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CONSUMPTION BEHAVIOUR IN ZAMBIA: THE LINK TO POVERTY ALLEVIATION?

Kirsten Ludi [1, 2]

ABSTRACT

In order to be able to suggest viable solutions to the overwhelming problem of poverty on the African continent, it is first necessary to know exactly what is causing that poverty. It is the intention of this paper to measure welfare in Zambia, via an estimated consumption function, and then to compare this estimated consumption to the levels of poverty, or subsistence level consumption expenditure, in Zambia. The objective is to understand the underlying determinants and depth of poverty in Zambia, by analysing the root of the problem – why people can't afford to consume. Aggregate real PCE is estimated in Zambia for the years 1970 to 2001, and it is found that the Zambian economy suffers from a very high MPC. The results also show that the average Zambian is regarded as being extremely poor, spending approximately US$17 on consumption per month, as calculated using the estimated PCE function.

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[2] The author is grateful for the invaluable input of Mr Marc' Ground.

1. Introduction

In order to be able to suggest viable solutions to the overwhelming problem of poverty on the African continent, it is first necessary to know exactly what is causing that poverty. The question then arises: does one estimate a poverty function, including the possible determinants of poverty, or does one estimate a consumption function, since poverty is after all the inability to consume? Appleton (2001) found that the results from poverty functions and consumption functions were overwhelmingly similar, despite the vast differences in their approaches. It is the intention of this paper to measure welfare in Zambia, via an estimated consumption function, which is "arguably the single most comprehensive indicator of ability to meet wants" (Appleton 2001: 435), and then to compare this estimated consumption to the levels of poverty, or subsistence level consumption expenditure, in Zambia. If the case were that the impoverished behave differently in their consumption decisions to the non-poor, it would be ideal to model the actual poverty gap (the difference between a subsistence level of consumption and actual consumption). However, given the fact that the majority of the Zambian population is either poverty-stricken or 'non-rich', it is assumed in this instance that every individual makes consumption decisions similarly. The objective of this paper is to understand the underlying determinants and depth of poverty in Zambia, by analysing the root of the problem – why people can't afford to consume.

Zambia has had one of the most rapidly declining economies in sub-Saharan Africa. A real GDP per capita growth rate of -3.9 per cent in 1998 has improved to a rate of 1.35 per cent in 2002. However, a poverty rate of 73 per cent,[3] of which 58 per cent are extremely poor,[4] and of which over 70 per cent live in rural areas, cannot be masked by positive GDP per capita growth rates (Kapungwe 2004: 487). Section 2 presents an analysis of private consumption behaviour in Zambia over the past three decades, followed by a review of the data and model methodology in section 3. The modelling procedure and estimation results are discussed in section 4. The analysis of the results

[3] 73 per cent of all Zambians live below the poverty line.

[4] 'Extremely poor' refers to individuals living in households with a monthly adult equivalent expenditure of less than 64 475 Kwachas (at 2001 levels), which is equivalent to US$16.83.

and the comparison of consumption behaviour to poverty levels are done in section 5. A conclusion with policy implications in section 6 completes this paper.

2. Background of Zambian Private Consumption Expenditure

Zambia has overall shown a level trend in real private consumption expenditure (PCE) since 1970. As can be seen from figure 1, there was slight growth in real PCE in the 1970s, which was followed by a peak in the late-1980s. A sharp decline in real PCE in the early-1990s followed, from which the economy has not recovered.

***Figure 1**: Real PCE in Zambia in constant Zambian Kwatchas (millions) (1970 – 2001)*

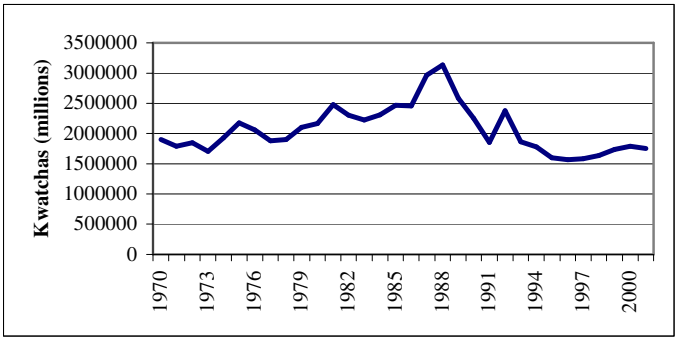


Figure 2 indicates that the increased growth in real PCE in Zambia in the late-1990s contributed to the positive real GDP growth rates of that period. However, the alarming trend is one of decreasing and negative growth rates in the early-2000s.

***Figure 2**: Annual growth rates of real PCE in Zambia (1970 – 2001)*

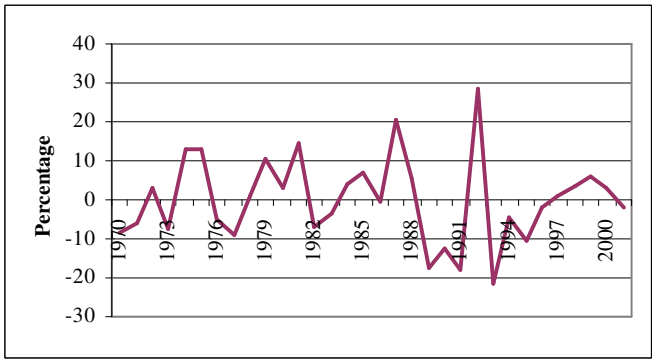
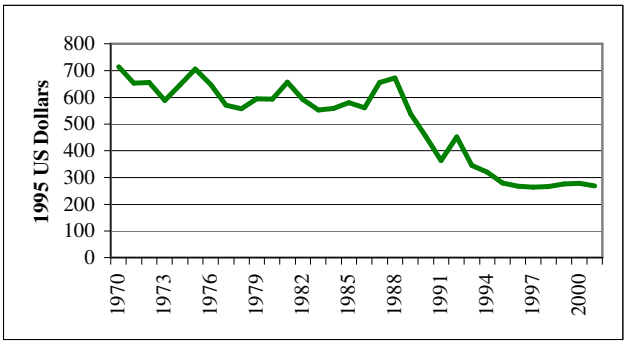


Figure 3 shows the trends in real PCE per capita in US Dollars. The aforementioned has declined at a steady rate, with the only periods of slight augmentation being the early-1970s, the early- and mid-1980s, and the early-1990s. The level of real PCE per capita has remained constant at approximately US$270 since 1995.

Figure 3: *Real Zambian PCE per capita in constant 1995 US Dollars (1970 – 2001)*



The relative high values of real PCE in Zambia in the early-1970s can be ascribed to the 'post-independence boom'. The prosperity of the Zambian economy was largely attributable to increased earnings from mineral exploitation as copper prices climbed. An average increase in real GDP of 2.3 per cent between 1964 and 1974 translated into increased individual incomes and thus increased PCE. However, those very copper prices, along with other external factors, caused an economic decline in Zambia from 1975 to 1990. World copper prices collapsed, and a decline in the quality of the copper ore in Zambia exposed the country's over-dependence on the mineral's extraction. The oil price shocks of the 1970s and the resultant global inflation hit Zambia's consumers hard, and thus diminished real PCE. A worsening balance of payments position was addressed by increased borrowing. Zambia's involvement with various political freedom fighting movements resulted in trade barriers, which further deteriorated the economic situation (Biz/ed 2005).

The sharp decline in real PCE (in levels and per capita) in the latter half of the 1980s was the direct result of the Zambian government's attempt to implement a structural

adjustment program, prescribed by donor organisations, which resulted in food subsidies being cut. However, civil unrest forced the government to abandon this program in 1987 (Biz/ed 2005).

Current PCE levels have declined and remained at low levels as a result of the many interaction effects between Zambia's poorly performing economy, the severely high poverty levels, and the devastating effects of HIV/AIDS in the region.[5] High short-term interest rates (between 25 and 36 per cent) from 1998 onwards also hampered PCE expenditure. Not reflected in the data presented are the PCE figures for 2002. It is expected that this figure will be disappointing due to severe food shortages induced by a bad drought, which has pushed inflation to levels approximated at 20 per cent.

Figure 4 shows the percentage of total consumption expenditure represented by PCE. Consistent with the extremely high poverty rate, and with the low levels of economic development prevalent in Zambia, PCE as a percentage of total expenditure has been at high levels, approximating 85 per cent in 2001.

***Figure 4**: Real PCE as a percentage of total consumption expenditure (1970 – 2001)*

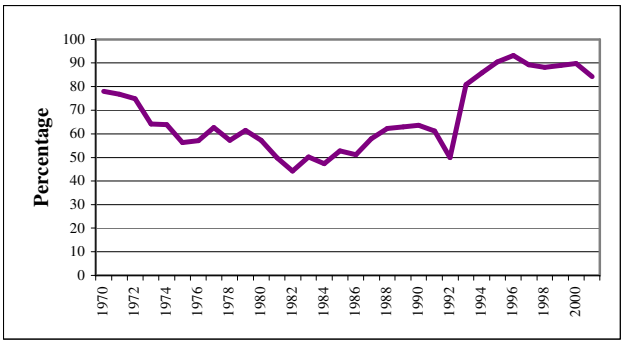
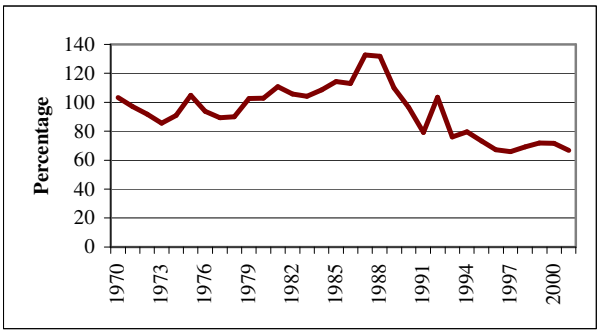


Figure 5 shows the trends in PCE as a percentage of GDP, otherwise known as the average propensity to consume (APC).

[5] Life expectancy at birth is currently 35 years, partly due to an HIV/AIDS adult prevalence rate of 21.5 per cent (CIA 2004).

***Figure 5**: Average Propensity to Consume in Zambia (1970 – 2001)*



The APC in Zambia has remained at high levels during the past three decades, currently at a level of 0.66. These rates are comparable to the industrialised and developed economies of the World, such as the United Kingdom (APC = 0.77), the United States of America (APC = 0.68) and Taiwan (APC = 0.6) (Abeysinghe and Choy 2004: 565). The problem is that the APC in Zambia is not entirely stable: it has declined quite steadily since the mid-1980s – PCE's contribution to output is decreasing over time. This therefore puts into doubt the existence of a built-in stabiliser in the economy. Since PCE is the most stable component of aggregate demand, a decline in its contribution to output implies greater contributions of more variable components, such as exports and investment, which leads to cyclical and volatile output growth (Abeysinghe and Choy 2004: 577). Another puzzling and worrisome aspect of Zambia's APC are the values greater than one that occurred in the 1980s. This seems to be consistent with a subsistence economy in the clutches of extreme poverty.

3. Methodology and Data

In line with approaches followed partly by Hatzinikolaou (1998), Drobny and Hall (1989), and Appleton (2001), and completely by Abeysinghe and Choy (2004), PCE in Zambia was estimated in two ways: the long-run determinants of PCE are estimated according to conventional OLS; and the short-run determinants are analysed according to the approach put forward by Engle and Granger (1987). In the case of analysing whether the poverty-stricken in Zambia are temporarily poor or permanently impoverished, a panel data analysis would be ideal – a case for further research.

In the long run, it is put forward that Zambian real PCE is influenced by real national income (for want of better data on disposable income) and the real short-term lending rates applicable at the time. In other words:

$$\ln C_t = \beta_1 \ln Y_t + \beta_2 r_t \qquad (1)$$

The obvious problem with using equation (1) as the final equation is the problem of non-stationarity. Thus, the data is to be differenced according to its order of integration, and the regression run again:

$$\Delta \ln C_t = \beta_1 \Delta \ln Y_t + \beta_2 \Delta r_t \qquad (2)$$

Equation (2) thus accounts for any short-term disturbances affecting real PCE in Zambia.

The data used to estimate equations (1) and (2) are extracted from the World Bank Development Indicators (TSE). The period under analysis is from 1970 to 2001, and unfortunately no later due to data unavailability. Table 1 below contains a list and description of the variables used in the various steps of the Engle-Granger approach.

***Table 1**: Variables used and descriptions*

Variable	**Description**	**Unit**	**Conversions / Workings**
LN_CONS_ZK	Real private consumption expenditure	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_GDP_ZK	Real GDP at market prices	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm. It was not possible to use disposable income, as would be ideal, due to the absence of any data on personal income tax.
LN_GDP_CAPITA	Real GDP per capita	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_INDTAX_ZK	Net indirect taxes paid	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_INV	Gross domestic investment	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_M3_ZK	Real M3 money supply	Constant 1994 Zambian	Natural logarithm.

		Kwatchas (millions)	
LN_GCONS_ZK	Real general government consumption expenditure	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
R_LENDRATE	Real lending rate	Per cent / annum	Nominal lending rate minus GDP-deflator inflation. Missing data for the year 1991 was calculated using an average annual growth rate formula.[6]
R_TBILL	Real treasury bill rate	Per cent / annum	Nominal treasury bill rate minus GDP-deflator inflation. Missing data for the years 1991 and 1992 were calculated as above.[6]

All of the data used, apart from LN_GDP_CAPITA, is integrated of order one.[7] Due to the fact that GDP per capita is a ratio of two non-stationary series, it is regarded as stationary, and thus is integrated of order zero.

4. Model and Estimation Results

4.1. Cointegration

Cointegration allows for non-stationary data series to be combined into a stationary series through a linear combination. This represents the long-run relationship between the data series. It was found in this case that real PCE in Zambia is dependent in the long run on constant GDP, real short term lending rates and a dummy variable accounting for the sudden and large decrease in PCE in 1992, largely as a result of the 30 per cent increase in short-term interest rates in that period. It is expected using economic intuition that an increase in national income will result in increased PCE and an increase in interest rates should result in less PCE:

$$\ln\_cons\_zk = f(\ln\_\overset{+}{gdp}\_zk, r\_\overset{-}{lendrate}, \overset{-}{dum}\_92) \qquad (3)$$

6 $\left(\frac{LENDRATE_{1992}}{LENDRATE_{1990}}\right)^{\frac{1}{2}} - 1$ and $\left(\frac{TBILL_{1993}}{TBILL_{1990}}\right)^{\frac{1}{3}} - 1$.

7 See Appendix A for the unit root tests of all data used.

The actual coefficients for the regression of equation (1) can be found in table 2.

Table 2: Regression results of the cointegration equation (dependent variable: LN_CONS_ZK)

Sample (adjusted): 1971 2001
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Consistent with Expectations?	Interpretation[8]
LN_GDP_ZK	0.999958	0.001639	610.0092	Yes	An increase in national income will increase PCE. The effect is much larger than that of the other independent variables.
R_LENDRATE	-0.002285	0.000585	-3.903330	Yes	An increase in short-term lending rates will increase the costs of consumption, and thus decrease PCE.
DUM_92	-0.309545	0.038157	-8.112476	Yes	The dramatic decline in PCE in 1992, will have an overall decreasing effect on the aggregate PCE function.
R-squared	0.713131				
Adjusted R-squared	0.692640				

An Augmented Dickey Fuller (ADF) unit root test was performed on the residuals of the cointegration equation, and it was concluded that the residuals are indeed stationary.[9]

4.2. The Error Correction Model (ECM)

The ECM represents the short-term relationship between the data series, and is based on the proposition that a proportion of any disequilibrium from one period can be corrected in the next period. Long-run effects are included in the short-run equation via the lagged residuals of the cointegrating equation (*res_coint*).

Attempts to estimate equation (2) as the ideal short-term situation were statistically fruitless. Thus, other short-run factors were included to be statistically successful and

[8] Due to the non-stationarity of the variables, the magnitudes of the coefficients cannot be stringently evaluated, and the variables may not be statistically evaluated.

[9] See Appendix B for the unit root tests of the cointegrating residuals.

more economically realistic in explaining real PCE. The short-run regression that explains real PCE in Zambia is therefore:

$$\Delta \ln C_t = \alpha\, res\_co\,\mathrm{int}_{t-1} + \beta_1 \Delta \ln Y/capita_{t-1} + \beta_2 \Delta r\_tbill_{t-2} + \beta_3 \Delta \ln M3_{t-2} + \beta_4 \Delta \ln G_{t-1} + \beta_5 \Delta \ln T_t + \beta_6 \Delta r\_lendrate + \beta_7 \Delta \ln Inv_{t-1} \quad [9] \qquad (4)$$

The results of the ECM regression are in table 3.

Table 3: *Regression results of the error correction model (dependent variable: D(LN_CONS_ZK)[10])*

Sample (adjusted): 1974 2001
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES_COINT(-1)	-0.421942	0.109743	-3.844812	0.0011
LN_GDP_CAPITA(-1)	-0.028966	0.009264	-3.126732	0.0056
D(R_TBILL(-2))	-0.002131	0.000498	-4.282284	0.0004
D(LN_M3_ZK(-2))	-0.165104	0.078352	-2.107218	0.0486
D(LN_GCONS_ZK(-1))	0.132035	0.064002	2.062989	0.0531
D(LN_INDTAX_ZK)	-0.251680	0.055979	-4.495959	0.0002
D(R_LENDRATE)	-0.001372	0.000465	-2.950467	0.0082
D(LN_INV(-1))	0.072068	0.039942	1.804303	0.0871
D(DUM_92)	-0.517581	0.065953	-7.847746	0.0000
R-squared	0.863362			
Adjusted R-squared	0.805830			

The coefficients of the independent variables may not be economically evaluated since the variables have been differenced once. However, the variables may be statistically evaluated. The t-statistics of all the independent variables are statistically significant at a 10 per cent level of significance. The adjusted-R^2 value indicates that 81 per cent of the short-run variation in real PCE can be explained by the model. Real PCE in Zambia in

[9] Where: C_t = real PCE; $Y_t/capita$ = real GDP per capita; r_tbill_t = real treasury bill yield rates; $M3_t$ = real M3 money supply; G_t = real government consumption expenditure; T_t = real net indirect tax revenue; $r\_lendrate_t$ = real short-term lending rate; and Inv_t = real gross domestic capital formation, all at time *t*.

[10] D(…) indicates that a variable has been differenced once to remove non-stationarity.

the short-run can thus be explained by: the long run dynamics indicated in table 2; GDP per capita from one period prior; a structural break dummy variable accounting for the sharp and sudden decline in real PCE that occurred in 1992 due to the interest rate shock mentioned earlier; short term treasury bill rates from the previous two periods; real wealth from two periods prior as proxied by the M3 money supply; indirect taxes paid to the government, where the burden usually falls entirely on the consumer; real lending rates; real domestic investment from the previous period; and real government expenditure from one period before. The lags involved make economic sense, as no effects in an economy are instantaneous, but rather take time (lags) to cause adjustments. The only 'surprising' independent variable that affects PCE in the short run is real government consumption expenditure, which incorporates remuneration of public sector employees. Since Zambia is largely a rural agricultural economy, the public sector comprises most of the non-agricultural salary-earners, and thus contributes largely to the 'higher' income class that are larger contributors to PCE. The battery of usual diagnostic tests on the residuals can be performed, with results in table 4.

***Table 4**: Selected diagnostic test results of the ECM of private consumption expenditure*

Test	Test statistic	P-value	Conclusion
Normality			
Jarque-Bera	JB = 0.280	0.869	Residuals are normally distributed
Serial correlation			
Breusch-Godfrey (2)	1.183	0.553	No serial correlation up to order 2
Heteroskedasticity			
ARCH (1)	0.918	0.338	No heteroskedasticity
White (no cross terms)	14.467	0.634	No heteroskedasticity
Stability			
Ramsey reset (1)	0.978	0.323	Stable regression

4.3. Engle-Yoo Third Step

The coefficients from the long-run cointegrating equation are biased and inaccurate due to the fact that they are based on non-stationary time series, and thus cannot be interpreted. Similarly, the t-statistics cannot be evaluated or used for inference, as they

are inaccurate and biased. Thus, the ECM is used via its residuals to adjust the long-run coefficients and their corresponding t-statistics.

The residuals from the ECM are regressed on the variables included in the long-run equation multiplied by the negative coefficient of the residuals from the cointegrating equation retrieved from the ECM. The results of the Engle-Yoo regression are shown in table 5.

Table 5: *Results of third-step Engle-Yoo regression (dependent variable: RES_ECM)*

Variable	Coefficient	Std. Error
0.421942*LN_GDP_ZK	0.000253	0.001416
0.421942*R_LENDRATE	0.000232	0.000601

The values from this regression are used to adjust the long-run coefficients, as shown in table 6.

Table 6*: Adjustment of long-run cointegrating coefficients and t-statistics*

Variable	Coefficient calculation	Adjusted coefficient	Standard error	Adjusted t-statistic[11]
LN_GDP_ZK	0.999958 + 0.000253	1.000211	0.001416	706.364
R_LENDRATE	-0.002285 + 0.000232	-0.002053	0.000601	-3.416

Now that the cointegrating coefficients have been adjusted, they may be interpreted with confidence. Since the t-statistics are statistically significant at a 1 per cent level of significance,[12] it can be claimed that real short-term lending rates and national output influence PCE in the long run. Economically, the coefficient of LN_GDP_ZK represents the marginal propensity to consume,[13] and is thus a very interesting result, due to the fact that it is larger than 1. This implies that Zambians are spending more on consumption that what they effectively earn. This result however should not be interpreted too stringently,

11 Calculation of the adjusted t-statistic: (*adjusted coefficient / std. error*).
12 The t-statistics are larger than the calculated critical value of 2.75 (df = 31).
13 Calculated as the first order derivate of PCE with respect to income.

since total GDP was used as a proxy for disposable household income – which will obviously lead to slightly misleading results.

Using the adjusted coefficients above, it is possible to interpret the elasticities of PCE, as is done in table 7.

***Table 7**: Elasticities of private consumption expenditure to income and short-term lending rates*

Variable	Elasticity	Interpretation
LN_GDP_ZK	1.000211	An increase in income of 10 per cent will increase PCE by 10 per cent.
R_LENDRATE	-0.002053	An increase in interest rates of 5 per cent will decrease PCE by 0.01 per cent.

5. Analysis of the Results

It is clear that the marginal propensity to consume (MPC) of 1 in Zambia is extremely high. Approximately all additional income received by individuals is spent on consumption. This has a very significant impact on savings, as evidently Zambia suffers from almost zero private savings. This MPC figure is higher than the APC for the year 2001 (0.66). Again this represents a very worrying structural phenomenon, as there are no stabilising effects in the economy.

2001 levels of the independent variables (R_LENDRATE and LN_GDP_ZK) of equation (1), the long-run equation, can be substituted into the adjusted cointegration equation (table 6), so as to estimate a value for PCE, $LN\_\hat{CONS}\_ZK$, to be compared to the current poverty levels in Zambia. Table 8 shows the results of this approach (all figures in millions of Zambian Kwatchas).

***Table 8**: $\hat{CONS}\_ZK$ for 2001 (in 1994 prices)*

Variable	GDP_ZK	LN_GDP_ZK	R_LENDRATE	CONS_ZK	$\hat{CONS}\_ZK$
2001 level	2622500	14.78	46.23	1753100	1755554

The poverty measurements in Zambia (Kapungubwe 2004: 485) are fixed poverty lines based on the monthly costs of a predetermined 'minimum' basket of goods required by the adult equivalents in an average six-member Zambian household (which is estimated to contain 4.7 adult equivalents) (Nsemukila 2001:4). The Prices and Income Commission and the National Food and Nutrition Commission of Zambia compiled the basket of food in 1992. This minimum food basket is shown in table 9.

***Table 9:** Composition of the minimum food basket: quantities required by a household of 6 per month*

Food item	**Quantity / month**
Roller meal	90 kg
Fresh milk	2 kg
Groundnuts	3 kg
Cooking oil	2.5 l
Kapenta	2 kg
Beans	2 kg
Tomatoes	4 kg
Onions	4 kg
Green vegetables	7.5 kg
Sugar	2 kg

Source: Nsemukila (2001: 5) and Kapungwe (2004: 485)

It should be noted that the discrepancies in the literature regarding the table above are large. Thus, it would be ideal to compile one's own food basket, taking into account Zambian traditional foods and calorie requirements set out by the World Health Organisation. One could ideally then estimate poverty lines according to this.

Persons living in a household with a monthly adult equivalent expenditure of less than 64 475 constant 2001 Zambian Kwatchas are regarded as extremely poor. Those living in households with a monthly adult equivalent expenditure of between 64 475 and 92 584

constant 2001 Zambian Kwatchas are regarded as moderately poor. Persons in households with a monthly adult equivalent expenditure of more than 92 584 constant 2001 Zambian Kwatchas are considered to be non-poor (Kapungwe 2004: 485).

The poverty levels described above for Zambia are measured in 2001 Zambian Kwatchas. These were calculated by using the GDP deflator to inflate the 1998 levels quoted in Kapungwe (2004) to 2001 levels. These values are then compared to the estimated PCE figure in table 8, which has been inflated to constant 2001 prices and divided by the population in Zambia in 2001[14] to estimate individual expenditure, and then converted to monthly figures. The poverty levels are described and compared to the estimated consumption levels in table 10.

Table 10: *Poverty levels in Zambia (unit: 2001 Zambian Kwatchas and US Dollars)*

Level	**Monthly individual expenditure**	**Estimated individual monthly expenditure**	**Estimated level of poverty (average)**
Extremely poor	Less than K64 475 (US$17)	K68 826 (US$17.97)	Extremely poor
Moderately poor	Between K64 475 (US$17) and K92 584 (US$24)		
Non-poor	More than K92 584 (US$24)		

Thus it is estimated, using aggregate consumption figures, that the average Zambian adult equivalent is on the borderline between being moderately and extremely poor, spending approximately US$17 per month. It is also known that this expenditure represents all of that individual's income (on average), proven by the fact that the MPC = 1. This is consistent with Kapungwe's (2004) result that 58 per cent of Zambians are extremely poor. This number jumps to over 70 per cent when analysing rural areas only. This is definitely a topic for further research: to analyse the poverty levels in rural vs. urban Zambia. The shockingly low levels of PCE reflected above have disastrous implications for food security – the average Zambian is not spending enough income to sustain him-/herself.

[14] Estimated at 10 462 436 people (CIA factbook 2004). Taken into account was the fact that approximately 78 per cent of the Zambian population are regarded as adult equivalents. Thus, the population figure was deflated to 8 195 575 adult equivalents.

6. Conclusion

Aggregate real PCE was estimated in Zambia for the years 1970 to 2001, and it was found that the Zambian economy suffers from a very high MPC, which combined with a declining APC, has disastrous implications for poverty relief in the country. In order for Zambia to make inroads into solving poverty, it needs to achieve an economic growth rate of 5 to 7 per cent (Standard Bank 2005). This is almost impossible with zero savings and with a currently declining APC. Compounding the difficulties of these poverty relief efforts is the fact that the average Zambian is regarded as being moderately to extremely poor, spending approximately US$17 on consumption per month, as calculated using the estimated PCE function.

In order to address poverty in Zambia, real incomes need to increase drastically so as to lift Zambian PCE above mere survival levels. A grass roots point of departure is to increase the standard of living, particularly in rural areas. Given that only 49 per cent of the population have access to potable water, it is clearly absolutely essential to improve all types of infrastructure in Zambia. Once this is done, and Zambian citizens have the means to improve their standards of living without the structural constraints of poor infrastructure, it will be possible to begin projects that target individuals' incomes. 85 per cent of the labour force is 'employed' in agriculture, yet the agricultural sector contributes only 14.9 per cent to GDP. Increasing the dependency of the agricultural sector is clearly not a sustainable option for growth in Zambia; however, development of this sector in the sense of making individuals more self sufficient with regards to food security is a necessity. The circumstances are ideal for the development of community farming cooperatives, micro-finance and government-funded empowerment projects, all of which need to improve the quality and quantity of the agricultural sector in Zambia. The objective is to slowly shift the focus, once incomes are sustainably higher of course, away from mere subsistence agriculture to more commercial and even non-conventional agriculture, such as the cut-flowers trade.

Once the average rural Zambian needs to spend less of their meagre income on consumption expenditure, the stage is set for more individual expenditure on education, domestic investment, and possibly even private savings, the pre-requisites for sustainable growth, and the path away from poverty.

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Appendix A

Unit Root Tests

Table10: *Unit root tests*

Series	Model	ADF[15] Lags	ADF τ_τ, τ_μ, τ	ADF Φ_3, Φ_1	PP[16] Lags	PP
LN_CONS_ZK	Trend	0	-1.771	1.775	3	-1.696
	Intercept	0	-1.650	2.722	3	-1.689
	None	0	-0.152	-	3	-0.170
LN_GDP_ZK	Trend	0	-3.635 **	6.612 ***	3	-3.378 *
	Intercept	0	-1.593	2.539	3	-1.333
	None	0	1.566	-	3	3.323
LN_INDTAX_ZK	Trend	1	-4.730 ***	7.628 ***	3	-4.059 **
	Intercept	0	-2.216	4.911 **	3	-2.006
	None	0	0.608	-	3	3.048
LN_INV	Trend	0	-3.326 *	5.262	3	-3.240 *
	Intercept	0	-2.287	5.232 **	3	-2.070
	None	1	-0.602	-	3	-0.822
LN_M3_ZK	Trend	0	-1.839	1.700	3	-1.925
	Intercept	0	-1.325	1.757	3	-1.325
	None	0	-0.160	-	3	-0.156
LN_GCONS_ZK	Trend	1	-4.404 ***	6.698 ***	3	-4.187 **
	Intercept	1	-2.718 *	3.918	3	-2.033
	None	4	-1.120	-	3	-0.432
R_LENDRATE	Trend	0	-2.247	2.823	3	-2.271
	Intercept	0	-2.338	5.468 **	3	-2.401
	None	0	-2.216 **	-	3	-2.253 **
R_TBILL	Trend	0	-2.302	2.998	3	-2.299
	Intercept	0	-2.395	5.734 **	3	-2.438
	None	0	-2.143 **	-	3	-2.135 **
ΔLN_CONS_ZK	Trend	0	-5.902 ***	17.442 ***	3	-6.550 ***
	Intercept	0	-5.867 ***	34.419 ***	3	-5.910 ***
	None	0	-5.971 ***	-	3	-6.020 ***
ΔLN_GDP_ZK	Trend	0	-6.820 ***	23.274 ***	3	-7.172 ***
	Intercept	0	-6.932 ***	48.050 ***	3	-7.298 ***
	None	0	-6.365 ***	-	3	-6.370 ***
ΔLN_INDTAX_ZK	Trend	1	-6.144 ***	15.374 ***	3	-14.077 ***
	Intercept	1	-6.268 ***	23.984 ***	3	-14.556 ***
	None	1	-6.192 ***	-	3	-6.939 ***

[15] Augmented Dickey Fuller unit root test (Dickey and Fuller 1979).

[16] Phillips Perron unit root test (Phillips and Perron 1988).

Series	Model	ADF[17] Lags	ADF τ_τ, τ_μ, τ	ADF Φ_3, Φ_1	PP[18] Lags	PP
ΔLN_INV	Trend	4	-4.501 ***	15.425 ***	3	-18.742 ***
	Intercept	0	-7.969 ***	63.508 ***	3	-13.750 ***
	None	0	-8.048 ***	-	3	-9.776 ***
ΔLN_M3_ZK	Trend	0	-4.945 ***	12.247 ***	3	-4.936 ***
	Intercept	0	-5.036 ***	26.363 ***	3	-5.029 ***
	None	0	-5.124 ***	-	3	-5.118 ***
ΔLN_GCONS_ZK	Trend	3	-5.365 ***	8.960 ***	3	-5.435 ***
	Intercept	3	-5.018 ***	9.996 ***	3	-5.710 ***
	None	3	-4.864 ***	-	3	-5.128 ***
ΔR_LENDRATE	Trend	0	-6.714 ***	22.539 ***	3	-6.895 ***
	Intercept	0	-6.719 ***	45.141 ***	3	-6.786 ***
	None	0	-6.841 ***	-	3	-6.911 ***
ΔR_TBILL	Trend	0	-7.002 ***	24.522 ***	3	-7.217 ***
	Intercept	0	-6.983 ***	48.769 ***	3	-7.157 ***
	None	0	-7.112 ***	-	3	-7.294 ***

Source: Own summary of Eviews results

* *Statistically significant at 10% level of significance*
** *Statistically significant at 5% level of significance*
*** *Statistically significant at 1% level of significance*

[17] Augmented Dickey Fuller unit root test (Dickey and Fuller 1979).
[18] Phillips Perron unit root test (Phillips and Perron 1988).

Appendix B

Cointegration Unit Root Test

- H_0: no cointegration (non-stationary residuals)
  H_1: cointegration (stationary residuals)
- Reject H_0 if ADF ≤ critical value

***Table 11**: MacKinnon critical values for the ADF test (T = 31)*

n	Model	%	Φ_∞	Φ_1	Φ_2	C(p)
3	constant, no trend	1	-4.2981	-13.79	-46.37	-4.79119
		5	-3.7429	-8.352	-13.41	-4.02627
		10	-3.4518	-6.241	-2.79	-3.65603
3	constant, + trend	1	-4.6678	-18.492	-49.35	-5.31567
		5	-4.1193	-12.024	-13.13	-4.52083
		10	-3.8344	-9.188	-4.85	-4.13583

Source: Own summary

- ADF = -4.282 (constant, no trend)
  ADF = -4.234 (constant, + trend)
- ADF is statistically significant at a 5 per cent level of significance in the case of 'constant, no trend' and at a 10 per cent of significance in the case of 'constant, + trend'.
- Reject H_0
- The residuals are stationary → there is cointegration

CONSUMPTION BEHAVIOUR IN ZAMBIA: THE LINK TO POVERTY ALLEVIATION?

Kirsten Ludi [1, 2]

ABSTRACT

In order to be able to suggest viable solutions to the overwhelming problem of poverty on the African continent, it is first necessary to know exactly what is causing that poverty. It is the intention of this paper to measure welfare in Zambia, via an estimated consumption function, and then to compare this estimated consumption to the levels of poverty, or subsistence level consumption expenditure, in Zambia. The objective is to understand the underlying determinants and depth of poverty in Zambia, by analysing the root of the problem – why people can't afford to consume. Aggregate real PCE is estimated in Zambia for the years 1970 to 2001, and it is found that the Zambian economy suffers from a very high MPC. The results also show that the average Zambian is regarded as being extremely poor, spending approximately US$17 on consumption per month, as calculated using the estimated PCE function.

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[2] The author is grateful for the invaluable input of Mr Marc' Ground.

1. Introduction

In order to be able to suggest viable solutions to the overwhelming problem of poverty on the African continent, it is first necessary to know exactly what is causing that poverty. The question then arises: does one estimate a poverty function, including the possible determinants of poverty, or does one estimate a consumption function, since poverty is after all the inability to consume? Appleton (2001) found that the results from poverty functions and consumption functions were overwhelmingly similar, despite the vast differences in their approaches. It is the intention of this paper to measure welfare in Zambia, via an estimated consumption function, which is "arguably the single most comprehensive indicator of ability to meet wants" (Appleton 2001: 435), and then to compare this estimated consumption to the levels of poverty, or subsistence level consumption expenditure, in Zambia. If the case were that the impoverished behave differently in their consumption decisions to the non-poor, it would be ideal to model the actual poverty gap (the difference between a subsistence level of consumption and actual consumption). However, given the fact that the majority of the Zambian population is either poverty-stricken or 'non-rich', it is assumed in this instance that every individual makes consumption decisions similarly. The objective of this paper is to understand the underlying determinants and depth of poverty in Zambia, by analysing the root of the problem – why people can't afford to consume.

Zambia has had one of the most rapidly declining economies in sub-Saharan Africa. A real GDP per capita growth rate of -3.9 per cent in 1998 has improved to a rate of 1.35 per cent in 2002. However, a poverty rate of 73 per cent,[3] of which 58 per cent are extremely poor,[4] and of which over 70 per cent live in rural areas, cannot be masked by positive GDP per capita growth rates (Kapungwe 2004: 487). Section 2 presents an analysis of private consumption behaviour in Zambia over the past three decades, followed by a review of the data and model methodology in section 3. The modelling procedure and estimation results are discussed in section 4. The analysis of the results

[3] 73 per cent of all Zambians live below the poverty line.

[4] 'Extremely poor' refers to individuals living in households with a monthly adult equivalent expenditure of less than 64 475 Kwachas (at 2001 levels), which is equivalent to US$16.83.

and the comparison of consumption behaviour to poverty levels are done in section 5. A conclusion with policy implications in section 6 completes this paper.

2. Background of Zambian Private Consumption Expenditure

Zambia has overall shown a level trend in real private consumption expenditure (PCE) since 1970. As can be seen from figure 1, there was slight growth in real PCE in the 1970s, which was followed by a peak in the late-1980s. A sharp decline in real PCE in the early-1990s followed, from which the economy has not recovered.

***Figure 1**: Real PCE in Zambia in constant Zambian Kwatchas (millions) (1970 – 2001)*

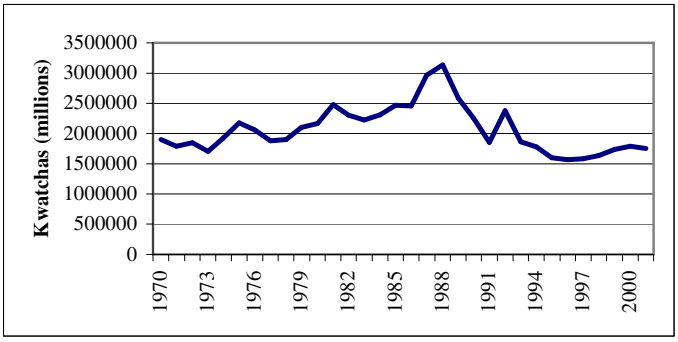


Figure 2 indicates that the increased growth in real PCE in Zambia in the late-1990s contributed to the positive real GDP growth rates of that period. However, the alarming trend is one of decreasing and negative growth rates in the early-2000s.

***Figure 2**: Annual growth rates of real PCE in Zambia (1970 – 2001)*

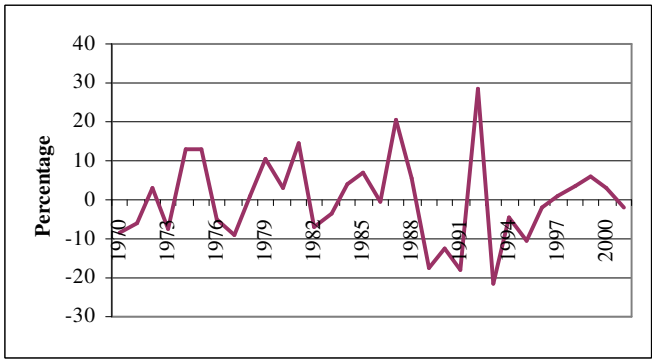
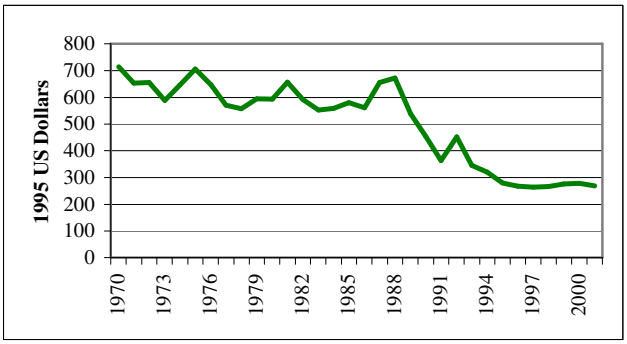


Figure 3 shows the trends in real PCE per capita in US Dollars. The aforementioned has declined at a steady rate, with the only periods of slight augmentation being the early-1970s, the early- and mid-1980s, and the early-1990s. The level of real PCE per capita has remained constant at approximately US$270 since 1995.

Figure 3: *Real Zambian PCE per capita in constant 1995 US Dollars (1970 – 2001)*



The relative high values of real PCE in Zambia in the early-1970s can be ascribed to the 'post-independence boom'. The prosperity of the Zambian economy was largely attributable to increased earnings from mineral exploitation as copper prices climbed. An average increase in real GDP of 2.3 per cent between 1964 and 1974 translated into increased individual incomes and thus increased PCE. However, those very copper prices, along with other external factors, caused an economic decline in Zambia from 1975 to 1990. World copper prices collapsed, and a decline in the quality of the copper ore in Zambia exposed the country's over-dependence on the mineral's extraction. The oil price shocks of the 1970s and the resultant global inflation hit Zambia's consumers hard, and thus diminished real PCE. A worsening balance of payments position was addressed by increased borrowing. Zambia's involvement with various political freedom fighting movements resulted in trade barriers, which further deteriorated the economic situation (Biz/ed 2005).

The sharp decline in real PCE (in levels and per capita) in the latter half of the 1980s was the direct result of the Zambian government's attempt to implement a structural

adjustment program, prescribed by donor organisations, which resulted in food subsidies being cut. However, civil unrest forced the government to abandon this program in 1987 (Biz/ed 2005).

Current PCE levels have declined and remained at low levels as a result of the many interaction effects between Zambia's poorly performing economy, the severely high poverty levels, and the devastating effects of HIV/AIDS in the region.[5] High short-term interest rates (between 25 and 36 per cent) from 1998 onwards also hampered PCE expenditure. Not reflected in the data presented are the PCE figures for 2002. It is expected that this figure will be disappointing due to severe food shortages induced by a bad drought, which has pushed inflation to levels approximated at 20 per cent.

Figure 4 shows the percentage of total consumption expenditure represented by PCE. Consistent with the extremely high poverty rate, and with the low levels of economic development prevalent in Zambia, PCE as a percentage of total expenditure has been at high levels, approximating 85 per cent in 2001.

***Figure 4**: Real PCE as a percentage of total consumption expenditure (1970 – 2001)*

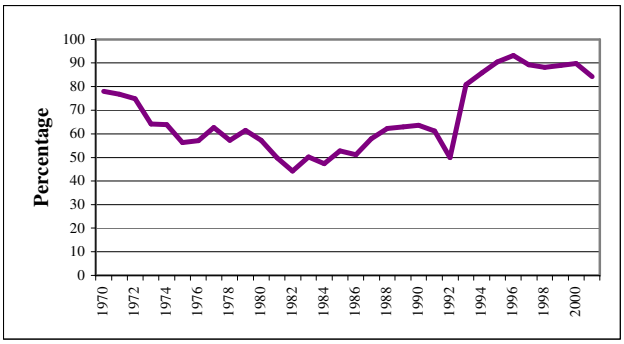
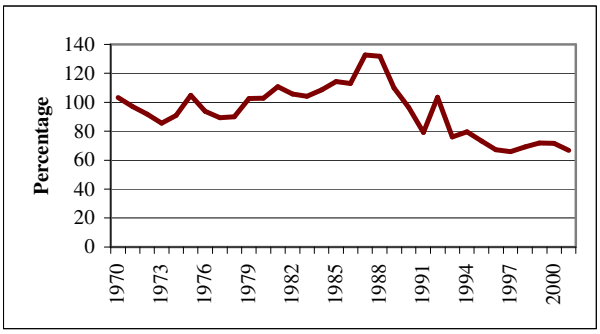


Figure 5 shows the trends in PCE as a percentage of GDP, otherwise known as the average propensity to consume (APC).

[5] Life expectancy at birth is currently 35 years, partly due to an HIV/AIDS adult prevalence rate of 21.5 per cent (CIA 2004).

***Figure 5**: Average Propensity to Consume in Zambia (1970 – 2001)*



The APC in Zambia has remained at high levels during the past three decades, currently at a level of 0.66. These rates are comparable to the industrialised and developed economies of the World, such as the United Kingdom (APC = 0.77), the United States of America (APC = 0.68) and Taiwan (APC = 0.6) (Abeysinghe and Choy 2004: 565). The problem is that the APC in Zambia is not entirely stable: it has declined quite steadily since the mid-1980s – PCE's contribution to output is decreasing over time. This therefore puts into doubt the existence of a built-in stabiliser in the economy. Since PCE is the most stable component of aggregate demand, a decline in its contribution to output implies greater contributions of more variable components, such as exports and investment, which leads to cyclical and volatile output growth (Abeysinghe and Choy 2004: 577). Another puzzling and worrisome aspect of Zambia's APC are the values greater than one that occurred in the 1980s. This seems to be consistent with a subsistence economy in the clutches of extreme poverty.

3. Methodology and Data

In line with approaches followed partly by Hatzinikolaou (1998), Drobny and Hall (1989), and Appleton (2001), and completely by Abeysinghe and Choy (2004), PCE in Zambia was estimated in two ways: the long-run determinants of PCE are estimated according to conventional OLS; and the short-run determinants are analysed according to the approach put forward by Engle and Granger (1987). In the case of analysing whether the poverty-stricken in Zambia are temporarily poor or permanently impoverished, a panel data analysis would be ideal – a case for further research.

In the long run, it is put forward that Zambian real PCE is influenced by real national income (for want of better data on disposable income) and the real short-term lending rates applicable at the time. In other words:

$$\ln C_t = \beta_1 \ln Y_t + \beta_2 r_t \qquad (1)$$

The obvious problem with using equation (1) as the final equation is the problem of non-stationarity. Thus, the data is to be differenced according to its order of integration, and the regression run again:

$$\Delta \ln C_t = \beta_1 \Delta \ln Y_t + \beta_2 \Delta r_t \qquad (2)$$

Equation (2) thus accounts for any short-term disturbances affecting real PCE in Zambia.

The data used to estimate equations (1) and (2) are extracted from the World Bank Development Indicators (TSE). The period under analysis is from 1970 to 2001, and unfortunately no later due to data unavailability. Table 1 below contains a list and description of the variables used in the various steps of the Engle-Granger approach.

***Table 1**: Variables used and descriptions*

Variable	**Description**	**Unit**	**Conversions / Workings**
LN_CONS_ZK	Real private consumption expenditure	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_GDP_ZK	Real GDP at market prices	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm. It was not possible to use disposable income, as would be ideal, due to the absence of any data on personal income tax.
LN_GDP_CAPITA	Real GDP per capita	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_INDTAX_ZK	Net indirect taxes paid	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_INV	Gross domestic investment	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
LN_M3_ZK	Real M3 money supply	Constant 1994 Zambian	Natural logarithm.

		Kwatchas (millions)	
LN_GCONS_ZK	Real general government consumption expenditure	Constant 1994 Zambian Kwatchas (millions)	Natural logarithm.
R_LENDRATE	Real lending rate	Per cent / annum	Nominal lending rate minus GDP-deflator inflation. Missing data for the year 1991 was calculated using an average annual growth rate formula.[6]
R_TBILL	Real treasury bill rate	Per cent / annum	Nominal treasury bill rate minus GDP-deflator inflation. Missing data for the years 1991 and 1992 were calculated as above.[6]

All of the data used, apart from LN_GDP_CAPITA, is integrated of order one.[7] Due to the fact that GDP per capita is a ratio of two non-stationary series, it is regarded as stationary, and thus is integrated of order zero.

4. Model and Estimation Results

4.1. Cointegration

Cointegration allows for non-stationary data series to be combined into a stationary series through a linear combination. This represents the long-run relationship between the data series. It was found in this case that real PCE in Zambia is dependent in the long run on constant GDP, real short term lending rates and a dummy variable accounting for the sudden and large decrease in PCE in 1992, largely as a result of the 30 per cent increase in short-term interest rates in that period. It is expected using economic intuition that an increase in national income will result in increased PCE and an increase in interest rates should result in less PCE:

$$\ln\_cons\_zk = f(\ln\_\overset{+}{gdp}\_zk, r\_\overset{-}{lendrate}, \overset{-}{dum}\_92) \qquad (3)$$

6 $\left(\frac{LENDRATE_{1992}}{LENDRATE_{1990}}\right)^{\frac{1}{2}} - 1$ and $\left(\frac{TBILL_{1993}}{TBILL_{1990}}\right)^{\frac{1}{3}} - 1$.

7 See Appendix A for the unit root tests of all data used.

The actual coefficients for the regression of equation (1) can be found in table 2.

Table 2: Regression results of the cointegration equation (dependent variable: LN_CONS_ZK)

Sample (adjusted): 1971 2001
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Consistent with Expectations?	Interpretation[8]
LN_GDP_ZK	0.999958	0.001639	610.0092	Yes	An increase in national income will increase PCE. The effect is much larger than that of the other independent variables.
R_LENDRATE	-0.002285	0.000585	-3.903330	Yes	An increase in short-term lending rates will increase the costs of consumption, and thus decrease PCE.
DUM_92	-0.309545	0.038157	-8.112476	Yes	The dramatic decline in PCE in 1992, will have an overall decreasing effect on the aggregate PCE function.
R-squared	0.713131				
Adjusted R-squared	0.692640				

An Augmented Dickey Fuller (ADF) unit root test was performed on the residuals of the cointegration equation, and it was concluded that the residuals are indeed stationary.[9]

4.2. The Error Correction Model (ECM)

The ECM represents the short-term relationship between the data series, and is based on the proposition that a proportion of any disequilibrium from one period can be corrected in the next period. Long-run effects are included in the short-run equation via the lagged residuals of the cointegrating equation (*res_coint*).

Attempts to estimate equation (2) as the ideal short-term situation were statistically fruitless. Thus, other short-run factors were included to be statistically successful and

[8] Due to the non-stationarity of the variables, the magnitudes of the coefficients cannot be stringently evaluated, and the variables may not be statistically evaluated.

[9] See Appendix B for the unit root tests of the cointegrating residuals.

more economically realistic in explaining real PCE. The short-run regression that explains real PCE in Zambia is therefore:

$$\Delta \ln C_t = \alpha\, res\_co\,\text{int}_{t-1} + \beta_1 \Delta \ln Y/capita_{t-1} + \beta_2 \Delta r\_tbill_{t-2} + \beta_3 \Delta \ln M3_{t-2} + \beta_4 \Delta \ln G_{t-1} + \beta_5 \Delta \ln T_t + \beta_6 \Delta r\_lendrate + \beta_7 \Delta \ln Inv_{t-1} \quad [9] \qquad (4)$$

The results of the ECM regression are in table 3.

Table 3: *Regression results of the error correction model (dependent variable: D(LN_CONS_ZK)[10])*

Sample (adjusted): 1974 2001
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES_COINT(-1)	-0.421942	0.109743	-3.844812	0.0011
LN_GDP_CAPITA(-1)	-0.028966	0.009264	-3.126732	0.0056
D(R_TBILL(-2))	-0.002131	0.000498	-4.282284	0.0004
D(LN_M3_ZK(-2))	-0.165104	0.078352	-2.107218	0.0486
D(LN_GCONS_ZK(-1))	0.132035	0.064002	2.062989	0.0531
D(LN_INDTAX_ZK)	-0.251680	0.055979	-4.495959	0.0002
D(R_LENDRATE)	-0.001372	0.000465	-2.950467	0.0082
D(LN_INV(-1))	0.072068	0.039942	1.804303	0.0871
D(DUM_92)	-0.517581	0.065953	-7.847746	0.0000
R-squared	0.863362			
Adjusted R-squared	0.805830			

The coefficients of the independent variables may not be economically evaluated since the variables have been differenced once. However, the variables may be statistically evaluated. The t-statistics of all the independent variables are statistically significant at a 10 per cent level of significance. The adjusted-R^2 value indicates that 81 per cent of the short-run variation in real PCE can be explained by the model. Real PCE in Zambia in

[9] Where: C_t = real PCE; $Y_t/capita$ = real GDP per capita; r_tbill_t = real treasury bill yield rates; $M3_t$ = real M3 money supply; G_t = real government consumption expenditure; T_t = real net indirect tax revenue; $r\_lendrate_t$ = real short-term lending rate; and Inv_t = real gross domestic capital formation, all at time *t*.

[10] D(…) indicates that a variable has been differenced once to remove non-stationarity.

the short-run can thus be explained by: the long run dynamics indicated in table 2; GDP per capita from one period prior; a structural break dummy variable accounting for the sharp and sudden decline in real PCE that occurred in 1992 due to the interest rate shock mentioned earlier; short term treasury bill rates from the previous two periods; real wealth from two periods prior as proxied by the M3 money supply; indirect taxes paid to the government, where the burden usually falls entirely on the consumer; real lending rates; real domestic investment from the previous period; and real government expenditure from one period before. The lags involved make economic sense, as no effects in an economy are instantaneous, but rather take time (lags) to cause adjustments. The only 'surprising' independent variable that affects PCE in the short run is real government consumption expenditure, which incorporates remuneration of public sector employees. Since Zambia is largely a rural agricultural economy, the public sector comprises most of the non-agricultural salary-earners, and thus contributes largely to the 'higher' income class that are larger contributors to PCE. The battery of usual diagnostic tests on the residuals can be performed, with results in table 4.

***Table 4**: Selected diagnostic test results of the ECM of private consumption expenditure*

Test	Test statistic	P-value	Conclusion
Normality			
Jarque-Bera	JB = 0.280	0.869	Residuals are normally distributed
Serial correlation			
Breusch-Godfrey (2)	1.183	0.553	No serial correlation up to order 2
Heteroskedasticity			
ARCH (1)	0.918	0.338	No heteroskedasticity
White (no cross terms)	14.467	0.634	No heteroskedasticity
Stability			
Ramsey reset (1)	0.978	0.323	Stable regression

4.3. Engle-Yoo Third Step

The coefficients from the long-run cointegrating equation are biased and inaccurate due to the fact that they are based on non-stationary time series, and thus cannot be interpreted. Similarly, the t-statistics cannot be evaluated or used for inference, as they

are inaccurate and biased. Thus, the ECM is used via its residuals to adjust the long-run coefficients and their corresponding t-statistics.

The residuals from the ECM are regressed on the variables included in the long-run equation multiplied by the negative coefficient of the residuals from the cointegrating equation retrieved from the ECM. The results of the Engle-Yoo regression are shown in table 5.

Table 5: *Results of third-step Engle-Yoo regression (dependent variable: RES_ECM)*

Variable	Coefficient	Std. Error
0.421942*LN_GDP_ZK	0.000253	0.001416
0.421942*R_LENDRATE	0.000232	0.000601

The values from this regression are used to adjust the long-run coefficients, as shown in table 6.

Table 6*: Adjustment of long-run cointegrating coefficients and t-statistics*

Variable	Coefficient calculation	Adjusted coefficient	Standard error	Adjusted t-statistic[11]
LN_GDP_ZK	0.999958 + 0.000253	1.000211	0.001416	706.364
R_LENDRATE	-0.002285 + 0.000232	-0.002053	0.000601	-3.416

Now that the cointegrating coefficients have been adjusted, they may be interpreted with confidence. Since the t-statistics are statistically significant at a 1 per cent level of significance,[12] it can be claimed that real short-term lending rates and national output influence PCE in the long run. Economically, the coefficient of LN_GDP_ZK represents the marginal propensity to consume,[13] and is thus a very interesting result, due to the fact that it is larger than 1. This implies that Zambians are spending more on consumption that what they effectively earn. This result however should not be interpreted too stringently,

11 Calculation of the adjusted t-statistic: (*adjusted coefficient / std. error*).
12 The t-statistics are larger than the calculated critical value of 2.75 (df = 31).
13 Calculated as the first order derivate of PCE with respect to income.

since total GDP was used as a proxy for disposable household income – which will obviously lead to slightly misleading results.

Using the adjusted coefficients above, it is possible to interpret the elasticities of PCE, as is done in table 7.

***Table 7**: Elasticities of private consumption expenditure to income and short-term lending rates*

Variable	Elasticity	Interpretation
LN_GDP_ZK	1.000211	An increase in income of 10 per cent will increase PCE by 10 per cent.
R_LENDRATE	-0.002053	An increase in interest rates of 5 per cent will decrease PCE by 0.01 per cent.

5. Analysis of the Results

It is clear that the marginal propensity to consume (MPC) of 1 in Zambia is extremely high. Approximately all additional income received by individuals is spent on consumption. This has a very significant impact on savings, as evidently Zambia suffers from almost zero private savings. This MPC figure is higher than the APC for the year 2001 (0.66). Again this represents a very worrying structural phenomenon, as there are no stabilising effects in the economy.

2001 levels of the independent variables (R_LENDRATE and LN_GDP_ZK) of equation (1), the long-run equation, can be substituted into the adjusted cointegration equation (table 6), so as to estimate a value for PCE, $LN\_\hat{CONS}\_ZK$, to be compared to the current poverty levels in Zambia. Table 8 shows the results of this approach (all figures in millions of Zambian Kwatchas).

***Table 8**: $\hat{CONS}\_ZK$ for 2001 (in 1994 prices)*

Variable	GDP_ZK	LN_GDP_ZK	R_LENDRATE	CONS_ZK	$\hat{CONS}\_ZK$
2001 level	2622500	14.78	46.23	1753100	1755554

The poverty measurements in Zambia (Kapungubwe 2004: 485) are fixed poverty lines based on the monthly costs of a predetermined 'minimum' basket of goods required by the adult equivalents in an average six-member Zambian household (which is estimated to contain 4.7 adult equivalents) (Nsemukila 2001:4). The Prices and Income Commission and the National Food and Nutrition Commission of Zambia compiled the basket of food in 1992. This minimum food basket is shown in table 9.

***Table 9:** Composition of the minimum food basket: quantities required by a household of 6 per month*

Food item	**Quantity / month**
Roller meal	90 kg
Fresh milk	2 kg
Groundnuts	3 kg
Cooking oil	2.5 l
Kapenta	2 kg
Beans	2 kg
Tomatoes	4 kg
Onions	4 kg
Green vegetables	7.5 kg
Sugar	2 kg

Source: Nsemukila (2001: 5) and Kapungwe (2004: 485)

It should be noted that the discrepancies in the literature regarding the table above are large. Thus, it would be ideal to compile one's own food basket, taking into account Zambian traditional foods and calorie requirements set out by the World Health Organisation. One could ideally then estimate poverty lines according to this.

Persons living in a household with a monthly adult equivalent expenditure of less than 64 475 constant 2001 Zambian Kwatchas are regarded as extremely poor. Those living in households with a monthly adult equivalent expenditure of between 64 475 and 92 584

constant 2001 Zambian Kwatchas are regarded as moderately poor. Persons in households with a monthly adult equivalent expenditure of more than 92 584 constant 2001 Zambian Kwatchas are considered to be non-poor (Kapungwe 2004: 485).

The poverty levels described above for Zambia are measured in 2001 Zambian Kwatchas. These were calculated by using the GDP deflator to inflate the 1998 levels quoted in Kapungwe (2004) to 2001 levels. These values are then compared to the estimated PCE figure in table 8, which has been inflated to constant 2001 prices and divided by the population in Zambia in 2001[14] to estimate individual expenditure, and then converted to monthly figures. The poverty levels are described and compared to the estimated consumption levels in table 10.

Table 10: *Poverty levels in Zambia (unit: 2001 Zambian Kwatchas and US Dollars)*

Level	**Monthly individual expenditure**	**Estimated individual monthly expenditure**	**Estimated level of poverty (average)**
Extremely poor	Less than K64 475 (US$17)	K68 826 (US$17.97)	Extremely poor
Moderately poor	Between K64 475 (US$17) and K92 584 (US$24)		
Non-poor	More than K92 584 (US$24)		

Thus it is estimated, using aggregate consumption figures, that the average Zambian adult equivalent is on the borderline between being moderately and extremely poor, spending approximately US$17 per month. It is also known that this expenditure represents all of that individual's income (on average), proven by the fact that the MPC = 1. This is consistent with Kapungwe's (2004) result that 58 per cent of Zambians are extremely poor. This number jumps to over 70 per cent when analysing rural areas only. This is definitely a topic for further research: to analyse the poverty levels in rural vs. urban Zambia. The shockingly low levels of PCE reflected above have disastrous implications for food security – the average Zambian is not spending enough income to sustain him-/herself.

[14] Estimated at 10 462 436 people (CIA factbook 2004). Taken into account was the fact that approximately 78 per cent of the Zambian population are regarded as adult equivalents. Thus, the population figure was deflated to 8 195 575 adult equivalents.

6. Conclusion

Aggregate real PCE was estimated in Zambia for the years 1970 to 2001, and it was found that the Zambian economy suffers from a very high MPC, which combined with a declining APC, has disastrous implications for poverty relief in the country. In order for Zambia to make inroads into solving poverty, it needs to achieve an economic growth rate of 5 to 7 per cent (Standard Bank 2005). This is almost impossible with zero savings and with a currently declining APC. Compounding the difficulties of these poverty relief efforts is the fact that the average Zambian is regarded as being moderately to extremely poor, spending approximately US$17 on consumption per month, as calculated using the estimated PCE function.

In order to address poverty in Zambia, real incomes need to increase drastically so as to lift Zambian PCE above mere survival levels. A grass roots point of departure is to increase the standard of living, particularly in rural areas. Given that only 49 per cent of the population have access to potable water, it is clearly absolutely essential to improve all types of infrastructure in Zambia. Once this is done, and Zambian citizens have the means to improve their standards of living without the structural constraints of poor infrastructure, it will be possible to begin projects that target individuals' incomes. 85 per cent of the labour force is 'employed' in agriculture, yet the agricultural sector contributes only 14.9 per cent to GDP. Increasing the dependency of the agricultural sector is clearly not a sustainable option for growth in Zambia; however, development of this sector in the sense of making individuals more self sufficient with regards to food security is a necessity. The circumstances are ideal for the development of community farming cooperatives, micro-finance and government-funded empowerment projects, all of which need to improve the quality and quantity of the agricultural sector in Zambia. The objective is to slowly shift the focus, once incomes are sustainably higher of course, away from mere subsistence agriculture to more commercial and even non-conventional agriculture, such as the cut-flowers trade.

Once the average rural Zambian needs to spend less of their meagre income on consumption expenditure, the stage is set for more individual expenditure on education, domestic investment, and possibly even private savings, the pre-requisites for sustainable growth, and the path away from poverty.

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Appendix A

Unit Root Tests

Table10: *Unit root tests*

Series	Model	ADF[15] Lags	ADF τ_τ, τ_μ, τ	ADF Φ_3, Φ_1	PP[16] Lags	PP
LN_CONS_ZK	Trend	0	-1.771	1.775	3	-1.696
	Intercept	0	-1.650	2.722	3	-1.689
	None	0	-0.152	-	3	-0.170
LN_GDP_ZK	Trend	0	-3.635 **	6.612 ***	3	-3.378 *
	Intercept	0	-1.593	2.539	3	-1.333
	None	0	1.566	-	3	3.323
LN_INDTAX_ZK	Trend	1	-4.730 ***	7.628 ***	3	-4.059 **
	Intercept	0	-2.216	4.911 **	3	-2.006
	None	0	0.608	-	3	3.048
LN_INV	Trend	0	-3.326 *	5.262	3	-3.240 *
	Intercept	0	-2.287	5.232 **	3	-2.070
	None	1	-0.602	-	3	-0.822
LN_M3_ZK	Trend	0	-1.839	1.700	3	-1.925
	Intercept	0	-1.325	1.757	3	-1.325
	None	0	-0.160	-	3	-0.156
LN_GCONS_ZK	Trend	1	-4.404 ***	6.698 ***	3	-4.187 **
	Intercept	1	-2.718 *	3.918	3	-2.033
	None	4	-1.120	-	3	-0.432
R_LENDRATE	Trend	0	-2.247	2.823	3	-2.271
	Intercept	0	-2.338	5.468 **	3	-2.401
	None	0	-2.216 **	-	3	-2.253 **
R_TBILL	Trend	0	-2.302	2.998	3	-2.299
	Intercept	0	-2.395	5.734 **	3	-2.438
	None	0	-2.143 **	-	3	-2.135 **
ΔLN_CONS_ZK	Trend	0	-5.902 ***	17.442 ***	3	-6.550 ***
	Intercept	0	-5.867 ***	34.419 ***	3	-5.910 ***
	None	0	-5.971 ***	-	3	-6.020 ***
ΔLN_GDP_ZK	Trend	0	-6.820 ***	23.274 ***	3	-7.172 ***
	Intercept	0	-6.932 ***	48.050 ***	3	-7.298 ***
	None	0	-6.365 ***	-	3	-6.370 ***
ΔLN_INDTAX_ZK	Trend	1	-6.144 ***	15.374 ***	3	-14.077 ***
	Intercept	1	-6.268 ***	23.984 ***	3	-14.556 ***
	None	1	-6.192 ***	-	3	-6.939 ***

[15] Augmented Dickey Fuller unit root test (Dickey and Fuller 1979).

[16] Phillips Perron unit root test (Phillips and Perron 1988).

Series	Model	ADF[17] Lags	ADF τ_τ, τ_μ, τ	ADF Φ_3, Φ_1	PP[18] Lags	PP
ΔLN_INV	Trend	4	-4.501 ***	15.425 ***	3	-18.742 ***
	Intercept	0	-7.969 ***	63.508 ***	3	-13.750 ***
	None	0	-8.048 ***	-	3	-9.776 ***
ΔLN_M3_ZK	Trend	0	-4.945 ***	12.247 ***	3	-4.936 ***
	Intercept	0	-5.036 ***	26.363 ***	3	-5.029 ***
	None	0	-5.124 ***	-	3	-5.118 ***
ΔLN_GCONS_ZK	Trend	3	-5.365 ***	8.960 ***	3	-5.435 ***
	Intercept	3	-5.018 ***	9.996 ***	3	-5.710 ***
	None	3	-4.864 ***	-	3	-5.128 ***
ΔR_LENDRATE	Trend	0	-6.714 ***	22.539 ***	3	-6.895 ***
	Intercept	0	-6.719 ***	45.141 ***	3	-6.786 ***
	None	0	-6.841 ***	-	3	-6.911 ***
ΔR_TBILL	Trend	0	-7.002 ***	24.522 ***	3	-7.217 ***
	Intercept	0	-6.983 ***	48.769 ***	3	-7.157 ***
	None	0	-7.112 ***	-	3	-7.294 ***

Source: Own summary of Eviews results

* *Statistically significant at 10% level of significance*
** *Statistically significant at 5% level of significance*
*** *Statistically significant at 1% level of significance*

[17] Augmented Dickey Fuller unit root test (Dickey and Fuller 1979).
[18] Phillips Perron unit root test (Phillips and Perron 1988).

Appendix B

Cointegration Unit Root Test

- H_0: no cointegration (non-stationary residuals)
  H_1: cointegration (stationary residuals)
- Reject H_0 if ADF ≤ critical value

***Table 11**: MacKinnon critical values for the ADF test (T = 31)*

n	Model	%	Φ_∞	Φ_1	Φ_2	C(p)
3	constant, no trend	1	-4.2981	-13.79	-46.37	-4.79119
		5	-3.7429	-8.352	-13.41	-4.02627
		10	-3.4518	-6.241	-2.79	-3.65603
3	constant, + trend	1	-4.6678	-18.492	-49.35	-5.31567
		5	-4.1193	-12.024	-13.13	-4.52083
		10	-3.8344	-9.188	-4.85	-4.13583

Source: Own summary

- ADF = -4.282 (constant, no trend)
  ADF = -4.234 (constant, + trend)
- ADF is statistically significant at a 5 per cent level of significance in the case of 'constant, no trend' and at a 10 per cent of significance in the case of 'constant, + trend'.
- Reject H_0
- The residuals are stationary → there is cointegration