The Behaviour of Household Consumption Post a Fiscal Shock*

Preliminary Draft

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ABSTRACT

The paper estimates the share of rule-of-thumb consumers in South Africa using theoretical foundations from the *Permanent income hypothesis theory*. This exercise is particularly important due to its relevance in fiscal multiplier debates, more specifically the direction and magnitude of consumption. Our results show that the Rule-of-Thumb consumers or Hand-to-Mouth consumers significantly outweigh consumers who adhere to the Permanent Income Hypothesis theory. Following this, the paper uses a simple Rule-of-Thumb theoretical based model to evaluate our results in the context of fiscal multipliers; with results showing that tax policy shocks and shocks to income is largely dictated by the Rule-of-Thumb consumers.

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1. Introduction

The literature on the magnitude and direction of fiscal multipliers is inconclusive in both the theory and empirical studies. The major debate on this issue involves not only the magnitude, but the direction of individual aggregate demand components that influence output (Ricco & Ellahie, 2012) . One particular aggregate demand component which seems to deter progress on this topic is household consumption. A review of literature shows that theoretically, Real Business Cycle models (RBC), Neoclassical and Keynesian models all reach opposing conclusions with regards to the magnitude and direction of consumption post fiscal shocks. RBC models predict a fall in consumption whereas Neoclassical models predict lower household consumption and lastly, traditional Keynesian models, show a rise in consumption.

Likewise, empirical studies show disparate outcomes in the direction and magnitude of household consumption. A plethora of studies following the structural vector auto regression model (SVAR) à la Blanchard and Perotti (2002) typically find that a government spending shock not only leads to an upswing in output, but also increases consumption in accordance with Keynesian predictions [Fatás & Mihov (200), Blanchard & Perotti (2002), Perotti (2007)]. On the other hand, narrative studies[1], where military events are used as a proxy for exogenous movements in government follow neoclassical predictions where consumption is lowered following a fiscal shock [Ramey & Shapiro, Barro & Redlick, (2009) (1998), Ramey (2011)].

Closer to our shores, the South African study by Jooste *et al* (2013) on fiscal multipliers employs a Dynamic Stochastic General Equilibrium Model (DSGE henceforth) which features household consumption distinguished by Rule-of-Thumb consumers (ROT henceforth) and Ricardian consumers à la Galí *et al* (2007). In this set-up, Jooste & Naraidoo (2015) show that fiscal foresight reduces the impact of a fiscal policy on consumption and output, however, it is outweighed when there is a large number of ROT consumers (i.e. $\lambda > 0.8$)The level of foresight in the Galí *et al* (2007) study which derived from distinguishing the households is obtained directly from Mankiw & Campbell's (1989) study on consumption and the *Permanent Income Hypothesis* in the United States. Devoid of literature akin to Mankiw & Campbell (1989), Jooste *et al* (2013) assume a ROT parameter of 0.1, 0.5 and 0.8 respectively. To delineate further on the assumption made, the aforementioned authors cite lack of literature on the subject in South Africa as their motive for these choices.

For this study, I identified two areas where I can contribute to South Africa literature. The first contribution relates to supplementing literature in empirical time-series consumption analysis in necessary to extract a ROT consumers parameter. The second contribution aims at meaningfully expanding on the understanding of the importance of the ROT consumers in fiscal multipliers studies with emphasis on the behaviour of consumption. The rest of the paper is as follows: In the next section, I review literature on the empirical estimation of ROT consumers, and the effects presented in Galí *et al* (2007). In section 3, I outline the econometric specification which mimics Campbell & Mankiw (1989)'s study of Permanent Income Hypothesis ("PIH") and how they obtained their ROT parameter. Section 4 I present the results, including robustness checks in line with literature. And to sum up, in section 5, I put forward the Bayoumi & Sgherri (2006) model for a comprehensive analysis on the implications of the estimated parameter in the determination of fiscal multipliers.

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[1] Case study approach as denoted in most literature which focuses on identifying exogenous fiscal shocks by studying government legislative documents and "news" information.

2. Literature Review

The idea of ROT consumers and Ricardian consumers' dates back to the consumption studies of Modigliani and Brumberg (1954) who studied the choices households made with regards to savings and consumption. They concluded that households decide on how much they want to spend their income at each stage in their lives, limited only by the resources available to them. The latter notion which introduced future expectations in household consumption led to Friedman's (1957) *permanent income hypothesis* theory. The theory states that the consumption decisions that households make are largely determined by changes in their permanent income, rather than changes in their temporary income. Hall (1978) formalized this idea by taking into account a concave utility curve, showing that consumers smooth their income over time. Flavin (1981) expands this proof to accommodate future expectations. The above can be represented by a simple representation as follows:

Following the Euler equation:

$$\beta(1+r)E_t u'(c_{t+1}) = u'(c_t) \dots\dots\dots\dots\dots\dots\dots. (1)$$

And working from the budget constraint,

$$a_{t+1} = (1+r)a_t + y_t - c_t \dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where a_t is the consumer's asset holding at time t. y_t is the stochastic labour income. r is market interest rate in a one period bond. $\beta \in (0,1)$ is the consumer's discount rate where $\beta \equiv \frac{1}{1+\rho}$ and ρ is the discount rate.

Assuming,

$$\beta(1+r) = 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

And a *linear marginal utility*[2], for simplicity sake, the Euler equation becomes:

$$E_t u'(c_{t+1}) = u'(c_t) \dots\dots\dots\dots\dots\dots\dots. \dots\dots\dots\dots\dots (4)$$

Applying Jensen's equality on equation (4), gives:

$$u'(E_t c_{t+1}) = E_t u'(c_{t+1}) = u'(c_t) \dots\dots\dots\dots\dots.... (5)$$

This immediately leads to Hall's (1978) results that shows that consumption is a martingale,

$$E_t C_{t+1} = C_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. \dots (6)$$

And since the expected value of consumption differs from its realization, the above can be rewritten as:

$$c_{t+1} = c_t + \eta_{t+1} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. (7)$$

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[2] A quadratic function of the form $u(c_t) = -(\gamma - c_t)^2$ is often used.

Where $E_t\eta_{t+1} = 0$ and η_{t+1} is iid. Equation (8) simply states that consumption is a random walk.

Iterating the budget constraint, and using a no *Ponzi* game condition, we can show that the PIH can be stated as

$$c_t = r(a_t + H_t) \equiv y_t^P \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where $H_t = \frac{1}{1+r}\sum_{j=0}^{\infty}\left(\frac{1}{1+r}\right)^j E_t y_{t+j}$ represents human wealth, the consumer's expected future ear nings and a_t is the financial wealth. y_t^P is the consumer's permanent income.

Campbell & Mankiw (1989) proposed an empirical model where consumption is dictated by consumers who follow equation (8), and those who only consume their current income. Consumers who follow the PIH own assets and earn wages from labour for consumption, whereas consumers whom do not follow the PIH, are myopic in nature, they simply consume all their income each period. The model, which will be outlined below, proposes an alternative characterization of time series on consumption, income and interest rate, and suggests that data is generated by two types of consumers, ROT consumers and Ricardian consumers. This debunks the general idea of Hall (1978) that consumption is a martingale process. The study finds a strong connection between current income and consumption, with the estimated ROT parameter of 0.5, which provides evidence of ROT consumption behaviour.

The next question would be why this share of consumers matter fiscal policy decisions. A paraphrase from Galí *et al* (2007) summarizing their importance is as follows: *A positive government shock leads to a demand shift for firms, as a result allowing firms to sell goods at unchanged prices. For the short run, the only way to raise output is by hiring more workers, most preferably from ROT consumers who have an inelastic supply of their labour. At the same time, the optimizing consumers will increase their labour as a result of the wealth effects that will be affected by taxes financing higher fiscal spending. How the hiring of labourers will affect the real wages will depend on the size of the shift in the labour supply and the slope thereof. So, if the size of the labour supply is dominant, real wages will react positively and therefore consumption will increase*. Evidence of this is shown in Jooste & Naraidoo (2015), who study the impact of high and medium ROT consumers' impact on output and consumption under different ROT shares. They find that as the share of ROT consumers increases, so does consumption and output.

In the next section, I outline the empirical model which follows Mankiw & Campbell (1989), that will show how I estimate the share of ROT consumers in South Africa, and discussion its implications on fiscal policy shocks.

3. Econometric model of Mankiw and Campbell

The Mankiw & Campbell (1989) framework considers a simple economy where there are two groups of consumers with disposable income y_{1t} and y_{2t} respectively. This results in total disposable income represented by $Y_t = y_{1t} + y_{2t}$. The first group, ROT consumers, are allotted a fixed share λ of the disposable income. The second group, Ricardian consumers, receive $1-\lambda$ of the total disposable income. By this rationale, I denote the two income groups as $y_{1t} = \lambda Y_t$ and $y_{2t} = (1-\lambda)Y_t$.

Applying the general principle governing ROT consumers (consumers who spend their full labour income and do not own any assets), the derived consumption equation for them becomes: $C_{1t} = y_{1t}$. Differencing the equation gives: $\Delta C_{1t} = \Delta y_{1t} = \lambda \Delta Y_t$. Ricardian consumers, who are characterised by their expected long term average income, consume their permanent income to generate a consumption function of the form: $C_{2t} = y_{2t}^{p} = (1 - \lambda) y_{2t}^{p}$. Following Flavin (1981) and Hall (1978), differencing this consumption equation results in: $\Delta C_{2t} = \mu + (1 - \lambda)\varepsilon_t$. The μ is a constant, while the consumers' assessment of total permanent disposable income between time $t - 1$ and t is measured by the innovation ε_t. The innovation ε_t is orthogonal to any lagged variable that is in the consumers' information set.

If we assume total consumption is $\Delta C_t = \Delta C_{1t} + \Delta C_{2t}$, then we have:

$$\Delta C_t = \mu + \lambda\, \Delta\, Y_t + (1 - \lambda)\varepsilon_t \dots\dots\dots\dots.(9)$$

In deriving equation (9), I want to estimate the share of ROT consumers given by λ. But note that due to the orthogonality of ε_t to lagged variables, the use of ordinary least squares (OLS) to estimate the equation will generally report an inconsistent estimate of the share in ROT consumers. To clarify the preceding statement, if I assume that $\Delta\, Y_t$ and ε_t are positively correlated, then an upward biased estimate emerges, which produces an upper bound on the true value of λ. And given the general multivariate process of income Y_t, the results will therefore not be true. For a negative correlation assumption, Campbell & Mankiw (1989) show that in a stylized consumption model, a negative relationship does occur, which may result in a negatively biased estimator, with lower bounds on the true value of λ.

To avoid making these assumptions, I resolve the issue by estimating equation (5) using instrumental variables (IV). The choice of instruments can be any lagged stationary variable because they are orthogonal to ε_t and furthermore correlated with ΔY_t. To explain this correlation, suppose a case where $\Delta\, Y_t$ is completely unpredictable, then we have a situation where there are instruments correlated with ΔY_t, however not orthogonal to ε_t . In such an instance, the whole procedure breaks down and Ricardian consumers equal rule-of-thumb consumers.

Equation (5), estimated by IV, can be formulated with a more generalized restricted two variable system where the variables ΔC_t and $\Delta\, Y_t$, are regressed on k instrumental variables denoted by Z_{1t} to Z_{1k} as follows:

$$\Delta C_t = \beta_0 + \beta_1 Z_{1t} + \cdots + \beta_k Z_{kt} + \upsilon_{ct} = Z_t \beta + \upsilon_{ct} \qquad (6)$$

$$\Delta\, Y_t = \gamma_0 + \gamma_1 Z_{1t} + \cdots + \gamma_k Z_{kt} + \upsilon_{ct} = Z_t \gamma + \upsilon_{ct}$$

Permanent-income hypothesis effectively means $\beta = 0$ $(e.g. \beta_1 = \cdots = \beta_k = 0)$. Hence we can try test for the permanent-income hypothesis directly by running the first equation in (6). However, Flavin (1981) showed that it is hard rejecting the permanent income hypothesis in this framework. An IV estimate of the parameter λ in equation (5) is much more useful to understanding deviations from theory and empirics. Therefore we continue the rest of the study with the IV estimation of equation (5).

If there is more than one instrument, equation (5) puts an over-identifying restriction on equation (6). This would mean that the vectors β and γ as well as anticipated changes in consumption and income are proportional, that is $\beta = \lambda\gamma$ or $\frac{\beta_k}{\gamma_k} = \lambda$. I use the Wald test to assess restrictions we place on the IV regression, which we construct by simply adding $k-1$ instrumental variables to the right hand side of our equation.

The correlation between ε_t and ΔY_t in equation (5) also reveals some critical information. For any value of λ, If there is a strong negative correlation between ε_t and ΔY_t, then the R^2 (coefficient of determination) from the OLS regression of ΔC_t on instruments will be lower than the R^2 from ΔY_t's regression on instruments [See equation (6)]. To clarify, Campbell & Mankiw (1989) derived the R^2 for the consumption equation as:

$$\frac{\lambda^2 var(Z_t\gamma)}{(\lambda^2 var(\Delta Y_t))} + (1-\lambda)^2 var(\varepsilon_t) + 2\lambda(1-\lambda)cov(\Delta Y_t, \varepsilon_t). \quad (7)$$

This consumption R^2 is less than or equal to the income R^2 when

$$(1-\lambda)^2 var(\varepsilon_t) + 2\lambda(1-\lambda)cov(\Delta Y_t, \varepsilon_t) \geq 0. \quad (8)$$

Basically the R^2's show that no matter what the value of the share in ROT may be, variation in consumption cannot be highly forecastable if the variation in income is not highly forecastable. Variation in consumption ultimately depends on variation in income, no matter how little. Further interpretation of the importance of the R^2s indicates that a small R^2 for changes in consumption [first in equation (6)] cannot be interpreted as robust evidence in support of the permanent income hypothesis theory. And a small R^2 for changes in income [second in equation (6)] might imply consumption that follows a random walk.

Now that we have outlined the theoretical aspects of the specification, we focus on the choice of instruments. One may select instruments that historically explain the variation of Y_t but this comes with issues. If lagged values of a detrended Y_t are used in the presence of a unit root, this may lead to statistical inference problems (Mankiw and Shapiro, 1986). The univariate time series properties of Y_t resemble a random walk, thus lagged values, despite being valid; do no not always explain a large portion of the variation in income.

One appropriate instrument in this context is lagged consumption, C_t. By the rationality of the PIH theory, consumption, C_t, provides a summary about consumer's expectation of the income process, Y_t. We cannot use non-stationary lagged levels of C_t, however both the permanent-income hypothesis model and our model imply that consumption and income are cointergrated, thus savings, $S_t \equiv Y_t - C_t$, is stationary. As a result, we can use lagged levels of S_t or stationary ΔC_t, which are likely to increase the precision we estimate λ.

But then there are econometric consequences of using lagged levels of the above mentioned variables, S_t, ΔY_t and ΔC_t. The usage of these lagged variables in the unrestricted system will result in an error-correction model (ECM) similar to Davidson and Hendry (1981). Although similar in structure, Davidson and Hendry (1981) interpret their ECM in terms of the disequilibrium adjustment of consumption while our model focuses on the forward-looking consumption behaviour of some consumers. Lastly, there's enough empirical evidence to support adding interest rates as a suitable instruments in this framework (Das et al, 2012; Kahn &Farrell, 2002).

The Campbell & Mankiw (1989) model has several advantages in this framework. Firstly, it can help explain the implicit smoothness of the growth in consumption. This assumption, as studied by Campbell and Deaton (1989) may not be the case because permanent income may be less smooth than measured income of consumers. A second advantage of this model is that if the share of ROT consumers is more than zero, the model will display properties of the results obtained by Flavin's study (1981) which show excess sensitivity of consumption to income.

3.1. Estimation Issues

Campbell & Mankiw (1989) identified issues one might experience during estimation. First, theory indicates that PIH consumers have a utility function which separates expenditure in durable and nondurable goods and services. We proceed with this assumption so that we can use consumption of nondurables as our consumption component. This is binding because the above mentioned utility function allows one to manage nondurables separately without modelling durable goods.

The second issue raised is the use of consumption in this approach. Unless we rescale the data, the coefficient of λ will equal the fraction of income accruing to ROT consumer multiplied by the consumption of nondurable goods and services [$\lambda = y_{2t} * C_t^{non-durables}$]. We solve this dilemma by multiplying our consumption of nondurable goods and services variable with the mean ratio of total consumption by households and consumption of nondurable goods and services. This transformation does not affect the statistical properties of the data, but allows us to preserve the original interpretation of our parameter.

The third issue is that consumption and income appear to be log-linear in nature, thus a transformation of sorts is essential. One approach proposed by Campbell and Deaton (1989) involves dividing the consumption component, C_t and the income component, Y_t with the lagged level of income, Y_{t-1}. A second approach involves taking the log of both consumption and income. One advantage of the latter is that it generalizes cases where interest rates vary or the utility function becomes non-separable. For this study, we will implement both solutions suggested in literature for robustness' sake.

The fourth issue involves the consequences of using quarterly consumption data. This type of data is usually taken as averages rather than data taken at points in time. In this case, if the permanent income hypothesis is true, then measured consumption is the time average of a random walk process. In our case, we interpolated the data[3] linearly to retrieve the quarterly data. Such transformation of low frequency data to high frequency data may have first-order serial correlation. We solve this problem by using twice lagged instrumental variables in our estimation. This is because twice lagged instrumental variables are uncorrelated with time average of consumption random walk variables.

The last issue is the presence of "white-noise" error terms in consumption and income data. We apply remedial action by using twice lagged instrumental variables which will result in the white-noise error terms becoming MA (1), as a result being correlated with once-lagged variables but uncorrelated with twice-lagged instrumental variables. The use of OLS and IV may report consistent coefficients but inconsistent standard errors. We solve this by estimating equations under White standard errors.

[3] We used a constant match-sum to preserve the annual data in the quarterly interpolation.

3.2 Data

For this study, I use a sample period from 1990:1 - 2011:4. Data at quarterly frequency is obtained from the South African Reserve Bank (SARB) for:

- Consumption expenditure of nondurable goods and services, C_t
- Disposable income of households, Y_t
- Savings, which we create using the standard equation, $S_t \equiv C_t - Y_t$.
- Interest rates, i_t

Note that C_t and Y_t are divided by the Y_{t-1}. We use lagged variables of Y_t, C_t and i_t as instruments. The minimum lag we use is two and maximum is six, i.e. $Y_{t-2}, \dots Y_{t-6}$. Savings is only lagged twice as an instrument.

Table 1: Unit roots test

Variable	Augmented Dickey-Fuller	Phillips - Peron
consumption of non-durables I(1)	-3.883865*	-3.954182*
Disposable income I(1)	-3.197080*	-4.445878*
Repo I(1)	-8.490859*	-8.267305*
Savings I(0)	-3.021090*	-4.528368*

** denotes rejection of the null of a unit root at 5% level of significance.*

Augmented dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are reported in table 3. We note that all the variables are integrated of order 1, $I(1)$, with the exception of savings, which is $I(0)$ as a result of the cointegrating relationship between consumption and income. All the variables are stationary at the 5% level of confidence.

3.3 Empirical specifications

To recap on the equations we estimate, firstly, we estimate the permanent income hypothesis equation, specified as equation (5). This will reveal our main parameter of interest, the ROT parameter. We use IV and OLS to estimate equation (5) recover λ :

$$\Delta C_t = \mu + \lambda \, \Delta \, Y_t$$

Secondly, we estimate the restricted two equation system where ΔC_t and ΔY_t are regressed on the instruments, as specified in (6):

$$\Delta C_t = \beta_0 + \beta_1 Z_{1t} + \cdots + \beta_k Z_{kt} + v_{ct} = Z_t \beta + v_{ct}$$

$$\Delta \, Y_t = \gamma_0 + \gamma_1 Z_{1t} + \cdots + \gamma_k Z_{kt} + v_{ct} = Z_t \gamma + v_{ct}$$

From these two equations, we are merely interested in the coefficient of the adjusted R^2. This coefficient will reflect the forecasting power of instruments on the dependant variables.

3.4 The results

Table 2: Estimation results

OLS REGRESSION ON Z				
	Instruments (z)	ΔC_t equation	ΔY_t equation	λ estimate
1	None (OLS)	-	-	0.753476***
2	$\Delta Y_{t-2},\dots\Delta Y_{t-4}$	0.493299*** (0.000)	0.562866*** (0.000)	0.880360***
3	$\Delta Y_{t-2},\dots\Delta Y_{t-6}$	0.480954*** (0.000)	0.555299*** (0.000)	0.876267***
4	$\Delta C_{t-2},\dots\Delta C_{t-4}$	0.649604*** (0.000)	0.337664*** (0.000)	1***
5	$\Delta C_{t-2},\dots\Delta C_{t-6}$	0.732147*** (0.000)	0.357035*** (0.000)	1.374420***
6	$\Delta i_{t-2},\dots\Delta i_{t-4}$	0.008145 (0.2388)	0.112644*** (0.000)	0.494890**
7	$\Delta i_{t-2},\dots\Delta i_{t-6}$	0.074109*** (0.0216)	0.154717*** (0.000)	0.699861***
8	$\Delta Y_{t-2},\dots\Delta Y_{t-4}$ $\Delta C_{t-2},\dots\Delta C_{t-4}$,$S_{t-2}$	0.669546*** (0.000)	0.586860*** (0.000)	0.902714***
9	$\Delta Y_{t-2},\dots\Delta Y_{t-4}$ $\Delta C_{t-2},\dots\Delta C_{t-4}$ $\Delta i_{t-2},\dots\Delta i_{t-4}$ S_{t-2}	0.681065 (0.000)	0.636025 (0.000)	0.871799***

- *Note: figures in square parenthesis denote P-values of the Wald test. * denotes statistical significance at 10% level, ** at 5% and *** at the 1% level*

The statistics in the 3rd and 4th column are the adjusted R^2 from the IV regressions of ΔC_t and ΔY_t. The P-values of the Wald tests that all variables except the constant are insignificant are presented in the parenthesis. These are presented with an asymptotic standard error derived from the imposing White standard errors. The 5th column shows the estimate of the share in ROT consumers, λ, given the restrictions in column2.

From table 4, the OLS regression sans instrumental variables, row one, results in a share of ROT consumers parameter of roughly 0.75. The rest of the rows, two through to nine, report the IV estimation results. As we add instruments, the parameter peaks at 0.90 (row eight), at 1% level of significance. The use of lagged income as an instrument results in modest forecasting power of income change, (row one and two), lamenting the notion that the univariate income process follows a random walk. Rows eight and nine show that the use of several instruments including savings and interest rates forecast consumption better than income. This is evident in the high R^2 statistics in column 3 relative to column 4, suggesting a departure from the permanent-income hypothesis. The use of lagged consumption as an instrument, in rows four and five, supports the permanent-income hypothesis. Since individuals smooth their consumption over time given permanent income, I expect lagged consumption to forecast current consumption better than lagged income. The corresponding ROT parameter of more than 1 is evident of consumers who do not rely on past consumption patterns to make inference about future income, but rather consumers who leverage their consumption by spending their entire labour income and borrowing. The forecasting power of interest rates on consumption is insignificant when a shorter lag length is used. As stated by Smal and De Jager (2001), monetary transmission mechanism may take up to two years to be effective. This may explain the significant forecasting power of longer lags of 2-6, evident in row seven.

The average of the share in ROT consumers estimated in table 3 is 0.87. If I discard the financial constraint instrument, interest rates, thus eliminating any credit channels, I have a ROT parameter of 0.77. We can posit that the share of ROT consumers in South Africa for the specified sample period lies between 77% and 87% or 0.77 – 0.87, Earlier we highlighted that using consumption as an instrument is beneficial because it enables the formation of future income expectation. If this held true, it would support the PIH and thus a larger share of Ricardian consumers in the Economy. However, Our empirical results show that consumption is a poor forecaster of income in this regard, thus providing sufficient evidence for the validity of our inference to depart from any hypothesis of a high Ricardian consumer base for South Africa.

3.5 Robustness

Table 3: Different sample size estimation

OLS REGRESSION ON Z SAMPLE 1970:1 2011:4				
	Instruments (z)	ΔC_t equation	ΔY_t equation	λ estimate
1	None (OLS)	-	-	0.308698***
2	$\Delta Y_{t-2}, \dots \Delta Y_{t-4}$	0.159433 (0.000)	0.332426 (0.000)	0.326164***
3	$\Delta Y_{t-2}, \dots \Delta Y_{t-6}$	0.208211 (0.000)	0.331440 (0.000)	0.365033**
4	$\Delta C_{t-2}, \dots \Delta C_{t-4}$	0.481275 (0.000)	0.076828 (0.001066)	1.767546***
5	$\Delta C_{t-2}, \dots \Delta C_{t-6}$	0.488461 (0.000)	0.072365 (0.004050)	1.574152***
6	$\Delta i_{t-2}, \dots \Delta i_{t-4}$	0.041012 (0.019701)	0.112644 (0.000)	1.344013
7	$\Delta i_{t-2}, \dots \Delta i_{t-6}$	0.034506	0.154717	0.440069

		(0.057433)	(0.000)	
8	$\Delta Y_{t-2}, \ldots \Delta Y_{t-4}$ $\Delta C_{t-2}, \ldots \Delta C_{t-4}$ S_{t-2}	0.497671 (0.000)	0.586860 (0.000)	0.493318***
9	$\Delta Y_{t-2}, \ldots \Delta Y_{t-4}$ $\Delta C_{t-2}, \ldots \Delta C_{t-4}$ $\Delta i_{t-2}, \ldots \Delta i_{t-4}$ S_{t-2}	0.499353 (0.000)	0.636025 (0.000)	0.495025***

- *Note: figures in square parenthesis denote P-values of the Wald test. * denotes statistical significance at 10% level, ** at 5% and *** at the 1% level*

For the first robustness check, I employ a different sample, extending the previous sample to 1970:1 through 2011:4. The results are summarized in table 5 above. The sample change does not affect the general pattern in our framework, but it does decrease the magnitude of ROT consumers towards a share of 0.30 - 0.5. Using a smaller sample, say, 2000:1 to 2011:4, the share of ROT consumers' parameter becomes insignificant and much smaller in magnitude.

Table 4: Logarithmic transformation results

OLS REGRESSION ON Z LOG TRANSFORMATION				
	Instruments (z)	$\Delta\log C_t$ equation	$\Delta\log Y_t$ equation	λ estimate
1	None (OLS)	-	-	0.753476***
2	$\Delta\log Y_{t-2}, \ldots, \Delta log Y_{t-4}$	0.509053 (0.000)	0.562866 (0.000)	0.880360***
3	$\Delta\log Y_{t-2}, \ldots, \Delta log Y_{t-6}$	0.497148 (0.000)	0.555299 (0.000)	0.876267***
4	$\Delta\log C_{t-2}, \ldots, \Delta log C_{t-4}$	0.649994 (0.000)	0.337664 (0.000)	1.440020***
5	$\Delta\log C_{t-2}, \ldots, \Delta log C_{t-6}$	0.725536 (0.000)	0.357035 (0.000)	1.452619***
6	$\Delta\log i_{t-2}, \ldots, \Delta log i_{t-4}$	-0.006768 (0.494532)	0.112644 (0.000)	0.520434*
7	$\Delta\log i_{t-2}, \ldots, \Delta log i_{t-6}$	0.000347 0.419535	0.154717 (0.000)	0.560740***
8	$\Delta\log Y_{t-2}, \ldots, \Delta log Y_{t-4}$ $\Delta\log C_{t-2}, \ldots, \Delta log C_{t-4}$ $log S_{t-2}$	0.665617 (0.000)	0.586860 (0.000)	1.023675***

9	$\Delta\log Y_{t-2},\ldots,\Delta log Y_{t-4}$ $\Delta\log C_{t-2},\ldots,\Delta log C_{t-4}$ $\Delta\log i_{t-2},\ldots,\Delta log i_{t-4}$ $log S_{t-2}$	0.681065 (0.000)	0.636025 (0.000)	0.978519***

- Note: figures in square parenthesis denote probability values of the Wald test. * denotes statistical significance at 10% level, ** at 5% and *** at the 1% level

Table 6 summarizes results from the log transformation of all variables. The transformation distorts the magnitude of the ROT estimate with significantly higher parameters. However, the logarithmic transformation model shows consistency with our initial results with the pattern of a high portion of ROT consumers. Furthermore, consumption as an instrument still has a larger forecasting power on future consumption than income. The U.S. study by Campbell & Mankiw (1989) exhibited similar properties when logs were used for a robustness check. The inclusion of a dummy variable to capture the 2008 recession does not add much to the regression estimation power.

4. Discussion

Now that I have estimated a potential value for the share of ROT consumers in South Africa, I proceed to bring its importance to light. Jooste *et al* (2013) made an assumption about the size of this parameter when estimating their fiscal multipliers. They ran three different variations of the ROT-DSGE model with the ROT parameter set at 0.1, 0.5 and 0.8. After a government spending shock, in the presence of a high share of ROT consumers, 0.8, the results show that consumption tends to increase due to the large response of ROT consumers. For the extreme opposite case, a share of ROT consumers of 0.1, consumption declines. To look closer at this notion, I employ a simplified form of the original Bayoumi and Sgherri (2006) model which solely focuses on ROT consumers. The model incorporates a lifetime cycle for the consumer, which allows consumption to respond less to temporary fiscal shocks and more to persistent shocks (e.g. shocks to income). The impact of fiscal policy shocks on consumption in this model depends on three characteristics: *(i)* persistence of the shock, *(ii)* whether the shock is anticipated or not and *(iii)* the discount wedge (consumer's excess discount with respect to the market interest rates).

4.1. Rule of thumb model

In their model, Bayoumi and Sgherri (2006) break down Ricardian equivalence by assuming ROT consumers in the consumption component. Income is denoted by y , c denotes consumption, r is real interest rate, Δ is the first difference operator and the Greek symbols are the principal parameters. Policy persistence is measured by θ^y. Effectively, If $\theta^y = 0$ then there will persistent shocks to income over time and if $\theta^y = 1$ then there will be a temporary shock to income over time. Bayoumi and Sgherri (2006) assume that all consumers have an infinite life-time with a proportion λ of consumers spending all their income in each period. They allow for two consumption processes. One, an unconstrained full Ricardian consumer who follows a pure random walk model and only responds to unexpected shocks to income

$$\Delta c_t = \frac{r}{r+\theta^y}\varepsilon_t^y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (9)$$

And the second, a ROT consumer who spends all of his/her income:

$$c_t = (y_t - t_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (10)$$

They aggregate equation (9) and (10), resulting in the following consumption function, which they call the *Rule-of-thumb consumption path*:

$$\Delta c_t = \lambda\left(\Delta y_t + \frac{(1-\lambda)}{\lambda}\frac{r}{r+\theta^y}\varepsilon_t^y\right) - \lambda\Delta t_t - \lambda(c_{t-1} - y_{t-1})\ldots(11)$$

Equation (11) predicts that the absolute value of the coefficients of change in income, taxes and error correction mechanisms will be equal. This means that ROT consumers will treat shocks to income, changes to taxes and income equally. From equation (11), a first order condition (F.O.C.) with respect to income shocks shows that an unanticipated shock in income (ε_t^y) will have a theoretical magnitude of $(1-\lambda)\frac{r}{r+\theta^y}$ on consumption. When $\lambda \rightarrow 1$, that is, as the share of ROT consumers increases, the impact of an income shock on consumption increases. ROT consumers are myopic in this model, thus I can that argue that as income increases, ROT workers might be reluctant to substitute their labour with leisure, instead working more hours to accumulate more income as resulting outweighing the impact of a tax shocks as shown in Jooste & Naraidoo (2015).

5. Conclusion and Evaluation

The paper estimated the magnitude of ROT consumers and shed light on its relevance current literature on the effects of fiscal policy in South Africa. This was motivated by the inconclusiveness present in both theoretical and empirical literature brought by the contentious issue of the impact of a fiscal shock on household consumption. One possible reason for this, as we explored in this paper is the fact that a significant portion of consumers do not behave in a forward looking manner i.e. they do not follow the Permanent Income Hypothesis. This is particularly important for the South African case given given the lack of literature on the topic and evidence that suggests that the higher the share the ROT consumers, the more consumption reacts to a fiscal shock

The results show the share of ROT consumers, estimated at approximately 76% to 87%, depending on sample preference and regression instruments. The implications for fiscal policy means that under the Jooste *et al* (2013) model, consumption will react positively, with ROT substituting their consumption and leisure for more work in light of future tax increases. This is supported by Gruen and Garbutt (2004) who notes that higher income earners are less responsive to changes in net wages than low income earners after tax changes, providing evidence of the willingness of ROT to supply more labour when faced with lower income and subsequently lower consumption. To expand on our exercise, paper employed the Bayoumi and Sgherri (2006) model, where we showed suggests diligence in the formulation of tax given a multiplier of less than unity. Conversely though, a government spending shock has the potential to stimulate demand and report multipliers above unity, signifying policy effectiveness.

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