EVALUATING THE RATIONAL EXPECTATIONS-PERMANENT INCOME HYPOTHESIS: EVIDENCE FROM CARIBBEAN COUNTRIES

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INTRODUCTION

As the recession in the world economy of the early 1980s continues to have its repercussions on the rates of growth in Less Developed Countries (LDCs), governments have been responding with a variety of policy measures aimed at stabilising the macro-economy[1]. Several of these policy actions have been explicitly aimed at influencing domestic consumption and saving in desired directions. The rational expectations-permanent income hypothesis (hereafter REPIH) casts serious doubts on the efficacy of short-run stabilisation policies, for example, temporary income tax cuts, which operate *via* changes in consumption. In fact, the hypothesis suggests that any policy aimed at influencing the time path of current income would affect current consumption only to the extent that it signals changes in permanent income. Further, only *new* information about taxes and other policy instruments can affect permanent income (Hall (1978)). The REPIH thus denies the empirical relevance of the Keynesian multiplier and challenges the conventional view which assumes that consumers are largely passive agents in the policy game, responding to policy induced changes in current income with only a slight lag. Hence, if the REPIH holds as a decent first approximation of reality, then little hope is held out for the success of such (systematic) stabilisation efforts. If on the other hand the REPIH does not offer an accurate enough description of consumer behaviour, say, because a large enough segment of the population is constrained by imperfect capital markets, then under *some* circumstances, systematic (short-run) stabilisation policy which operates *via* consumption can be effective whether such policies are anticipated or not; government can manipulate aggregate demand even in a world of essentially rational, forward-looking individuals (see Hayashi (1982)). Identification of any factors which cause the data not to accord with the empirical predictions of the REPIH may offer valuable insights into the possible scope for policy action available to government.

This paper investigates the empirical relevance of the permanent income - life cycle hypothesis under rational expectations within the context of the small open developing economies of the Caribbean region. Generally, little work has been done on testing the REPIH's validity in LDCs; our research was unable to unearth studies of the REPIH for the Caribbean and only a few studies which dealt with the general subject of private consumption behaviour. This study thus attempts to fill this perceived void in the empirical Caribbean literature.

Section II of the paper notes some of the common objections to the permanent income hypothesis within the context of LDCs and provides a brief assessment of the empirical success of the hypothesis. The empirical methodology is presented in Section III. The empirical tests and results - based on data for four Caribbean economies - are reported in Section IV. Finally, conclusions are made.

II. ASSESSMENT OF THE REPIH

The permanent income hypothesis was formally introduced into the literature by Milton Friedman in his seminal paper of 1957. Working within an explicit permanent income framework and using the adaptive expectations mechanism, Friedman showed that current consumption could not be considered as simply a positive function of contemporaneous income: current consumption depends not only on current income but also on future income as embedded in the notion of permanent income. Friedman's pioneering work was expanded upon by Hall (1978) who combined the theory of rational expectations with the permanent income - life cycle theory of intertemporal optimisation of consumption to derive strikingly simple and testable predictions of the permanent income hypothesis. Specifically, by making the following set of assumptions: (i) the representative agent maximises an intertemporal utility function subject to a lifelong budget constraint; (ii) capital markets are perfect; (iii) expectations are rationally formed; (iv) the real rate of interest is constant over the life cycle and (v) the utility function is quadratic or the change in marginal utility from one period to another is small, Hall showed that consumption follows a random walk with drift. Hall's initial work has opened up the way for the rigorous empirical validation of the REPIH and his original model has since then been extended by such authors as Flavin (1981), Mankiw (1981), Hansen and Singleton (1983), Mankiw *et al* (1985), Bean (1986) and Hall himself (1988).

While the REPIH has come to be generally accepted as providing a theoretically sound explanation of rational, intertemporal consumer behaviour in a market economy, results of real world tests of the hypothesis have been mixed with the weight of the evidence seemingly against the hypothesis[2]. Hall (1978) although reporting results largely favourable to the REPIH noted the predictive significance of stock prices contrary to the REPIH's predictions. Flavin (1981) reported a statistically and quantitatively significant rejection of the Hall model when she allowed Hall's test procedure to depend on the properties of the income process. Since then, the Hall model has been extended to include such 'realistic' assumptions as stochastic interest rates - Mankiw (1981), Shapiro (1984); non-separability of consumption and leisure - Mankiw *et al* (1985); substitutability between private consumption and government expenditure - Bean (1986). These studies, however

all report rejection of the strict overidentifying restrictions of the REPIH model although some evidence to support the basic notion of rational, intertemporal optimising behaviour by consumers was found (for example, see Bean (1986)). Hall and Miskin (1982) and Hayashi (1985) using panel and cross-sectional US data respectively, while finding evidence consistent with some REPIH behaviour reported evidence of a significant fraction of liquidity constrained households contrary to the basic assumptions of the REPIH. Similar rejections of the REPIH were reported for the UK economy by Daly and Hadjimatheou (1981) and Muellbauer (1983), but Bilson (1981) could not reject the hypothesis for the UK or the Federal Republic of Germany.

For the most part, the limited research done on the permanent income hypothesis in LDCs has not tended to operate within an explicit rational intertemporal optimisation framework[3]. Basically, a consumption function of the form

$$C_t = f(Y^P_t, Y^T_t, Z_t) \qquad (*)$$

is estimated where C_t is private consumption, Y^P_t and Y^T_t are permanent and transitory income measures respectively and Z_t are any other determinants thought relevant (see, for example, Laumas and Laumas (1976) and Singh *et al* (1978)). In such tests, whether or not the permanent income hypothesis is supported by the data is determined by the size of the coefficient of Y^T (relative to Y^P). The results of such models cannot, however, be treated as definitive as many questions can be raised about the appropriateness of their measures of permanent income and as Lucas (1976) argues, about the tractability of attempting to model the relationship between consumption, income and interest rates by an equation such as (*).

Given the limited empirical work done on the REPIH in LDCs, most of the objections to the hypothesis have been conducted at the theoretical level. It is often argued that capital market imperfections offer a compelling reason for non-applicability of the REPIH to LDCs. Capital markets in LDCs tend to be embryonic and highly fractured and there may be significant liquidity constraints, for example, due to asymmetric information about creditworthiness which would result in lenders denying loans to prospective borrowers simply on the basis of such observable characteristics as income or collateral[4]. Such individuals are likely to be constrained by current income and assets rather than by life cycle wealth in their consumption decisions. Constrained individuals would react strongly to even transient changes in income contrary to what the REPIH predicts[5]. That this characterisation of consumption behaviour is considered as accurate within the context of LDCs can be easily inferred from Rossi (1988), *inter alia*. However plausible this scenario may be, whether

or not a significant fraction of the population is able to smooth out consumption in the face of (negative) transitory income is nevertheless an empirical issue.

It is also argued that rational expectations demands an unrealistic amount of information on the part of consumers concerning the structure of the economy. While it is accepted that strictly speaking, rational expectations is consistent with any size forecast error as long as such errors are orthogonal, it is sometimes argued that the informational requirements for an agent in small open (and informationally unsophisticated) economies may be sufficiently high that the agent cannot avoid making serially dependent forecast errors due to plain ignorance of the stochastic processes generating key variables. After all, the 'poor' agent in a small open economy not only must keep abreast of domestic variables but also the structure of external demand, interest rates and prices. Myopia, rules of thumb and habit formation may thus be important for at least some individuals.

The above arguments could be so formulated as to suggest that the behaviour of consumers in LDCs would be 'excessively' sensitive to current income; one is of course wary of postulating that a consumer in a LDC is necessarily less rational than his developed country counterpart given that they operate with different information sets.

Despite the acknowledged reasonableness of the above-mentioned objections to the applicability of the REPIH to the Caribbean and other LDCs, little hard evidence exists to support such positions. This paper hopes to provide some evidence -using data from Barbados, Guyana, Jamaica and Trinidad and Tobago - with which to evaluate both the hypothesis and such objections.

III. THE EMPIRICAL FRAMEWORK

The framework used to evaluate the validity of the REPIH i this paper is that developed by Hall (1978) and Flavin (1981)[6] Essentially, it allows the REPIH to be tested via the restriction which the hypothesis imposes on the consumption function and i involves the estimation of both a consumption function and a se of forecasting equations for current income and other determinant which enter the consumption function in expected and 'surprise form. While the generality of the assumptions underlying the Hall Flavin approach may be queried, as Campbell (1987, p 1252) argues the resulting model provides "a simple and tractable representatio of the forward-looking consumption behaviour postulated by the PI and .... may approximate optimal consumption behaviour under mor general conditions". Moreover, this approach is less susceptibl to the Lucas-critique than the traditional method embodied in (' above.

The empirical specifications used are presented below:

$$w_t = AV_{t-1} + \epsilon_t \qquad (1)$$

$$\Delta c_t = \gamma_o + \gamma_1 c_{t-1} + \gamma_2 Ey_t + \gamma_2^* (y_t - Ey_t) + Ex_t \Psi + (x_t - Ex_t) \Psi^* + u_t \qquad (2)$$

where w_t is a vector containing y_t and x_t as elements; y_t is the logarithm of income while x_t contains such variables as the real interest rate and government spending, also in log form. c_t is the logarithm of private consumption. The vector V_{t-1} includes (two) lags on consumption, income and every variable in x_t[7]. E is the expectations operator, Δ is the difference operator and u_t and ϵ_t are white noise error terms. $(y_t - Ey_t)$ and $(x_t - Ex_t)$ denote the relevant 'surprise' terms[8].

Zuehlke and Payne (1989) use a similar framework in their study of the REPIH for eight developing nations. They, however, employ only lagged consumption and income in the generating equation for y and implicitly assume $\Psi = \Psi^* = 0$. The approach adopted herein thus differs in that it permits expected and 'surprise' terms on interest rates and public spending to enter the consumption equation along with the income terms in some of the actual empirical tests. Modern macroeconomics have re-emphasised intertemporal substitution. Yet standard consumption functions often omit the rate of interest as an argument. This implies the view that consumption - and hence saving - is insensitive to the rate of return. However, while there is some evidence to support the view that interest rate sensitivity is apt to be reduced in the presence of liquidity constraints and that such constraints may be pervasive in LDCs, the question of liquidity constraints and significant responsiveness of consumption to interest rate changes is an empirical, sample-specific issue that should ideally be tested for. Government spending can enter the consumption function if economic agents maximise a utility function in which effective consumption is the argument, where effective consumption is defined as a weighted index of private consumption and public expenditures.

The modelling of the expected and 'surprise' variables in Equation (2) can be carried out using the well known two-step procedure first introduced by Barro (1977)[9]. In the first step, the prediction equations for y and x (Equation 1) are estimated then fitted values ($\hat{y}_t$ and $\hat{x}_t$) and the estimated residuals ($(y_t - \hat{y}_t)$ and $(x_t - \hat{x}_t)$) are used as proxies for Ey_t and Ex_t and $(y_t - Ey_t)$ and $(x_t - Ex_t)$, respectively in the second stage regression explaining Δc_t (Equation 2)[10]. For generated variables to conform to the notion of rational expectations and genuine 'news' as relevant, it is essential that auxiliary equations exhibit a high degree of predictive power and no significant correlation in the residuals. Once anticipated and unanticipated series are available, Equation (2) can be consistently estimated by OLS. However, as is

emphasised in Pagan (1984) and in Hoffman et al (1984) there are some problems associated with the conventional application of the two-step procedure. In particular, difficulties arise from the non-spherical nature of the disturbance series, u_t, which is attributable to the fact that u_t is a convolution of the true disturbance term in Equation (1) and additional random terms arising from the errors made in approximating expected and 'surprise' terms by OLS fitted values and residuals, respectively. The standard Ordinary Least Squares estimate of the variance-covariance matrix of the parameters in the second stage regression tends to understate the true variance. Hence the test statistics in the conventional two-step procedure 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 generated regressors; 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 employs actual values while omitting generated terms and uses the Vector Autoregression (VAR) as the first stage.

Returning to the actual test of the REPIH, Flavin (1981) showed that under the REPIH only lagged consumption and unexpected income should be useful as predictors of current consumption. While not specifically identifying the source of the rejection, significance of expected income is interpreted as evidence against the null hypothesis of REPIH. However, 'excess' sensitivity of consumption to income as implied by a rejection of the hypothesis that $\gamma_2 = 0$ is most generally interpreted as reflecting the presence of liquidity constraints (for example, see Bean (1986)). This is the interpretation adopted herein.

As stated earlier, we extend the original Flavin model to allow expected and 'surprise' terms on the real interest rate (r_t) and government spending (g_t) to enter Equation(2). However, significance of Er_t and/or Eg_t cannot be taken as providing evidence against the REPIH as the REPIH can be readily extended to account for stochastic real interest rates and as government spending may legitimately enter the consumption function by substituting for private consumption in utility (Bean 1986)). It is informative to see whether the coefficient of Ey_t in Equation (2) is much altered in the presence of these additional regressors.

IV. DATA AND EMPIRICAL RESULTS

The data employed in this study were obtained from central bank reports and publications of Statistical Offices for the various countries, as well as from the International Financial Statistics (an IMF publication). Data used are annual observations of gross domestic product (GDP), private consumption expenditure and government spending, all in real per capita terms. A real

interest rate variable, defined as the nominal rate minus the rate of inflation plus one,is also constructed. This interest rate should represent the rate on a free-traded asset to satisfy the REPIH assumptions. For Barbados, Guyana and Trinidad and Tobago, a deposit rate of interest is employed. In the case of Jamaica, only a treasury bill rate was available over a long enough period and this rate is used.

Ideally, tests of the REPIH should be done using flow consumption - expenditure on non-durables plus service flows from the existing stock of durables - rather than total consumption expenditures. As in practice it is very difficult if not impossible to correctly determine service flows from durables, most researchers in developed countries have compromised by using expenditures on non-durables alone to proxy flow consumption, although this approach is flawed when durables and non-durables are non-separable in utility. However, the published data in the Caribbean and in LDCs generally do not afford such a breakdown and like the authors, other researchers on consumption behaviour in LDCs have had to utilise total consumption expenditures as the consumption measure. Some comfort can however be taken in the finding that at least for the USA, where the vast majority of the empirical work on the REPIH has taken place, the empirical rejection of the REPIH does not seem to hinge crucially on the exact measure of consumption.

The basic permanent income - life cycle hypothesis theory suggests that consumption depends on current wealth and on current and future expected labour income. However, where separate series on wealth are unavailable, a broader measure based on total income rather than just labour income (which is usually unavailable, anyway) may be preferable as such a measure would encompass an estimate of both wealth and income. Disposable income series are available only for Trinidad and Tobago; to enhance comparability of results we use GDP as our income construct. Initial investigations using the Trinidad and Tobago data would imply that the choice makes no fundamental difference to the results. In any case, the unadjusted GDP variable does have some advantages. Bilson (1981) argues that undistributed corporate profits are a useful substitute for stock price indices as a signal of future income growth. As GDP includes undistributed corporate profits, it may be a more appropriate measure than disposable income in the absence of wealth measures (see Zuehlke and Payne (1989)).

For Jamaica and Guyana, annual observations on all variables are available for the 1960-86 period; for Barbados the data cover the period 1954-88 while for Trinidad and Tobago, the relevant period is 1965-87.

Empirical Results

VARs were fitted for each country to generate expected and unexpected series for income and other variables. The VARs themselves are of only limited importance although care is taken in ensuring that they satisfy the twin Rational Expectations requirements of orthogonal errors and good predictive content. These requirements are met by accepting only formulations which are well fitted and satisfy structural stability (within - sample predictive accuracy) and serial independence conditions. Consequently, lag length and in some cases the elements of the x-vector may vary across countries.

Jamaica

The Vector Autoregressions used to generate 'surprise' and expected variables are reported below in Table J1. Inspection of the VAR system would show that while the overall regressions are extremely well fitted, few individual parameters are significant. However, it should be noted that as the regressor set contains (three) lags on each variable, this finding that few individual coefficients are statistically significant is far from surprising as the resultant multicollinearity would tend to confuse the extent to which individual determinants contribute to explaining variation in the dependent variable. In any case, all that is needed for our purpose is a strong prediction equation and significance of individual regressors is of no real interest.

Equations J1 and J2 (see Table J2) report the results of the 'simple' and 'extended' consumption functions, respectively. The expected income term is highly significant in both formulations as is lagged consumption. Coefficient values shift across equations to some extent, although the basic result is preserved. The expected interest rate is also significant in the expanded model and implies a positive elasticity of consumption with respect to the real interest rate[11]. 'News' about government spending matters but not expected outlays. There also seems to be some interaction between government spending and the income variable so that 'news' about government spending may well be reflecting 'news' about income, i.e. permanent income revisions. The sign on the government spending term would suggest that government spending substitutes in utility for private spending in Jamaica. Equations J1 and J2 satisfy model residual diagnostics and exhibit structural stability. The Lucas critique and the REPIH stress the importance of the expected/unexpected variable dichotomy: economic agents are envisioned as reacting asymmetrically to foreseen and unforeseen happenings. Our empirical analysis thus includes an F-test of restrictions to test whether actual rather than anticipated plus unanticipated income (the variable of focus) should enter the consumption equation. This is equivalent to testing that the parameters of 'surprise' and expected income are equal. The

results of the F-test, $F_R(\ \ )$, suggest that actual income could be used.

Guyana

VARs for the income and government spending terms were well behaved but that for the interest rate was rather poorly fitted. As a consequence, the rate of inflation was substituted for the real interest rate in the VAR estimation, results for which are reported as Table G1.

The results of the consumption equations (see Table G2) suggest that liquidity constraints are relevant for private consumption behaviour in Guyana. Results show that consumers react strongly to income 'news' but weakly to 'innovations' in government spending. The expected income and government expenditure variables are both significant; moreover, the coefficient on the expected income term seems robust to the inclusion of additional regressors. The negative sign on the g_t variable indicates substitutability between government outlays and private consumption expenditures. We also experimented with putting inflation in the consumption equation but model diagnostics indicated that while belonging to the information set, inflation had no significant direct impact on consumption growth[12]. Again, the $F_R(\ \ )$ statistic would indicate that actual income could be used instead of entering Ey_t and $(y_t - Ey_t)$ as separate regressors.

Trinidad and Tobago

Table TT1 reports the results for the VAR estimation using two lags on consumption, income, government spending and interest rates. The VARs are well fitted and are structurally stable and free of significant autocorrelation.

In the 'simple' model, both income innovations and forecasts are significant along with lagged consumption. In the 'extended' model, expected income is again significant as is lagged consumption (see Table TT2). Coefficient values do not change markedly across equations for the expected income and lagged consumption variables. However, there again seems to be interaction between the different 'surprise' terms, and none is individually significant. F-tests of restrictions again support using actual income. While the positive sign on the government spending variable implies that such spending complements private outlays, the parameter on the fiscal variable is statistically insignificant.

Barbados

The results for Barbados highlight the perils of doing empirical work with Caribbean data which are so often imprecisely measured. The Barbados consumption equations were not well defined

and are reported here for the sake of completeness in the spirit of Leamer (1978).

The VARs for Barbados are themselves well specified and meet the conditions for good rational prediction equations. The poor consumption function results therefore hint strongly at problems with the consumption measure itself. The VARs for Barbados are reported in Table B1; the government spending variable is however omitted as it tended to make the results even worse.

Downes (1989) has highlighted the problems with doing empirical work on consumption behaviour in Barbados using published data series. Such data are historically derived from as many as five different sources (employing different methods). Downes argues that consumption data entails both systematic and non-systematic measurement error. Moreover, as the method of measurement may have improved over our observation period, this would tend to induce heteroscedasticity in regression results. In addition, given that non-random error is present, this would lead to bias in the estimated parameters and also to inflated variances which would affect tests of significance (see Downes (1989), p 14-17).

The results for the consumption equations are summarised in Table B2. At first glance, the Barbados results would seem to indicate the absence of borrowing constraints. However, further inspection of equations B1 and B2 reveals very low explanatory power of the regressions. Furthermore, as Downes (1989) predicts, the HET [ ] statistic indicates significant heteroscedasticity in the residuals. These basic results did not change when a variety of variables such as inflation and the terms of trade were included in the analysis. It is therefore difficult to conclude anything definitive from these results. The consumption function forms a key part of most macroeconometric models such as the on-going modelling efforts of the Central Bank of Barbados. The above results would indicate that such efforts should proceed circumspectly and with caution.

CONCLUSION

The statistical evidence presented herein would tend to strongly reject the REPIH for all cases except the inconclusive case of Barbados. Generally, the coefficient on the expected income term is highly significant implying the existence of liquidity constraint due to imperfect capital markets. These findings for Caribbean economies are by no means surprising given the underdeveloped nature of Caribbean credit markets. While generalisation of empirical results beyond the range of countries covered in a specific sample is an exercise fraught with peril, it is likely that the finding of liquidity constraints is germane to other Caribbean economies as credit markets in these generally smaller countries are likely to be even more unsophisticated than

those in the more developed economies of Jamaica and Trinidad and Tobago. It is interesting to note that Haque and Montiel (1987), Rossi (1988), Lahiri (1989) and Zuehlke and Payne (1989) have all reported evidence supportive of the pervasiveness of liquidity constraints in a broad spectrum of LDcs. Our results are therefore consistent with those for other LDCs.

The significance of expected income while contradicting the REPIH does not in itself imply that Caribbean consumers are irrational. In the presence of borrowing constraints, even rational forward-looking optimising individuals would react strongly to changes in current income whether such changes are anticipated or not.

The finding of liquidity constraints is potentially important for the conduct of government policy: if such constraints are exploitable by government policy, this would suggest a significantly wider scope for employing credit and fiscal policies in stabilising the macroeconomy than predicted by the REPIH.

Finally, the data do not reject using observed income rather than the expected/unexpected income dichotomy. This lends some validity to the use of a Keynesian-type consumption function as argued by Forde (1987) for the case of Trinidad and Tobago. However, the results taken as a whole would suggest that additional variables such as interest rates and government spending and lagged consumption ought to be considered in empirical tests of a more general consumption function[13]. In any case, conditional on the data set used herein, the results would suggest that the polar form of the REPIH does not fit Caribbean data well and the search is on for a theoretically and empirically satisfactory explanation of consumer behaviour in the Caribbean which encompasses rational intertemporal behaviour within the context of imperfect credit markets.

FOOTNOTES

1. For example, in 1986 Barbados instituted a broad-based tax cut aimed at stimulating both domestic demand and supply. Trinidad and Tobago has also implemented a number of fiscal measures aimed at stabilising the economy.

2. See King (1985) and Deaton (1986) for comprehensive surveys of recent empirical work on the REPIH.

3. Such tests are therefore tests of the Friedman version of the permanent income hypothesis rather than the Hall REPIH model. However, in a recent paper Zuehlke and Payne(1989) employ the Hall-Flavin framework to evaluate the REPIH for eight developing countries.

4. For example, in a study of commercial banking practices in the Eastern Caribbean, McClean (1975) found that individuals were screened by banks on the basis of such observable characteristics as capital ownership, collateral and class (income).

5. However, see Foley and Hellwig (1975) who show that this result does not necessarily obtain in the uncertainty case.

6. The theoretical restrictions of Hall (1978) and Flavin (1981) are obtained from a microeconomic model of consumption choice that makes no economy-specific assumptions beyond those tested under the REPIH null hypothesis. Thus their methodological framework may be applied without revision to LDCs.

7. Dickey-Fuller tests were conducted to ensure that using the log-level form of variables rather than a diffference form accorded with the time series properties of the data. These tests did support a specification in levels for all countries but also indicated that a linear time trend should be added to V_{t-1} for Barbados.

8. Decomposing variables into expected and 'surprise' series is justified as the current value of a variable may have a well-defined role in Equation (2) but additionally, the 'news' contained in any contemporaneously dated variable may cause agents to revise their estimate of permanent income, and thus lead to revisions in planned consumption so that these variables will be correlated with the change in consumption for reasons divorced from their inherent role in the consumption function (Blinder and Deaton (1985)).

complicated 'system' procedures that jointly estimate Equation (1) and Equation (2). Firstly, it is simpler computationally and has the decided advantage in small samples of conserving degrees of freedom. Additionally, the estimated parameters in Equation (2), the consumption function, are less contaminated by specification errors in auxiliary Equation (1). This is, in fact, the standard argument for favouring limited information over full information methods.

10. To identify the system formed by Equation (1) and Equation (2), we must assume that $cov(\epsilon_t, u_t) = 0$, i.e. that transitory consumption (u_t) is orthogonal to the 'surprises' in income and other variables, ϵ_t. It should also be noted that the 'surprise' model, Equation (2), is observationally equivalent to a model regressing the change in consumption on lagged consumption and current levels of income, real interest rates and government spending with simultaneity affecting income, real interest rates and government spending. A model with both 'surprises' and simultaneity is consequently unidentifiable; the reader, like the authors must choose one interpretation or the other - 'surprises' or simultaneity. We adopt the 'surprise' interpretation as is common in the empirical literature. Readers preferring the simultaneity interpretation can disregard the coefficients of the 'surprise' terms in Equation (2) and view the other coefficients as TSLS estimates of Equation (2) (with actual variables replacing expected ones).

11. Changes in real interest rates have both an income and substitution effect on consumption, operating in obverse directions. Thus the sign of Er_t in Equation (2) is *a priori* uncertain although the literature generally takes the intertemporal substitution effect as dominating.

12. Nominal rates of interest have been kept constant in Guyana for many years at a time, so that the vast majority of the variation in real rates is derived from variation in inflation. Using real rates of interest implicitly assumes that nominal interest and inflation have equal but opposite effects on consumption. However, it is possible for inflation to have additional, Deaton (1977)-type 'confusion' effects on consumption quite independently of its role via real interest rates. Our empirical results, however, did not imply any significant role for inflation beyond helping to predict y_t and g_t.

13. Lagged consumption may be thought of as summarising the effect of habit formation.

TABLE J1

Estimates of Vector Autoregressions for Jamaica
Dependent Variables

Regressors	y_t	r_t	g_t
Constant	-0.35(-1.24)	-1.00(-4.77)	-0.13 (-0.47)
c_{t-1}	-0.46(-1.07)	0.19(0.60)	0.45(1.06)
c_{t-2}	-0.15(-0.39)	-0.23(-0.80)	0.36(0.96)
c_{t-3}	0.21(0.69)	0.13(0.58)	-0.60(-1.97)
y_{t-1}	1.39(4.34)	-0.20(-0.82)	0.68(2.16)
y_{t-2}	-0.35(-0.75)	0.60(1.71)	-0.31(-0.66)
y_{t-3}	0.17(0.44)	-1.06(-3.63)	-0.18(-0.46)
r_{t-1}	0.50(1.63)	-0.34(-1.51)	-0.55(-1.83)
r_{t-2}	0.22(0.78)	-0.54(-2.49)	-0.50(-1.77)
r_{t-3}	0.08(0.29)	-0.57(-2.94)	-0.54(-2.12)
g_{t-1}	0.62(1.84)	0.32(1.27)	0.36(1.08)
g_{t-2}	-0.58(-1.51)	0.25(0.85)	-0.27(-0.70)
g_{t-3}	-0.03(-0.09)	-0.63(-2.66)	0.62(1.99)
$\bar{R}^2$	0.93	0.81	0.98
F(12,10)	25.13	8.98	80.84
LM[F(1,9)]	$6x10^{-4}$	3.20	3.05
D.W.	1.96	2.58	2.64

Notes: The numbers in parentheses next to the estimated coefficients are t-statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is the F-test for the overall significance of the regression; LM[ ] is a Lagrange Multiplier test for first order serial correlation and D.W. is the standard Durbin and Watson "d" statistic for serial correlation.

TABLE G1

Estimates of Vector Autoregressions for Guyana
Dependent Variables

Regressors	y_t	g_t	π_t
Constant	0.04(0.09)	0.29(0.44)	0.34(2.04)
c_{t-1}	0.04(0.09)	-0.08(-0.13)	0.02(0.13)
c_{t-2}	0.11(0.27)	-0.01(-0.02)	0.11(0.76)
y_{t-1}	1.09(2.55)	0.38(0.65)	-0.17(-1.11)
y_{t-2}	-0.40(-0.99)	-0.11(-0.20)	-0.02(-0.13)
g_{t-1}	-0.05(-0.31)	0.36(1.51)	0.15(2.43)
g_{t-2}	0.13(0.63)	0.60(2.09)	-0.01(-0.15)
π_{t-1}	0.08(0.09)	-1.01(-0.87)	0.001(0.005)
π_{t-2}	-1.39(-1.49)	0.22(0.18)	0.15(0.47)
$\bar{R}^2$	0.87	0.78	0.62
F(8,15)	19.55	11.30	5.71
LM[F(1,14)]	0.82	0.05	2.32
D.W.	2.02	1.93	2.10

Notes: The numbers in parentheses next to the estimated coefficients are t-statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is the F-test for the overall significance of the regression; LM[ ] is a Lagrange Multiplier test for first order serial correlation and D.W. is the standard Durbin and Watson "d" statistic for serial correlation.

TABLE TT1

Estimates of Vector Autoregression for Trinidad and Tobago
Dependent Variables

Regressors	y_t	r_t	g_t
Constant	-1.96(-1.38)	-6.09(-2.84)	-8.29(-2.20)
c_{t-1}	-0.38(-1.36)	0.81(1.94)	-1.13(-1.53)
c_{t-2}	-0.001(-0.004)	0.29(0.62)	0.13(0.15)
y_{t-1}	1.48(3.44)	0.64(0.99)	2.31(2.02)
y_{t-2}	0.23(0.42)	-0.03(-0.04)	1.26(0.89)
r_{t-1}	-0.05(-0.26)	0.15(0.51)	-0.37(-0.70)
r_{t-2}	-0.30(-1.93)	0.10(0.43)	-0.66(-1.57)
g_{t-1}	0.02(0.11)	-0.81(-3.42)	0.47(1.11)
g_{t-2}	-0.14(-0.70)	-0.03(-0.11)	-0.31(-0.56)
$\bar{R}^2$	0.88	0.62	0.92
F(8,11)	18.26	4.82	27.67
LM[F(1,10)]	2.72	0.23	0.07
D.W.	2.49	2.01	2.03

Notes: The numbers in parentheses next to the estimated coefficients are t-statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is the F-test for the overall significance of the regression; LM[ ] is a Lagrange Multiplier test for first order serial correlation and D.W. is the standard Durbin and Watson "d" statistic for serial correlation.

TABLE B1

Estimates of Vector Autoregressions for Barbados
Dependent Variables

Regressors	y_t	r_t
Constant	-1.80(-1.91)	-0.10(-0.13)
Trend	0.006(0.85)	0.12(1.97)
c_{t-1}	0.29 (1.55)	-0.30(-1.79)
c_{t-2}	-0.19(-1.10)	0.15(1.02)
y_{t-1}	0.47(2.15)	-0.10(-0.51)
y_{t-2}	0.25(1.10)	-0.20(-1.02)
r_{t-1}	0.20(0.88)	0.50(2.36)
r_{t-2}	-0.12(-0.55)	-0.26(-1.33)
$\bar{R}_2$	0.96	0.34
F(7,24)	100.59	3.25
LM[F(1,23)]	0.19	0.80
D.W.	1.89	1.81

Notes: The numbers in parentheses next to the estimated coefficients are t-statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is the F-test for the overall significance of the regression; LM[ ] is a Lagrange Multiplier test for first order serial correlation and D.W. is the standard Durbin and Watson "d" statistic for serial correlation.

TABLE J2

Estimates of the Consumption Equation for Jamaica

Equation J1

$$\Delta c_t = \underset{(-2.87)}{-0.45} - \underset{(-3.67)}{0.76 c_{t-1}} + \underset{(3.62)}{0.65\ Ey_t} + \underset{(1.62)}{0.59\ (y_t - Ey_t)}$$

$\bar{R}^2$ = 0.46 F(3,19) = 5.39 RR[F(1,18)] = 2.27
D.W. = 1.16 LM[F(1,18)] = 2.82 NRM[CHI - Sq(2)] = 1.07
HET[F(1,21)] = 0.001 F_R(1,19) = 0.23

Equation J2

$$\Delta c_t = \underset{(-2.08)}{-0.31} - \underset{(-3.37)}{0.54 c_{t-1}} + \underset{(3.32)}{0.52\ Ey_t} + \underset{(2.49)}{0.39\ Er_t} - \underset{(-1.07)}{0.04\ Eg_t} + \underset{(1.20)}{0.40\ (y_t - Ey_t)} + \underset{(0.52)}{0.25\ (r_t - Er_t)} + \underset{(2.18)}{0.71\ (g_t - Eg_t)}$$

$\bar{R}^2$ = 0.68 F(7,15) = 7.60 RR[F(1,14)] = 0.08
D.W. = 1.91 LM[F(1,14)] = 0.14 NRM[CHI - Sq(2)] = 0.53
HET[F(1,21)] = 0.003 F_R(1,15) = 0.13

Notes: The numbers in parentheses next to the estimated coefficients are t-statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is the F-test for the overall significance of the regression: LM[ ] is a Lagrange Multiplier test for first order serial correlation and D.W. is the standard Durbin and Watson "d" statistic for serial correlation; RR[ ] is the Ramsey Reset Test for functional misspecification; NRM[ ] is the Bera-Jarque normality test and HET [ ] is a test for heteroscedasticity. Standard errors for the expected terms have been derived from a TSLS regression as suggested by Pagan (1984).

TABLE G2

Estimates of the Consumption Equation for Guyana

Equation G1

$$\Delta c_t = \underset{(-0.90)}{-0.19} - \underset{(-2.04)}{0.61 c_{t-1}} + \underset{(2.38)}{0.70\ Ey_t} + \underset{(4.46)}{0.93\ (y_t - Ey_t)}$$

$\bar{R}^2$ = 0.52 F(3,20) = 9.14 RR[F(1,19)] = 1.93
D.W. = 1.42 LM[F(1,19)] = 1.05 NRM[CHI - Sq(2)] = 0.35
HET[F(1,22)] = 0.58 F_R(1,20) = 1.21

Equation G2

$$\Delta c_t = \underset{(-2.15)}{-0.44} - \underset{(-2.07)}{0.54 c_{t-1}} + \underset{(2.19)}{0.65\ Ey_t} - \underset{(-2.32)}{0.15\ Eg_t} + \underset{(3.91)}{0.81\ (y_t - Ey_t)} + \underset{(1.20)}{0.18\ (g_t - Eg_t)}$$

$\bar{R}^2$ = 0.64 F(5,18) = 9.10 RR[F(1,17)] = 0.12
D.W. = 1.86 LM[F(1,17)] = 0.48 NRM[CHI - Sq(2)] = 2.20
HET[F(1,22)] = 1.11 F_R(1,18) = 0.22

Notes: The numbers in parentheses next to the estimated coefficients are t statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is th F-test for the overall significance of the regression: LM[ ] is a Lagrang Multiplier test for first order serial correlation and D.W. is the standard Durbi and Watson "d" statistic for serial correlation; RR[ ] is the Ramsey Reset Tes for functional misspecification; NRM[ ] is the Bera-Jarque normality test an HET [ ] is a test for heteroscedasticity. Standard errors for the expected term have been derived from a TSLS regression as suggested by Pagan (1984).

TABLE TT2

Estimates of the Consumption Equation for Trinidad and Tobago

Equation TT1

$$\Delta c_t = \underset{(-5.39)}{-0.48} \underset{(-6.59)}{-0.62c_{t-1}} + \underset{(6.13)}{1.02Ey_t} + \underset{(2.12)}{0.64(y_t-Ey_t)}$$

$\bar{R}^2$ = 0.70 F(3,16) = 16.08 RR[F(1,15)] = 0.18
D.W. = 2.05 LM[F(1,15)] = 0.03 NRM[CHI - Sq(2)] = 1.32
HET[F(1,18)] = 0.92 $F_R(1,16)$ = 1.10

Equation TT2

$$\Delta c_t = \underset{(-0.41)}{-0.82} - \underset{(-2.98)}{0.69c_{t-1}} + \underset{(1.90)}{0.92Ey_t} - \underset{(-0.71)}{0.17Er_t}$$

$$+ \underset{(0.16)}{0.04Eg_t} + \underset{(0.77)}{0.36(y_t-Ey_t)} - \underset{(-0.47)}{0.10(r_t-Er_t)}$$

$$+ \underset{(0.84)}{0.15(g_t - Eg_t)}$$

$\bar{R}^2$ = 0.69 F(7,12) = 6.97 RR[F(1,11)] = 0.19
D.W. = 2.10 LM[F(1,11)] = 0.23 NRM[CHI - Sq(2)] = 0.12
HET[F(1,18)] = 0.41 $F_R(1,12)$ = 0.65

Notes: The numbers in parentheses next to the estimated coefficients are statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is t F-test for the overall significance of the regression: LM[ ] is a Lagran Multiplier test for first order serial correlation and D.W. is the standard Durb and Watson "d" statistic for serial correlation; RR[ ] is the Ramsey Reset Te for functional misspecification; NRM[ ] is the Bera-Jarque normality test a HET [ ] is a test for heteroscedasticity. Standard errors for the expected ter have been derived from a TSLS regression as suggested by Pagan (1984).

TABLE B2

Estimates of the Consumption Equation for Barbados

Equation B1

$$\Delta c_t = \underset{(1.50)}{1.64} - \underset{(-1.69)}{0.17c_{t-1}} + \underset{(0.91)}{0.10\ Ey_t} + \underset{(1.50)}{0.34\ (y_t - Ey_t)}$$

$\bar{R}^2$ = 0.14 F(3,28) = 2.67 RR[F(1,27)] = 4.41
D.W. = 1.84 LM[F(1,27)] = 0.008 NRM[CHI - Sq(2)] = 0.88
HET[F(1,30)] = 23.19

Equation B2

$$\Delta c_t = \underset{(0.87)}{0.97} - \underset{(-0.94)}{0.10c_{t-1}} + \underset{(0.48)}{0.06\ Ey_t} + \underset{(1.76)}{0.56\ Er_t} + \underset{(1.67)}{0.40\ (y_t - Ey}$$

$$+ \underset{(0.68)}{0.17\ (r_t - Er_t)}$$

$\bar{R}^2$ = 0.20 F(5,26) = 2.53 RR[F(1,25)] = 0.06
D.W. = 1.76 LM[F(1,25)] = 0.08 NRM[CHI - Sq(2)] = 0.85
HET[F(1,30)] = 19.53

Notes: The numbers in parentheses next to the estimated coefficients are statistics; $\bar{R}^2$ is the adjusted multiple coefficient of determination; F( ) is t F-test for the overall significance of the regression: LM[ ] is a Lagran Multiplier test for first order serial correlation and D.W. is the standard Durb and Watson "d" statistic for serial correlation; RR[ ] is the Ramsey Reset Te for functional misspecification; NRM[ ] is the Bera-Jarque normality test a HET [ ] is a test for heteroscedasticity. Standard errors for the expected ter have been derived from a TSLS regression as suggested by Pagan (1984).

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