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The Welfare Cost of Inflation in Kenya

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Abstract
The article aims to identify an appropriate money demand function that describes the Kenyan money market, then employ it to approximate the welfare cost. The empirical estimation uses quarterly data sets from 2000 (2000:01) to 2014 (2014:03). The empirical results reveals that, the appropriate money demand function that fits the Kenyan data is the semi-log model, which gives the welfare cost estimate of between 0.041 and 0.103 percent, for the $5\% \pm 2.5\%$ inflation band. The results are consistent with literature and smaller when regression techniques are employed to derive the elasticities as opposed to using Lucas (2000) specifications. We conclude that the target inflation band maybe appropriate, however, the welfare cost estimates interest rate distortions, and any reduction may lead to welfare gains.
Keywords: Kenya's welfare cost of inflation, ARDL Model, VECM Model

1 Introduction

The IMF has consistently encouraged Kenya to shift from monetary aggregate to Inflation targeting, and equally supports in developing infrastructure, institutional and statistical reforms, data collection, and other analytical capabilities with a view of moving towards adoption of inflation targeting policies that ensure low and sustained inflation levels. In line with IMF recommendations, Kenya's conservative monetary policy mainly focuses on keeping both interest rates and inflation low, with the aim of maintaining a stable price level. Low and stable inflation plays a key role in sustaining the general price to such a level that it no longer adversely influences the decisions of producers and consumers, a key feature for market-based economies. However, high inflation rates inevitably leads to a decline in the efficient working of a market economy and lowers the economy growth rate as a whole. Inherently, the Kenya Minister for Finance sets the price target (inflation) each year, and expects the Central Bank of Kenya (CBK) to factor it in monetary policy decisions, work towards achieving and sustaining it. This means that CBK is an implicit inflation targeter. According to Misati, Roseline, Esman Nyamongo & Isaac Mwangi (2013), Kenya's monetary policy inflation targeting range is $5\% \pm 2.5\% \quad or\ (2.5\%\ to\ 7.5\%)$, and that this target has remained since late 1990's.

Kenya inflation regime falls under ITL - "Inflation Targeting Lite" - term coined to describe countries inclined towards an IT configuration but whose frameworks lack transparency and clarity of objectives (Ndung'u, Njuguna, 2000). Authorities employing ITL, publically commit to flexible exchange rate and often announce target inflation, but in practice according to Ndung'u (2000), they engage in aggressive exchange rate management, to a point where the desire to influence the exchange rate path and the prioritization of the competing constraints of independent monetary policy are obscure. Inflation, however, is traditionally hard to drive down during election years in Kenya. This is mainly due to the incumbent government-spending spree, on massive development projects and salary adjustments for public workers all geared towards appeasing electorates. The increase in spending, is usually funded via borrowing or seignorage revenue given the government is unable to increase taxes hence exerting upward pressure on prices, which leads to increased inflation. Despite the vital, financial role-played by Kenya in the East and Central Africa economies, there is little research undertaken to investigate the losses generated by inflation. Yet is an essential component for a properly designed monetary policy (mainly price stability).

In literature, there are several measures used to estimate welfare cost and their results substantially differ. Cysne, Rubens & David Turchick (2012) re-derived and ordered six alternative measures of the welfare cost in literature. Our focus therefore, is to identify an appropriate money demand function that describes the Kenyan money market, and employ it to approximate the welfare cost. We further examine the enormity of welfare cost in Kenya, with a view of establishing whether there is need to recommend a change of the target band to reduce the welfare cost imposed to the economy by such decisions if any. Therefore, the main aim is to calculate the cost imposed on the Kenyan economy through its inflation policy of $5\% \pm 2.5\%\ (or\ 2.5\%\ to\ 7.5\%)$ range against the Friedman (1969) optimal policy of deflation to attain zero normal interest rates. The welfare cost was assessed based on approaches originally derived by Bailey, Martin (1956) and Cagan, Phillip (1956) and widely extended thereafter by Lucas (2000) and Yavari & Serletis, (2011) among others. Whether inflation is costly is a vital subject, particularly due to the inflation prevalence in Kenya's economic history. The papers contribution is twofold: (i) identify the money demand measure for Kenya, and (ii) estimate welfare based on the best measure fitting Kenyan data. Based on available information, this is the first detailed attempt to measure the WC for the Kenyan economy applying various approaches and techniques.

2 Theory

Empirical and theoretical research in relation to the welfare cost (WC, henceforth) of inflation has attracted considerable focus in the recent past. Several studies report varying magnitudes of WC estimates for similar countries, signifying that the WC of inflation is an outstanding question in monetary economics and macroeconomics in general. According to Yavari, Kazem & Apostolos Serletis (2011), WC is higher in small economies than it is in big ones, and with the exception of very high inflation periods, it is generally not costly. Several studies established that, the poor bear the highest burden of WC of inflation and that it cannot be precisely assessed using aggregate methods regardless of its dependence on income distribution. Lucas, Robert (2000) employed a general-equilibrium framework and defined the WC to be the compensation in percentage, required for the households to be indifferent between any positive and the zero nominal interest rate. Dotsey, Michael & Peter Ireland (1996) observed that, "a sound judgment on the price stability level, as the principal goal of monetary policy requires an accurate assessment of the consequences of sustained price inflation".

Lucas (2000) based on compensating variation and consumer surplus approaches provides a substantive work on the WC and counters the trivialized menu costs of inflation. Bailey's formula compares the WC to that of an excise tax by treating real money balances like consumable good, and inflation as a tax, and then computes WC by estimating the inverse function. For the precise estimation of the interest elasticity; the choice of a suitable empirical strategy and an appropriate money demand function that accurately fits the data, are key while using Lucas and Bailey's approach (see Yavari and Serletis, 2011; Ireland, 2009; Gupta & Uwilingiye, 2008; Lucas, 2000).

Table 5 Summarizing the Literature

Study	Country	Methodology (Functional Form)	Inflation comparison	Welfare costs (% of GDP)
Lucas, 2000	US	Calibration	0 to 3%	0.9%
Serletis & Yavari, 2004	Canada & US	Long-Horizon Regression	0 to 3%	0.15% to 0.18%
Serletis & Yavari, 2005	Italy	Long-Horizon Regression	3% to 14%	0.1% to 0.4%
Gupta & Uwilingiye, 2008	S. Africa	Johansen Cointegration	0 to 3%	0.34%
			3 to 6%	0.67%
Ireland, 2009	US	Phillips-Ouliaris Cointegration	0 to 10%	0.21%
Yavari & Serletis, 2011	Latin America	Long-Horizon Regression	5 to 10%	0.1% to 0.4%
Neyapti, 2013	Turkey	OLS & FMOLS	8.6% to 104%	9% to 64%
Kumar, 2014	India	MLE	2% to 14%	0.1% to 1%
Ashworth, Barlow & Evans, 2014	UK	ARDL Cointegration	0 to 10%	0.03% to 0.1%

Lucas (2000) showed that a 3-percent decrease in interest rates to zero yields 0.9-percent increase in real GDP for the US economy. Serletis and Yavari (2004) replicated the Lucas (2000) study and yielded much lower values for US and Canada, they equally obtained smaller values for Italy in their 2005 paper. Serletis and Yavari (2004) used inflation rate as opposed to the usual interest rate for a group of Latin American countries, due to what he called non-responsiveness of the central bank fixed nominal interest rate and lack of market interest rate data. Gupta & Uwilingiye (2008) using cointegration techniques observed that a 3-percent decrease in interest rates yields between 0.34 and 0.67-percent of income for South Africa economy. Ireland (2009) using semi-log function showed that a 10-percent inflation rate corresponds to 0.21-percent of income. Yavari and Serletis (2011) estimated a welfare gain ranging from 0.1 to 0.4-percent of income, from reducing interest rates from 10 to 5-percent for European and Latin American countries. Neyapti (2013) using OLS & FMOLS regression estimated that a reduction of inflation in Turkey from 104 to 8.6-percent increased income by between 9 to 64-percent. Kumar (2014) used MLE and observed a 12-percent decrease of interest rates from 14 to 2-percent yields 0.1 to 1-percent of income in India. Ashworth, Barlow & Evans (2014) used ARDL regression, and observed that, a 10-percent decrease in interest rates yields between 0.03 and 0.1-percent of income in UK.

In literature, many studies (see Ireland, 2009, Serletis and Yavari, 2004, Lucas, 2000) obtained different WC for the US and attributed the cause of the differences to different estimates of interest elasticity obtained, notably; the majority of the studies obtains a single estimate of the WC for the whole sample due to application of constant interest elasticity. Similarly, Kumar (2014) notes that two key issues, for the precise estimation of the interest elasticity are the choice of a suitable empirical strategy and an appropriate money demand function that accurately fits the data.

Recent developments (see Cysne, Rubens & David Turchick, 2010) have established that using the unidimensional welfare formulas that disregard other types of money in an economy leads to a misleading outcome and biased recommendations. This is mainly due to sensitivity of the non-interest-bearing money demand to variations in the opportunity costs of interest-bearing deposits performing monetary functions. Cysne & Turchick (2010) rightly observed that, most estimates of the WC are formulated considering only noninterest-bearing assets, in disregard to technological innovations that have tremendously increased the liquidity of interest-bearing assets. While using bi-dimensional bi-logarithmic money demands, Cysne & Turchick (2010) showed that ignoring interest - bearing money's leads to an overestimation of the WC of inflation, mainly due to the belief that these moneys may partially account for the reduced demand of the noninterest-bearing assets because of higher inflation. Unidimensional formula disregards the presence of a possible trade-off between less liquid interest-bearing money and more-liquid noninterest- bearing; hence there calculation of the WC of inflation, may be misleading.

2.1 Consumer Surplus Approach

To estimate the WC in Kenya, we replicated Yavari and Serletis (2011) an approach based on Lucas (2000). Lucas (2000) noted that in determining the correct size of the WC, money demand specification is vital. Many studies contrast between two money demand specifications to compute WC, namely log-log and semi-log.
Consider the function;-

$$\frac{M}{P} = L(r, y) \tag{1}$$

where M, r, y and P denotes nominal money balances, the nominal rate of interest, real income and price, respectively, at a time t

Letting $M / P = m$, $Y / P = y$, and $z = m / y$ then $L(r, y)$ becomes $L(r, y) = z(r) y$. We can rewrite function 1 as $m = z(r) y$ where z is the unit of an income money demand balances. Yavari and Serletis (2011) defines the WC, *w(r),* as the compensation that makes households indifferent with either a zero or a constant interest rate. We integrate the money demand (inverse), on a defined interval of 0 *to* r to estimate the area of part $A+B$ related to the nominal interest rate, subtract part B (seigniorage) to obtain the WC as shown in the figure 1.

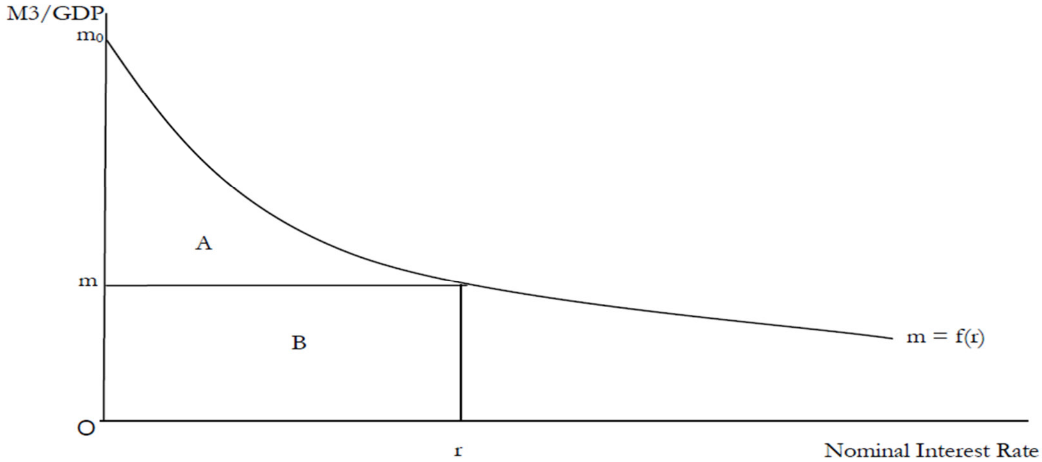

Figure 3 Bailey's Consumer Surplus Approach

Given that, $z(r)$ is a fraction of income, then the function *w(r)* derived from it will equally be a fraction of GDP. According to Lucas (2000), if the money demand function approximated by $z(r)$, and its inverse function given by $\psi(z)$ then we estimate WC of inflation by

$$w(r) = \int_{z(r)}^{z(0)} \psi(z)dz = \int_{0}^{r} z(r)dr - rz(r) \tag{2}$$

2.1.1 Log-Log Demand Function

If the specification follows log-log, where $z(r) = c_1 r^{-\alpha}$ *or* $ln(z) = ln(c_1) - \alpha ln(r)$ equation 2 reduces to;

$$w_1(r) = \int_{0}^{r} c_1 r^{-\alpha} dr - rc_1 r^{-\alpha} = \frac{c_1}{1-\alpha} r^{1-\alpha} |_0^r - c_1 r^{1-\alpha} = \frac{\alpha}{1-\alpha} c_1 r^{1-\alpha} \tag{3}$$

where $c_1 > 0$ is a constant, $\alpha > 0$ denotes the money demand elasticity in absolute terms and r is the nominal interest rate

2.1.2 Semi – Log Demand Function

If the specification follows a semi-log, where $z(r)=c_2e^{-\gamma r}$ *or* $ln(z)=ln(c_2)-\gamma r$ then;

$$w_2(r)=\int_0^r c_2e^{-\gamma r}dr-rc_2e^{-\gamma r}=\frac{c_2}{-\gamma}e^{-\gamma r}\Big|_0^r-rc_2e^{-\gamma r}=\frac{c_2}{\gamma}[1-(1+\gamma r)e^{-\gamma r}] \quad (4)$$

where $c_2 \approx e^{\alpha}$ is a constant, r is nominal interest rate, and $\gamma > 0$ is the money demand semi-elasticity in absolute terms

2.2 Compensating Variation Approach

Lucas (2000) defines the $w(r)$ as income compensation that makes a household indifferent between a zero interest rate, steady state and an identical one with a constant interest rate r. Lucas (2000) estimates the WC of interest rates based on compensating variation approach in general equilibrium, where the solution to equality 5, is w(r).

$$u\left[\left(1+w(r)\right)y,\phi(r)y\right]=u\left[y,\right]\phi(0)y \quad (5)$$

Further, using an assumption of a homothetic current period utility function, obtains a differential equation after setting up the dynamic programming problem [see details in Yavari and Serletis, 2011],

$$w'(r)=\psi\left(\frac{\phi(r)}{1+w(r)}\right)\phi'(r) \quad (6)$$

For the "log-log" demand function where $z(r)=c_1r^{-\alpha}$ *or* $ln(z)=ln(c_1)-\alpha ln(r)$ equation 5 reduces to

$$w'(r)=\alpha c_1r^{-\alpha}(1+w(r))^{1/\alpha}$$

with solution

$$w(r)=-1+\left(1-c_1r^{1-\alpha}\right)^{\frac{-\alpha}{1+\alpha}} \quad (7)$$

where $c_1>0$ is a constant, $\alpha>0$ is the money demand elasticity in absolute terms and r is the nominal interest rate

We derive welfare cost as approximated by equations 3, 4 and 7 via integration of money demand curve to estimate the lost consumer surplus over the interest rate range (zero to r), followed by subtraction of deadweight loss associated with seigniorage revenue rz. We note that, money demand elasticity estimates is critical in the estimation of WC of inflation, therefore, we first estimate the short-term nominal interest rate and the money balance to income ratio long-run relationship. Lucas (2000) preferred specifications set $\alpha=0.5$, $\gamma=7$ and constants pinned down such that $c_1=\bar{z}.(\bar{r})^{\alpha}$ and $c_2=\bar{z}e^{\gamma\bar{r}}$

3 Data and Methodology

The empirical estimation uses quarterly data sets from year 2000 (2000:01) to 2014 (2014:03) for the Kenyan economy, obtained from CBK and KNBS databases. The following variables were used; the money balance ratio *(z,* "M3 to GDP ratio"*),* interest rate *(r,* "91 days T-bill rate").

Methodology consists of the following steps; the first step is to employ the various test to investigate the order of integration, estimate the required lags and other time series variable properties. Secondly, undertake cointegration test using the Johansen maximum likelihood approach (Johansen, 1995). When two or more non-stationary variables have a linear stationary relationship, the variables are "said" to be cointegrated, and their cointegration provides valuable information about their long run relationships. We used VECM and Wald-test to test the exogeneity or endogeneity of variables.

We further employ the ARDL to estimate the long-run equation, given its flexibility of application when the variables are either "mutually co-integrated" or are of different integration order, that is, $I(1)$ or $I(0)$, but not appropriate when integrated at order two ($I(2)$) or higher (Pesaran & Pesaran, 2009). However, the ARDL model is applicable given all variables as reported in the table 2 are $I(1)$ or $I(0)$. Laurenceson & Chai (2003) noted "ARDL takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework". Moreover, according to Banerjee and others (1993), ARDL is easily convertible

to ECM, via a simple linear transformation. The ECM integrates the long-run equilibrium with the short run dynamics without losing long-run information.
The auto-regressive distributed lag (ARDL) estimating equation is as below for the log-log model

$$z_t = c_1 + \alpha_1 z_{t-1} + \alpha r_{t-1} + \sum_{j=1}^{n} \varphi_{1,i} \Delta z_{t-j} + \sum_{j=1}^{n} \varphi_{2,j} \Delta r_{t-j} + \varepsilon_t \qquad (8)$$

where: z is log(*M/Y*), Δ denotes difference operator, *r* denotes interest rate (or its log)

4 Empirical Results

4.1 Unit roots tests

The series comprise quarterly observations of *z* - "M3 as a ratio of gross domestic product" - and *r* - "91 day T-bill rates". Units root test where performed to determine the level of integration and appropriate lags. The table 2 reports main results from five mostly used unit roots test. All series are $I(1)$ at level and $I(0)$ at the first difference.

The estimation of *lz* & lr *in* $ln(z) = ln(c_1) - \alpha ln(r)$ and *lz* & *r* in $ln(z) = ln(c_2) - \gamma r$ poses a possible concern that requires, as Ireland (2009) rightfully observes, a 'somewhat schizophrenic view of those data sets' given that the semi-log analysis requires *r* to be I(1), while the identical log-log model analysis equally requires lr to be I(1) as well. Many researchers including Bae, Youngsoo & Robert Jong (2007), Gupta & Uwilingiye (2008) & Ireland (2009), have extended the discussion by putting the two models on 'equal footing ex ante'. The main assumption is that, *"r* follows an autoregressive unit root process, with the semi-log model viewed as a linear relationship between *lz & r* and the log-log specification being viewed as a nonlinear framework for the same two variables".

Table 6 Unit roots test

Series	Model	ADF	DF GLS	PP	KPSS	NP	Conclusion
lz	τ_t	-2.267	-0.539	-2.277	0.375***	-0.838	
	τ_u	2.085	5.979	2.223	1.623***	2.133	Non- stationary
	τ	-3.33***		-3.083***			
Δlz	τ_t	-12.27***	-12.34***	-12.28***	0.094	-84.29***	
	τ_u	-11.88***	-11.42***	-11.87***	0.664**	-83.18***	Stationary
	τ	-9.57***		-10.35***			
lr	τ_t	-3.144*	-2.448	-2.816	0.117	-14.197	
	τ_u	-3.146**	-1.738*	-2.832*	0.117	-6.84*	Non- stationary
	τ	-0.579		-0.389			
Δlr	τ_t	-8.370***	-3.924***	-8.276***	0.040	-24.803***	
	τ_u	-8.384***	-2.337**	-8.290***	0.092	-10.056**	Stationary
	τ	-8.410***		-8.316***			
r	τ_t	-3.249**	-2.000	-3.736**	0.169	-7.964	
	τ_u	-3.264**	-1.059	-3.807***	0.169	-2.397	Non- stationary
	τ	-0.402		-2.088**			
Δr	τ_t	-5.574***	-1.848	-9.566***	0.051	-0.567	
	τ_u	-5.594***	-0.276	-9.609***	0.058	0.224	Stationary
	τ	-5.613***		-9.645***			

*(**) *** denotes 10(5)1 percent level; Δ denotes the difference operator
τ_u, τ_t, τ indicates the model includes "intercept, trend & intercept, or none" respectively

4.2 Cointegration Results

The next step involves testing whether the *lz* & lr series *in* $ln(z) = ln(c_1) - \alpha ln(r)$ and *lz* & *r* series in $ln(z) = ln(c_2) - \gamma r$ are cointegrated given, they are of similar order of integration $I(1)$ at level and $I(0)$ at first difference. However, before cointegration, we first test VAR model stability. No roots lie outside the unit circle of the estimated VAR for both the log-log and semi-log specifications, hence conclude; VARs are stable and suitable for further analysis. For both specifications (log-log and semi-log), the VAR model with two lags and no deterministic trend were selected based on various information criterion. Trace and Maximum Eigen Value tests for both model's specification confirms one stationary relationship at 5-percent level of significance (see table 3).

Table 7 Test of Cointegration

Null hypothesis	Alternative Hypothesis	Test statistic			0.05 critical value	Prob.**
		Eigenvalue	*Trace Statistic*	*Max-Eigen Statistic*		
ln(*r*) vs ln(*z*)						
r=0	r=1	0.1721*	37.775	31.731	15.892	0.0001
r=1	r=2	0.0353	6.044	6.044	9.165	0.068
r vs ln(*z*)						
r=0	r=1	0.1816*	39.422	33.668	15.892	0.0000
r=1	r=2	0.0337	5.7536	5.7536	9.165	0.2106

Notes: **denotes MacKinnon-Haug-Michelis (1999) p-values
* denotes rejection of the hypothesis at the 0.05 level

For any cointegrating equation $\beta' X_t$, the unrestricted β is not always economically meaningful regardless of chosen normalization for its unique determination. Therefore, according to Hendy & Juselius (2000), to achieve an economic interpretability, an identifying restriction is imposed (over) on β in the long-run cointegration analysis. Given that we only have one cointegrating vector, we first restricted *lz* to unity, with a view of exactly identifying the long-run relationship; normalizing restriction on *lz* is enough. However, the *lz* coefficient was statistically insignificant and restriction was not bidding even after imposing zero restriction on the adjustment coefficient of *lz*. We therefore treated *lz* as exogenous and instead normalized *r or* lr as the case may be. Based on the above restrictions, the long-run effects and error correction terms for both specifications were obtained (see table 4).

Table 8 Regression Estimation Results

	VECM Regression		ARDL Regression	
Functional Form	Log-log	Semi-log	Log-log	Semi-log
Dependent Variable	ln(r)	r	ln(r)	r
ln(z)	- 3.0123** (-2.077)	- 0.047** (-1.95)	- 3.0356** (-2.136)	- 0.0583** (-2.407)
Constant	- 2.7709	- 0.1161***	- 6.6728	- 0.1737
ECT	- 0.0044 (-1.153)	- 0.0922*** (-3.72)	- 0.0311 (-0.964)	- 0.1875*** (-2.4715)
LR test - Binding Restriction		1.847 [0.174]		

*(**)*** represents 10%(5%)1% significance, (), [] denotes t-values and p-values respectively

$$lr = -2.7707 - 3.0123 * lz \atop (-2.077) \tag{9a}$$

$$r = -0.1161 - 0.047 * lz \atop (-1.95) \tag{10a}$$

$$lr = -6.6728 - 3.0356 * lz \atop (-2.136) \tag{9b}$$

$$r = -0.1737 - 0.0583 * lz \atop (-2.407) \tag{10b}$$

The results indicate that coefficient estimates of the lagged error-correction terms are negative as expected, but only for semi-log specification are significant. The adjustment coefficient corrects at 9.22 percent and 18.75-percent of the disequilibrium for the semi-log specification in the VECM and ARDL models respectively, in the next period.

The cointegrating relationship is as depicted in figure 3 under the semi-log specification. The residuals are stationary and mean reverting around zero for the cointegrating equation, an indication that the estimated cointegrating relations are appropriate. We treat equations, 9a,b and 10a,b as a long-run Treasury bill rule as they have interest rate as the dependent variable; however, they are inverse of the money demand functions.

Our main concern is not the naming of cointegrating relations, but the value of coefficients used in computation of WC of inflation. The sign in both specifications, that is, semi-log and log-log specifications adhere to economic theory. The elasticities obtained by taking reciprocal of lz coefficient in equation 9a and 10a;

the slope coefficients are $\alpha = 0.33197$ and $\gamma = 21.27116$, while the intercepts[1] are $c_1 = 0.39858$ and $c_2 = 0.08462$ for log-log and semi-log respectively.

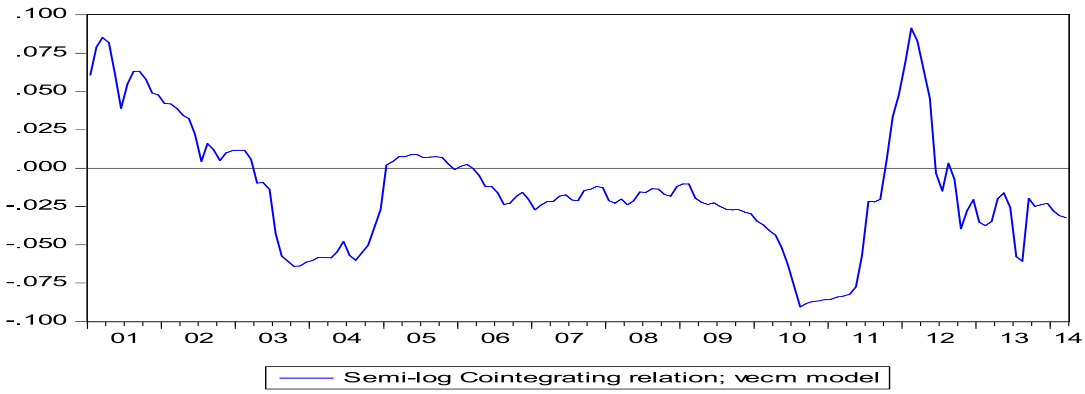

Figure 4 Semi Log Cointegrating relation

4.3 ARDL Cointegration Results

The ARDL model elasticities obtained by taking reciprocal of *lz* coefficient in equation 9b and 10b; the slope coefficients are $\alpha = 0.32942$ and $\gamma = 17.14766$, while the intercepts [2] are similarly computed as $c_1 = 0.111008$ and $c_2 = 0.050882$ for log-log and semi-log respectively.

4.4 Welfare Cost Computation Results

Based on VECM and ARDL models, we estimate the welfare cost. The adjustment (ECT) coefficient should be negative and significant, as it measures the speed of adjustment towards long run equilibrium. However, for log-log models, both in VECM and ARDL, the ECT is negative but not significant hence their results may not be valid. Only the semi-log model results were used, even though all results are tabulated as shown in table 5. The average T-bill rates over the period is 7.99-percent, which corresponds to zero inflation based on our assumption. Therefore, inflation of 2.5-percent corresponds to interest rates of 10.49-percent and so on. WC is computed based on i_t (T-bill average plus inflation) then deduct WC based on the average T-bill rate of 7.99-percent. The difference treated as a cost imposed by inflation to the economy. Since only semi-log model is considered, the results show that for 2.5-percent inflation, the inflation cost is between 0.041 and 0.058-percent of output. When inflation increases to say 7.5-percent, the cost ranges 0.103 to 0.133-percent of output. We note that, the two regression models provide slightly different results, with VECM imposing a greater welfare cost than ARDL model in the economy. The key question is to choose the best regression model among the two. Based on model assumptions, we prefer ARDL to VECM. Therefore, the inflation cost ranges between 0.041 and 0.103-percent, for the 2.5 to 7.5-percent inflation band in Kenya

Table 9 Welfare Cost of Inflation

	VECM			ARDL		
Inflation	Consumer Surplus		Compensating Variation	Consumer Surplus		Compensating Variation
	Log-log	Semi-log	Log-log	Log-log	Semi-log	Log-log
2.50	0.007303	0.**000582**	0.008289	0.002006	0.**000412**	0.002075
5.00	0.014045	0.001018	0.016119	0.003859	0.000755	0.004004
7.50	0.020367	0.**001329**	0.023624	0.005598	0.**001025**	0.005823
10.00	0.026357	0.001545	0.030886	0.007245	0.001233	0.007556
12.50	0.032076	0.001690	0.037961	0.008819	0.001388	0.009221
15.00	0.037567	0.001787	0.044889	0.010331	0.001502	0.010827
17.50	0.042863	0.001850	0.051699	0.011789	0.001586	0.012384
20.00	0.047989	0.001891	0.058415	0.013201	0.001645	0.013898

[1] The intercepts are computed as follows: $c_1 = e^{(-2.7709/3.0123)}$ and $c_2 = e^{(-0.1161/0.047)}$

[2] The intercepts are computed as follows: $c_1 = e^{(-6.6728/3.0356)}$ and $c_2 = e^{(-0.1737/0.0583)}$

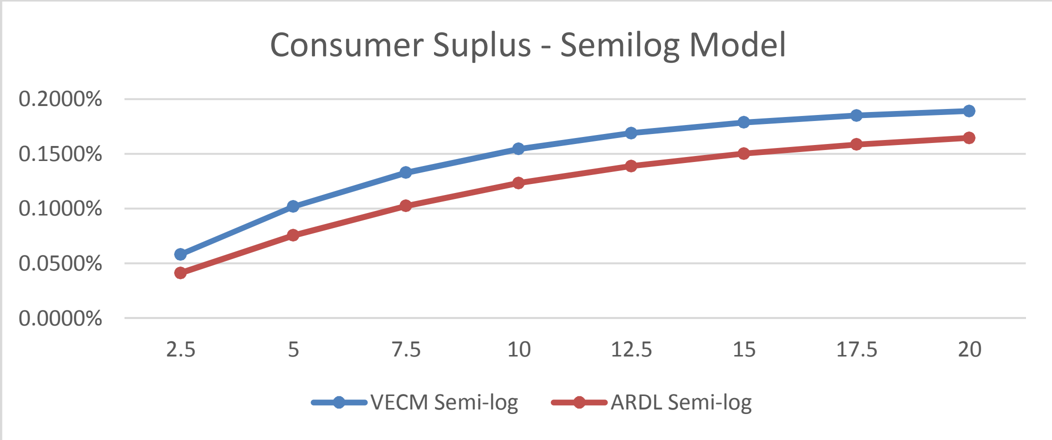

Figure 5 Welfare Cost

Computing the WC based on Lucas (2000) preferred the specification of $\alpha = 0.5$ and $\gamma = 7$, and constants pinned down such that $c_1 = \bar{z}.(\bar{r})^{\alpha} = 0.266831$ and $c_2 = \bar{z}e^{\gamma\bar{r}} = 0.352922$ yields higher costs of 0.298 and 0.94-percent for 2.5 and 7.5-percent inflation respectively for the semi-log model against our estimate of between 0.041 and 0.103-percent. Therefore, just like Yavari & Serletis (2004, 2005), we equally obtained smaller estimates when we employ regression techniques to derive the elasticities as opposed to using Lucas (2000) estimates.

5 Conclusions

The study employed cointegration techniques (VECM and ARDL) to estimate the appropriate long-run money demand relationship for the Kenyan economy. Based on approaches originally derived by Bailey (1956) and Cagan (1956) and widely extended thereafter by Lucas (2000) and Yavari & Serletis, (2011) among others, to deduce the cost of inflation imposed by $5\% \pm 2.5\%$ inflation band. The semi-log model provided the best data fit for the inverse money demand relationship via the ARDL model. Our results show that the cost of inflation ranges between 0.041 and 0.103-percent, for the 2.5 to 7.5-percent inflation band in Kenya. Our results compare well with those of Yavari & Serletis (2011), Kumar (2014) and Ashworth, Barlow & Evans (2014) among others estimates observed in literature. Further, just like Yavari & Serletis (2004, 2005), we equally obtained smaller estimates when we employ regression techniques to derive the elasticities as opposed to using Lucas (2000) estimates. The current target band by CBK, therefore based on our estimates maybe considered appropriate. However, as noted by Gupta & Uwilingiye (2008), the welfare cost estimates the interest rate distortions to money demand, and any reduction on the inflation band, may result to a better welfare gains.

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