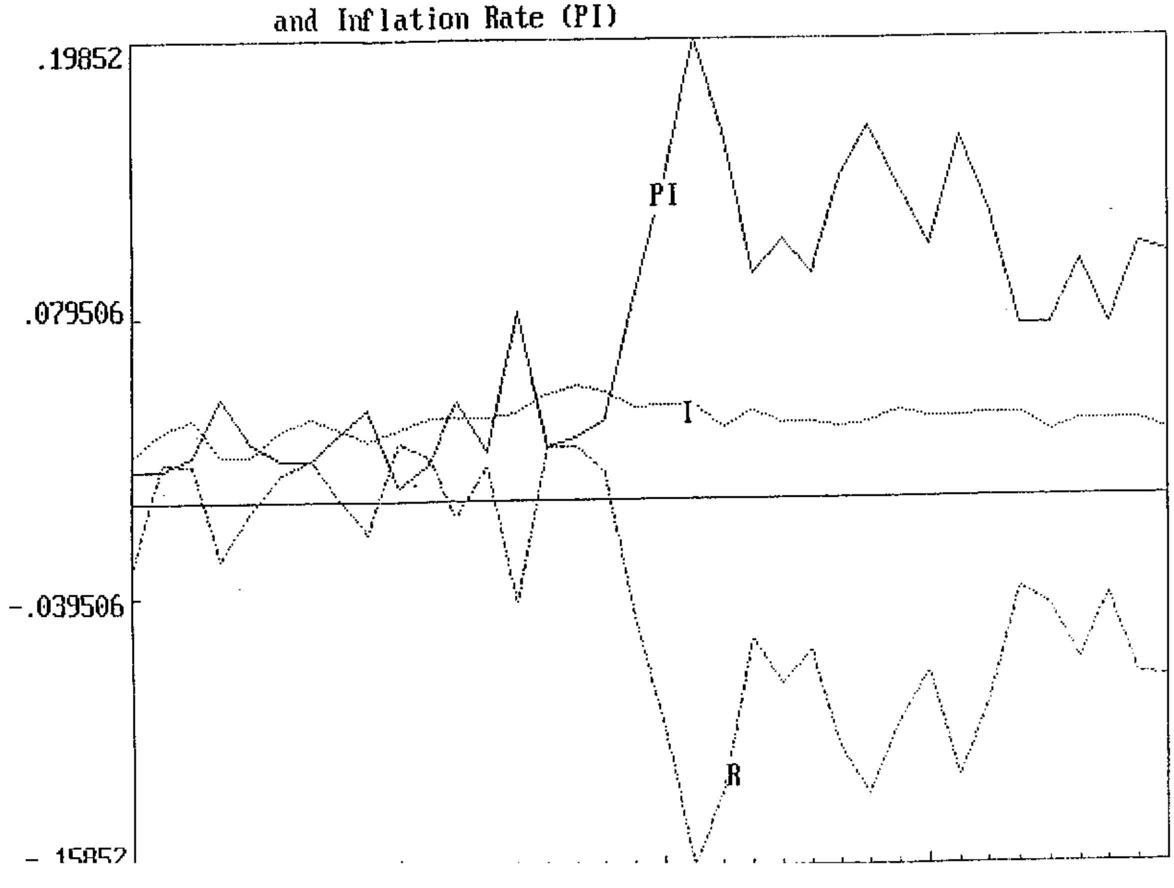

FIGURE 3: Plot of Actual versus Predicted Values for Model 3.1b

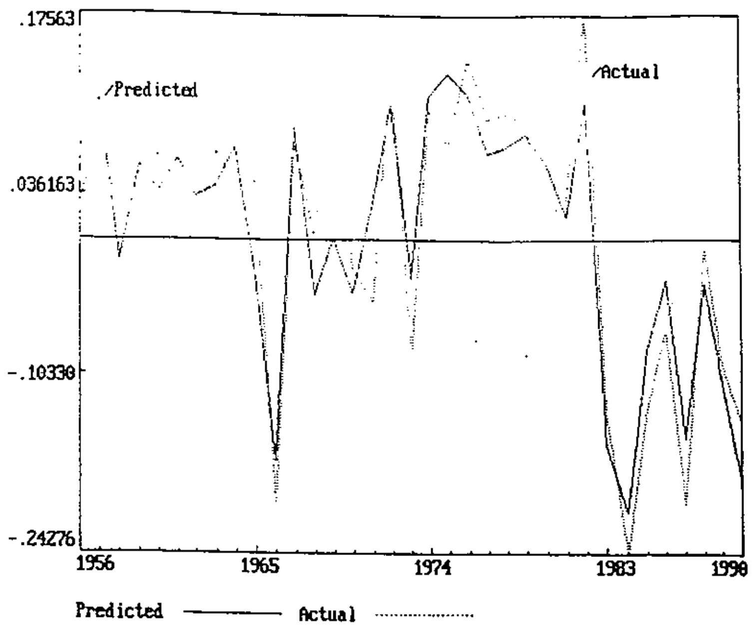

FIGURE 4: Plot of Actual versus Predicted Values for Model 3.2a