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Excise tax changes and their impact on Gadam sorghum demand in Kenya

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Excise tax changes and their impact on Gadam sorghum demand in Kenya

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ABSTRACT

Gadam sorghum has in the recent past been promoted by various operators through a Public-Private-Partnership. Taking advantage of this, the largest brewing establishment in Kenya developed a beverage targeted for the low-end market in an effort to stem the problems associated with illicit alcoholic beverages while giving farmers a reliable income source. With its promotion, a number of farmers have devoted effort at availing grain to via contract, for the purposes of brewing. However, excise tax changes are destined to impact this arrangement by altering the conditions for different players along this particular chain. Using ARIMA time series modelling, we analyse the imposition of two tax changes—a reduction of tax in 2006 and an increase of tax in 2013—on the demand for the product and therefore demand for Gadam sorghum grain. Data is represented by Results show a relatively large change in demand occasioned by tax increases. The paper argues that the further encouragement of sorghum growing will undoubtedly cushion farmers from climate change impacts while it's processing can boost manufacturing to meet the targets stated in Vision 2030 while offering farmers a consistent income source.

INTRODUCTION

Sorghum is one of the drought-tolerant crops whose production is to be promoted through the Agricultural Sector Development Strategy 2010-2020 (Government of Kenya, 2010). With climate change poised to influence choices made in the sector, sorghum is one of the prioritized technologies contained in the Technology Needs Assessment report submitted to UNFCC in 2005. The crop is seen to advance a low carbon and climate resilient development in the National Climate Change Action Plan (Republic of Kenya, 2013). Recent simulations indicate that unlike maize, with sorghum, food insecurity is predicted to witness modest improvements by the year 2050 due to its drought-resistant nature (Kabubo-Mariara & Kabara, 2015). Besides, it is unlikely that maize—being the most important staple in Kenya—will provide the revenue to small holders to generate improvements in household incomes, especially in the semiarid areas. Increasingly scarce and smaller land sizes are compelling farmers to adopt commercialization strategies that can enable maximization of output per unit of land (Ariga, et al., 2010). At a more pragmatic level, a commercialized agriculture with high value addition remains a key priority in the Second Medium Term Plan (MTPII) 2013-2017 (Government of Kenya, 2013). The MTPII through the Agribusiness Development Programme aims at ensuring market opportunities for agricultural commodities. The further processing and value addition of agricultural produce is therefore a means to

achieving this objective. These pronouncements are in line with several sector projects designed to enhance the growing and processing of crops such as sorghum.

A staple food crop for many low-income households in Kenya's Arid and Semi-Arid Lands (ASALs), sorghum has mainly been used for home consumption. It is predominantly grown in Kenya's south-western and south-central counties within the Eastern, Nyanza, Western and Rift Valley regions. These regions accounted for about 45, 39, 6 and 8 percent of Kenya's total sorghum production in 2012, respectively. Homabay County in Nyanza region and Kitui in Eastern region recorded the highest production. Sorghum production varies considerably between years due to changes in yield and area harvested (**Figure 1**). Average annual sorghum production during 1990-2013 was about 113,489 tonnes, while the average annual growth in production was about 2,199 tonnes over the entire period. Production has been the most volatile in recent years, reaching its lowest point in 2008 due to low yields and decline in total area planted resulting mainly from political instability following Kenya's December 2007 elections (Chemonics, 2010). In 2008, area grown to sorghum fell by some 33 percent but in 2009, cultivated area increased by 66 percent. Between 2009 and 2013, sorghum production recovered to the 2007 level. Most of this growth (Figure 1) was driven by increases in area harvested, largely due to the promotion of sorghum as a drought resistant crop in the Arid and Semi-Arid Lands (ASALs) as well as attractive prices from growing consumption (MOA, 2011).

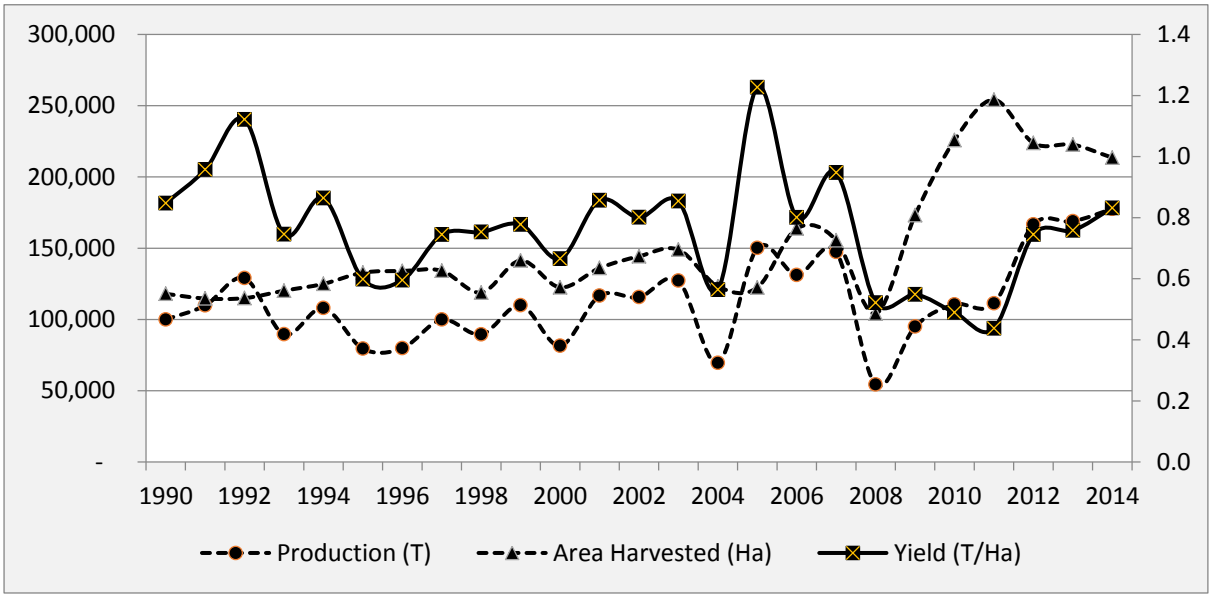

Figure 1: Sorghum production indices in Kenya (1990-2014)

Kenya is estimated to account for only 0.6 percent of Africa's sorghum production far behind major producers in Africa such as Sudan and Nigeria and where it is malted commercially. For instance, in Nigeria a ban on imported barley malt imposed in 1988 has necessitated the use of indigenous cereals such as sorghum (Swanston, et al., 1992). Cultivars with good malting quality for brewing have been developed and tested (Swanston, et al., 1992; Beta, et al., 1995; Taylor, 2003).

Domestic sorghum trade in Kenya has generally been limited due to low production volumes and poor marketing channels as most farmers produce enough sorghum to meet their domestic requirements, with little surplus to sell. Production has traditionally been centred in the drought-prone areas where it is predominately produced (Nzuma & Sarker, 2008). In fact, it has been estimated that only 30 percent of domestic sorghum production is actually marketed (Mwadalu & Mwangi, 2013; Kilambya & Witwer, 2013). On the trade front, the country has for a long time imported small but unrecorded amounts of cereals (e.g. maize, sorghum, rice, simsim) across the Uganda border which are transported as head or hand loads (Ackello-Ogutu & Echessah, 1997). Informal imports also occur through the Tanzanian border points. Sorghum however accounts for 2.7 percent of internal trade within the East African Community (inter-EAC trade) and 1.7 percent of extra EAC imports (Mbithi & Kiio, 2012). Between 2005 and 2013, Kenya was a net importer of sorghum except in 2010 when the country exported 49,709 tonnes of sorghum mainly to Somalia and Southern Sudan (Kilambya & Witwer, 2013).

Total sorghum consumption in Kenya increased gradually from 2005 to 2007, but decreased dramatically between 2007 and 2008 which in part was caused by the post-election violence (PEV) leading to a decline in sorghum production. Since 2008, total sorghum consumption in Kenya increased once again, levelling off at about 81,000 tonnes (MOA, 2011). In the 1960s, the share of sorghum in total cereal expenditure was about 30 percent but appears to have fallen recently to less than 5 percent as maize appears to have substituted sorghum (Nzuma & Sarker, 2008).

Samples analysed by the East African Breweries Limited (EABL) revealed that sorghum (Gadam) contained 75% carbohydrates, compared to 67% for barley and 66% in maize, making sorghum a good source of fermentable sugars (Kavoi, et al., 2013). From a technical perspective, sorghum can yield higher extract amounts of linter (at 290 linter/kg versus 250 for barley) which is good for the malting and brewing process (Maina, 2015). Gadam sorghum is early-maturing, high yielding, and is highly adapted to stressful drought conditions. With this situation, the government through various Public-Public-Partnership initiatives involving the use of sorghum in the brewing industry have been trying to interest the growing of Gadam sorghum, mainly in some ASAL counties. This bore fruit in that the final product (commercial beer: Senator™) not only earned farmers a good return but drew many low income segment Kenyans from the consumption of illegal brews. However, an excise tax remission granted since 2004 was withdrawn in 2013, resulting a depressed demand for the product. What followed was a disruption of the value chain as demand contracted with consequences down the value chain.

This paper looks at the series of policy decisions affecting the Gadam sorghum value chain in Kenya and attempts to trace their likely impacts. These policies relate mainly to fiscal policies that are thought to directly impact the sorghum value chain.

The rest of the paper is organised in the following manner; a background to the history and development of the product and the sorghum sub-sector is presented. A summary of excise taxation and related literature is similarly provided. After setting the scene, we describe the

data used in the study as well as the econometric approach utilized in its analysis. The paper concludes with a discussion and recommendations from the analysis.

The senator story

Partly driven by the abandonment of barley for wheat by local farmers following a rise in international wheat prices, EABL chose to replace 60% of barley used in the brewing process with fermentable gadam sorghum (Kavoi, et al., 2014). Some authors suggest that Kenyan wheat farmers are relatively protected from international pressures, and this could explain this production shift (Monroy, et al., 2013). In addition, barley prices in the international market have in recent years been volatile (FAO, 2009). Raw material for the malting process may account for as much as70% of malt production costs or close to 29% of the total production costs (ibid). Under these circumstances, other initiatives such as the Sorghum Value Chain Development project covering three East African countries have been implemented. The goal of the project was[1] to develop a stable and high quality Gadam sorghum supply chain that will increase incomes of sorghum farmers and enable national beverage industries to substitute imported grains by locally produced sorghum[2]. In this project, The European Cooperative for Rural Development (EUCORD) coordinates the supply of sorghum to East African Maltings Ltd (EAML) through a number of partners such as Smart Logistics, an aggregator (Orr & Mwema, 2013). Maintaining long-term contracts with buyers, Smart Logistics established outgrower agreements with organized farmer groups since 2006[3] to produce sorghum (Orr & Mwema, 2013). The grain is screened by agents at the aggregation centres since for brewing; raw material needs to be exceptionally high and consistent quality (FAO, 2009).

In 2004, East African Breweries Ltd (EABL), one of the country's leading brewers, launched Senator™, a beer derived from sorghum grain and intended for the low end market (Orr, et al., 2013). The Kenya Agricultural and Livestock Research Organization (KALRO) and the Ministry of Agriculture, through the orphan crops program[4] in collaboration with EABL, have in the last few years promoted the use of high quality sorghum varieties, such as Gadam, to supplement barley in beer production (MOA, 2011; MOAL&F, 2015; Mwadalu & Mwangi, 2013). In the context of this paper, such measures represent forms of government intervention which are intended to directly or indirectly influence market outcomes from the supply side of the market for sorghum. In turn, this change in farm level production would translate in beer brewed from sorghum.

These recent developments have spurred renewed interest in the commercial production of sorghum, as it offers ASAL farmers prospects for higher returns from sale of sorghum grain. In addition, livestock farmers (e.g. dairy) located within a radius from the brewery stand to

[1] This project which ran December 2012-2015 was supported by the East African Breweries Ltd. / Diageo and Common Fund for Commodities (CFC)

[2] At the same time, other countries such as Uganda, Zambia and Mozambique (cassava) have embarked similar initiatives to encourage the incorporation of local raw materials such as sorghum in the brewing industry.

[3] This was the same year when a 100% excise tax remission was granted for sorghum derived beer.

[4] This is a Ministry of Agriculture, Livestock and Fisheries program intended at promoting neglected "orphaned " or "less mainstream" crops such as sorghum.

benefit from the availability of brewers waste, a bi-product from the brewing process which is rich in protein and can stimulate milk production (Heuzé, et al., 2015).

Demand for Gadam sorghum was estimated at 60,000MT but production in 2010 was estimated to be 2,000 MT (Mwadalu & Mwangi, 2013). In 2009, EABL could only raise 1,000 MT of grain but through the initiatives mentioned before, by 2015, EABL could access 16,000MT locally (Maina, 2015). The bridging of this deficit serves to show that a commodity that receives relatively favorable tax treatment will tend to be supplied (McGee, 2004). In addition, contract farming is a practical vehicle which provides support by improving market access for smallholders (Vermeulen & Cotula, 2010). That farmers are contracted to produce sorghum of acceptable quality indicates that they are cushioned from volatile prices and markets for sorghum. Before EABL—through the aggregator; Smart Logistics—entered the market, the market price for sorghum grain was Kshs 3/kg compared to the Kshs 22/kg offered by Smart Logistics in 2012 (Orr & Mwema, 2013). The government had in 2004 reduced excise duty on non-malted keg beer to 30% (Orr, et al., 2013). In 2005, this remission was brought to 42% in 2005 and was eliminated (100% remission) in 2006. This made Senator™ beer—a recent product introduction in the Kenyan market—competitive against illegal brews, in effect wrestling 44% of the informal market and making Senator Keg one of EABL's best-selling beer brands by volume in Kenya (EABL, n.d.). East African Breweries maintained the leading position in beer in 2014 with a 73% total volume and Senator™ Keg and Senator™ Lager each had a 9%[5] volume share (Euromonitor, 2015).

Whereas one player controls close to 95% of the commercial beer market, it only controls 44% of the country's overall alcoholic beverage market. The larger share (56%) is divided between traditional brews and illicit liquors. Since about 14% of Kenyans drink alcohol[6], it means a large section of the population were taking brews that could be harmful and whose standard was unknown. With increasing disposable income levels, promotion and marketing activities and improvements in the quality of beer, this could see an increase in the beer consuming population. According to a report by market research Canadian Ltd., the volume of beer sold in Africa is expected to grow 5% per year on average from 2015 to 2020, faster than any other continent and nearly double the global rate, as more African consumers change their home brewed drinks for commercially brewed ones over the coming years. In Kenya, they predict an increase by 1% within this period.

Excise tax

Efficiency in taxation calls for excise taxes to be set in inverse proportion to the product's elasticity of demand (McGee, 2004). However, the story gets complicated from a general equilibrium framework. If there are substantial cross-price elasticities, the impacts of an

[5] Senator was the leading EABL brand 5 years into its launch, but has since lost this to the much more mature brands such as Tusker and Guiness (Euromonitor, 2015)

[6] A recent report by global investment bank UBS indicates that on average, an East African consumes well below the global average of about 35 litres per annum, consuming just about 9 litres of beer per annum compared to the EU average of 73 litres with Czech Republic leading the pack with an average per capita consumption of 145 litres followed by Germany with 107 litres.

excise tax in other markets could add to the economic efficiency of the tax. By their nature, goods with low elasticity of demand will tend to have fewer substitutes. However, this general *Ramsey rule* does not consider the political environment under which taxes are designed since it assumes an omniscient benevolent legislature (Holcombe, 2002). This author argues that interest groups always have an incentive to present information showing their goods to have elastic demand and therefore deserving low taxes. Further, excise taxes also decrease social welfare, since an increase in price can cause consumers to shift their purchases to products that previously ranked lower on their list of preferences (McGee, 2004). Tax designers however do not have sufficient information to create a tax structure that conforms to the Ramsey rule, even if they wanted to. Even if they wanted to implement the rule, some argue that the incentives inherent in the political process can result in a substantial amount of rent-seeking losses (Holcombe, 2002). Running a modern tax collection system such as Kenya's is further confronted with the large proportion of individuals in the informal sector, yet the obvious instruments used by the tax agency and which impose the highest direct costs on the poor are excise taxes and the VAT (Eissa & Jack, 2009). Excise and VAT are consumption based revenues and are therefore dependent on population levels. In terms of compliance, beer excise in Kenya was 85% by 2000/01, higher than for example corporate tax at 34%. This signifies the relative ease of collecting excise in Kenya (Waris, et al., 2009).

Just like in other jurisdictions, the usual commodities for excise include alcohol and tobacco (Republic of South Africa, 2014; Bird, 2015). In fact in Kenya, beer was the first commodity to remit excise tax in 1923 (Waris, et al., 2009). As an illustration of the affinity to tax alcohol, in 1990, beer contributed 14.2% of non-oil excise revenue in Kenya but by 1998, this stood at 58.1%, and was accompanied by sky rocketing of retail prices (Karingi, et al., 2001). The authors argued for a review of the tax rate which in turn would maximize tax revenues. Their argument was based on the Laffer curve, which simply illustrates the tradeoff between tax rates and the total tax revenues actually collected by the government (Heijman & van Ophem, 2005; Trabandt & Uhlir, 2011; Laffer, 2004). Given the elasticity of western style beer in Kenya (-.33 in the short-run and -1.0 in the longrun), it is expected that an increase in excise will translate into higher retail prices and therefore a fall in demand for the taxed commodity. The tax buoyancy is inelastic and as suggested by Okello, (2001) it is estimated at 0.64, less than in Tanzania. We also estimate that between 2004 and 2014, the buoyancy for beer excise was 0.74, close to the figure of 0.77 for all excise taxes as estimated by Kinyua (2013).

Many East Africans have actually come to believe that the biggest objective of excise duty is revenue collection (TMEA, 2014). The percentage of revenue collected from alcohol excise in East Africa (Burundi, Kenya, Rwanda, Tanzania and Uganda) averages 47.6% while in Kenya, this is about 50.5%. Between 2004 and 2014, this ranged between 50% and 59%. Excise tax contributes about 14%-19% of tax revenue in Kenya (Waris, et al., 2009; Kinyua, 2013). Such indirect taxes may contribute about 9% of GDP compared to direct taxes 3.8%, and it has been estimated that for developing countries (Kenya included), incumbent governments may lower such taxes just prior to an election year (Ehrhart, 2013). Moreover, indirect taxes are "invisible" and thus taxpayers suffer from "fiscal illusion", systematically underestimating the tax burden from indirect taxes (Sausgruber & Tyran, 2005). This could

be the reason why excise on beer is always a prime target for tax increases. Excise taxes from beer witnessed a 8.6% CAGR between 2004 and 2014 where it contributed between 50% and 58% of excise tax revenue, but grew by 2% between 2012 and 2013 (Republic of Kenya, 2008; Republic of Kenya, 2012; Republic of Kenya, 2015). This compared to a CAGR of 24% for wines and spirits and 9% for cigarettes between the same period.

During the 2013 budget speech, the cabinet secretary at treasury noted that it had been "*difficult administratively to differentiate between various beer products and Senator™ keg, which posed a threat to revenue collection*". The government therefore through Legal Notice 103(3) reduced the 100% remission granted in 2006 to 50% and to grant it only in respect of beer made of millet, sorghum and cassava[7]. The Senator™ keg would however, continue to enjoy a remission at this new level, on a transitional basis, for a period of three years. We also contend here that this proclamation may also have been prompted by the principles of public finance as contained in the new Kenyan Constitution: that the burden of taxation shall be shared fairly[8]. The 50% excise duty imposed on Senator™ Keg reduced sales by 80 percent (Orr, et al., 2013). According to officials, the exchequer was expecting to generate an additional Kshs 6.2 billion in the process (Business Daily, 2013). A review conducted by Tegemeo Institute shows that imposing the excise duty on Senator™ Keg led to a decline in sales, an increase in prices of the Senator™ Keg beer while some retail outlets also closed subsequently leading to job losses. The major single buyer of the sorghum at the same time threatened to cancel contracts with about 20,000 farmers who had been contracted to supply gadam sorghum. Termination or renegotiation of these contracts by argument of *force majeure* is a provision for this change as indicated in the recent legal guide on contract farming (UNIDROIT, FAO & IFAD, 2015). Tegemeo's report estimated that farmers, transporters and other players in the sorghum value chain lost Ksh. 6.4 billion (Opiyo, 2014). This author estimates that farmers lost 65% of potential revenues, a fall attributed to the excise tax. This fall in demand for sorghum beer was not surprising since estimates in Kenya suggest a long-run price elasticity of beer of -1.11 and a short-term elasticity of .74 (Okello, 2001). The estimates provided by various authors suggest that the revenue maximizing tax rate (RMTR) for market beer in Kenya is set very high (Bird & Wallace, 2010). Following lobbying by the brewer and other stakeholders such as Cereal Growers Association (CGA), Alliance for a Green Revolution in Africa (AGRA), East African Grain Council (EAGC) and Tegemeo, the Alcoholic Drinks Control (Amendment) Act 2015 was signed in May 2015 and in effect brought the excise remission from 50% to 90%. This is in line with the Excise Duty Act (2015), which grants possibility of remission of excise duty on beer or wine derived from sorghum, millet, cassava or other Kenyan grown agricultural commodity—excluding barley.

[7] Beers from these locally available crops have been introduced in several African countries such as Uganda, Zambia, Ghana, Mozambique and Nigeria

[8] Chapter 12 (Public Finance): Part I, 201(b) (i)

MATERIALS AND METHODS

Data description

We use data digitized from graphical presentation of volumes of monthly sorghum brewed beer by the brewer between July 2004 and May 2015. We use GetData Graph Digitizer (V2.26.0.20) software to extract the data. We assume that the quantity demanded can be recovered by a conversion of the amount of monthly senator beer sales. That is, the litres of beer sold to distribution agents every month; as beer sold to distribution agents is resold to the retailers and finally to consumers within a period of one month, since distributors stock beer in response to demand from retailers (Okello, 2001). In order to protect company data, we convert this quantity of beer sold by transforming it by a factor into tons of sorghum used in brewing for each reported month. In effect, the data shows a consistent increase in sorghum use between 2004 and 2008, followed by a marginal decline in 2009 which was followed by another period of growth until sorghum use peaked in 2012. A sharp decrease is visible in 2013, which coincides with the 50% remission. This result suggests that since EABL signs three-year contracts with suppliers demand for the raw material inelastic in the short term as they are forced to honour these contracts. Assuming that the brewer used locally procured sorghum throughout this period; then this translates to between 2% and 43% of Kenyan grown sorghum or averaging about 18% of Kenyan produced sorghum annually (Figure 2)[9]. The extreme value of 43% occurs when sorghum production (as well as other agricultural commodities) was low, mainly due to the PEV of 2008 whereas poor rainfall was the origin of low production in the following years, especially in 2010. From about 22% in 2012, the amount of sorghum brewed as a percentage of national production fell to 16% in 2013 and further to 6% in 2014.

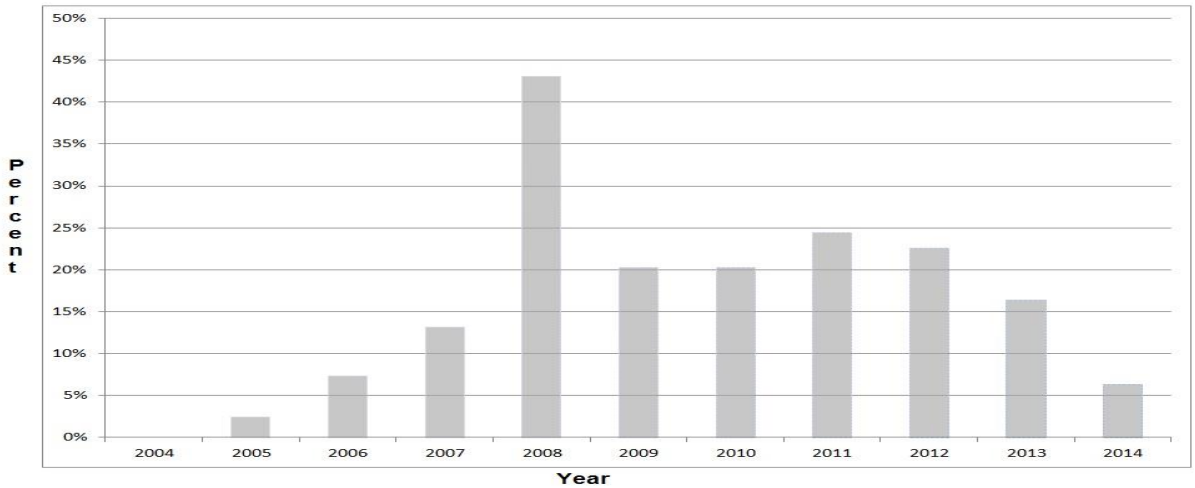

Figure 2: Use of sorghum in commercial brewing as percent of national sorghum production

Source: Author computations

This trend; if correct implies that farmers supplying this market had to direct the "extra" sorghum quantities elsewhere. Bearing in mind that EABL may have been the only consistent

[9] Though we are unable to authenticate this, we assume that since Kenya is a net importer of sorghum, then local stocks are used before any imports are declared.

bulk market for sorghum, farmers would then be forced to sell to brokers and other outlets. These outlets (brokers) have been reported to offer lower prices than the aggregator (Smart Logistics) who arrange with EUCORD to supply EABL with sorghum (Orr & Mwema, 2013).

First, the series is examined for desirable qualities. On examining a plot of the Autocorrelation Function (ACF), we identify a slow decay in the autocorrelation, suggesting autocorrelation is present in the series or more formally, $Corr(u_t,u_s) \neq 0$, for all $t \neq s$ (Wooldridge, 2009). We also perform on the series, the Dickey-Fuller test for a unit root which yields that $\rho=0.0675$ which is significantly different from unity, leading us to reject the null of a unit root for the series in levels. The test is implemented through the expression $\Delta y_t=\alpha+\theta y_{t-1}+\sum c\Delta y_{t-1}+e_t$ where θ is defined as being equal to ρ-1. We also extend this Dickey-Fuller test by augmenting it using lagged changes i.e. Δy_{t-1}. The results of the unit-root tests are presented in **Table 1**. The series is not stationarity at levels but is stationary after first differences.

We use the Akaike Information Criterion (AIC) which produces the most accurate structural and semi-structural impulse response estimates for realistic sample sizes for monthly VAR models (Ivanov & Kilian, 2001). The AIC indicates that one lag would be sufficient and augment the test using lagged Δy_{t-h}, and the result confirms the presence of a unit root in the un-differenced series.

Table 1: Augmented Dickey-Fuller (ADF) test results for unit roots

	Level			First differences		
	(y_t)	Z(t) has t-distribution		(Δy_t)	Z(t) has t-distribution	
		1%	5%		1%	5%
Intercept	-2.312	-2.356	-1.657	-13.103	-2.356	-1.657
p value for Z(t)	(0.0112)			(0.0000)		
Intercept and trend	-2.121	-4.030	-3.446	-13.159	-4.030	-3.446
p value for Z(t)	(0.5346)			(0.0000)		

Taking the first difference converts the series to one that is stationary i.e. y_t is $I(1)$ but Δy_{t-1} is $I(0)$ since by definition, if y_t is $I(1)$, then Δy_{t-1} is $I(0)$. The ACF from the differenced series is stationary, strongly suggesting; statistically speaking, a random walk without drift. In addition, the ACF plot shows a slow decay at all lags considered while a plot of the partial autocorrelation function (PACF) shows a strong coefficient on lag1 which dies off suddenly after this lag. This pattern strongly suggests an AR rather than an MA process. In the remainder of the paper, we therefore consider the series as an AR(1), MA(0) process in the ARIMA models. Using the Portmanteau test (Ljung-Box Q test), we conclude that the differenced series is white noise, and this is confirmed through the DW statistic as well as the Breusch-Godfrey LM test for autocorrelation. We therefore see no need to difference the series further after the first difference. Since the data represents monthly values, it is expected that there is a seasonal signal, during which certain months of the year are expected to draw greater demand for Senator keg, and therefore sorghum. This is shown by decomposing the

series into the various—trend, seasonality and random components (**Figure 3**). The variation due to seasonality is not of primary interest, and therefore, the seasonally adjusted series is useful for the purposes of this paper (Hyndman & Athanasopoulos, 2014). Rather than diseasonalize the data by performing seasonal differencing we can include dummy variables representing the different months. The data represents 11 years and the seasonal component on **Figure 3** shows an eleven equally spaced seasonal pattern.

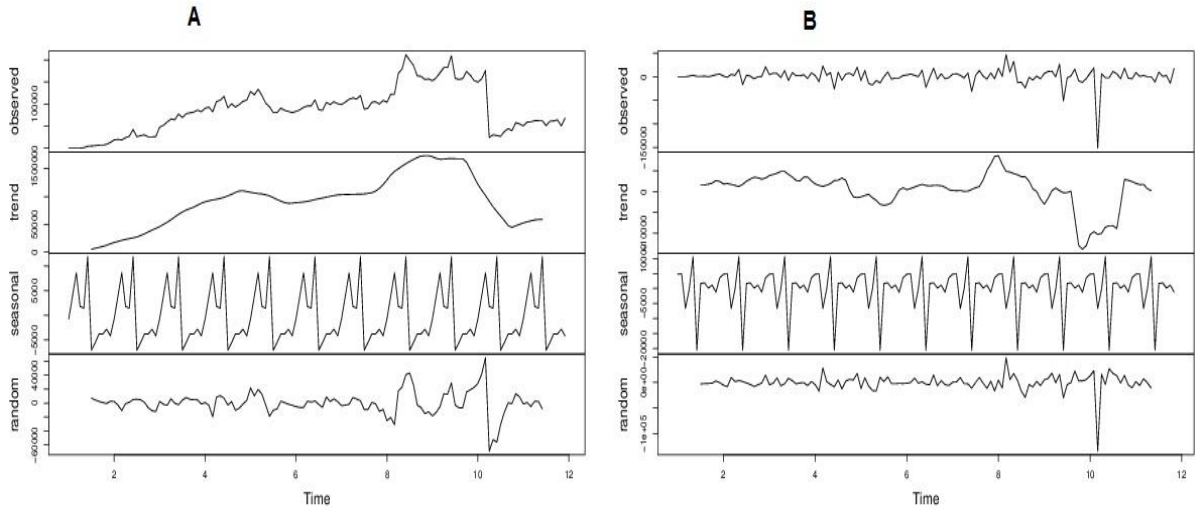

Figure 3: Original series (panel A) and differenced series (panel B) decomposed into their trend, seasonal and irregular components

Econometric model:

A number of researchers utilize the interrupted time series (ITSA) analysis to study different phenomena in the health sector e.g.; (Högberg, et al., 2005; Alba, et al., 2013; Boudreaux, et al., 2014; Abegaz, et al., 2014; Jebb, et al., 2015). ITSA is a general design relying on the analysis of a before and after intervention using time series data (Lagarde, 2011; Linden, 2015). ARIMA modelling is one of the approaches which tries to account for all time series properties, specifically stationarity and autocorrelation. A difficulty in implementing an ITSA resides in the complexity of identifying the best fitting AR and MA structures (Lagarde, 2011). In its place, an alternative—the segmented linear regression—can be used. Data for a segmented regression (interrupted time series) analysis is therefore organised as suggested in (Wagner, et al., 2002; Lagarde, 2011; Jebb, et al., 2015). The purpose of this analysis is exploratory, rather than predictive. In effect, we are trying to answer questions regarding the impact of events and for our purpose; we rely on segmented time series analysis, a strong quasi-experimental design to evaluate the longitudinal impact of policy (Wagner, et al., 2002; Lagarde, 2011). By partitioning the series into pre and post event segments, the segmented regression technique allows us to examine levels and trends in the series (Jebb, et al., 2015). The general form of the model is shown below;

$$y_t = \beta_0 + \beta_1 \bullet t + \beta_2 \bullet event_t + \beta_3 \bullet t \ \ postevent + \varepsilon_t \ldots\ldots.(1)$$

Where β_0 represents the pre-policy baseline, β_1 estimates the secular trend prior to the event (e.g. policy), β_2 is the intercept reflective of the policy whereas β_3 estimates trend due to the policy change. ε is an independent, identically distributed (i.i.d) sequence with $E(\varepsilon_t)=0$, $Var(\varepsilon_t)=\sigma^2_e$. In effect, we estimate several models using y_t as the dependent variable. These include (1) an OLS, (2) a Prais-Winsten (Cochrane-Orcutt procedure) linear regression, (3) AR GLS using restricted maximum likelihood and (4) autoregressive ARIMA (1,0,0) model as presented in Table 2. The models (5) and (6) on are ARIMA models but the dependent variable is the differenced series i.e. Δy_t. The different interventions investigated include i) the alcoholic drinks control act hereinafter referred to as "*Mututho*" regulations, which are reported to have contributed to declines in excise revenue (Republic of Kenya, 2012); ii) decision to grant 100% excise tax remission (↓100% tax) and iii) decision to reduce remission to 50% (↑50% tax). In the series, 100% tax is implemented in July 2006 while "*Mututho*" laws are starting August 2010 whereas the 50% tax replaces 100% tax in October 2013. These interventions (events) enter the regression as dummy variables i.e. 1 representing periods when the intervention is active and 0 otherwise. The post-intervention period on the other hand is a vector (1, 2,… n) where is 0 for all periods before the respective event and proceeds from 1 to n from the point of the intervention where n is the number of months that the intervention has been effective.

RESULTS AND DISCUSSION

From the various results provided, we can use the AIC to make a choice among competing models. We drop the linear OLS because of the usual deficiencies in the presence of serially related data. The Prais-Winsten regression on the other hand presents coefficients roughly similar to those from GLS maximum likelihood estimation though the latter is a better choice going by the AIC. The ARIMA (1,0,0) also provides estimates that are consistent with the other AR(1) estimations. However, based on the non-stationarity of the series in levels, these models may not be reliable leaving a choice between (5) and (6). We pick the more parsimonious ARIMA (1,1,0) since it takes care of both the AR effect as well as stationarity.

The results presented in

Table 2 suggest that the expected signs on the coefficients are as expected. This is so, save for the "Mututho" regulations, which we expected to have a negative sign. Nevertheless, this coefficient in all of the separate estimations is not significant. Coefficients for both tax interventions (50% remission and 100% remission) are all significant. Besides, as expected, a cut in excise taxes increase sorghum use while the reverse is true for an increase in taxes, represented by the 50% excise tax. What is interesting is the magnitude of the effect of these two tax policies. The 100% tax remission in 2006 replaced a 42% tax remission granted in 2005, but the effect was not as big as the one occasioned by a 50% tax remission. This could be explained by prospect theory: people value losses more than equivalent gains. In this regard, we are equating gains to tax decreases and losses to tax increases from the perspective of consumers. Since the change in excise tax is transferred to consumers (at least in the short run), a change of ↓0.58 (42% to 100%) is valued less than a change of ↑0.5 (100% to 50%) as one tax policy replaces another. The first excise change is represented by an increase of

361 tons whereas the second change is represented by a decrease of 2,330 tons of sorghum. Looking at the original series on **Figure 3**, suggests that this tax is shifted to consumers. Although the immediate tax incidence falls on consumers, the ultimate tax burden will also be felt by farmers as demand for sorghum is affected by tax increases.

Table 2: Impact of various policies on the sale of sorghum beer in Kenya (2004-2015)

VARIABLES	(1) (y_t) OLS Linear	(2) (y_t) Prais winsten Linear	(3) (y_t) GLS REML	(4) (y_t) ARIMA (1,0,0)	(5) (Δy_t) ARIMA (1,1,0)	(6) (Δy_t) ARIMA (1,1,0)
Secular trend	28.56***	37.33**	35.71*	37.32**	20.72	26.26*
	(9.190)	(16.66)	(21.87)	(15.91)	(37.02)	(15.69)
"Mututho"	13.90	35.69	50.26	34.94	71.93	78.77
	(135.4)	(195.30)	(206.11)	(188.72)	(204.64)	(203.03)
Post mututho	27.27***	21.39	18.92	21.53**	14.06	---
	(5.582)	(13.28)	(19.42)	(12.67)	(38.73)	
↑50% tax	-3,603***	-4338.83**	-4135.07*	-4339.80***	-2467.93	-2330.87***
	(945.1)	(1821.00)	(2442.24)	(1737.37)	(3911.13)	(290.88)
Post ↑50% tax	-21.98	-25.24	-20.15	-25.40	1.88	---
	(15.55)	(33.26)	(45.63)	(31.70)	(66.69)	
↓100% tax	782.4***	474.30**	417.43**	478.71***	370.56**	361.51*
	(152.9)	(198.79)	(206.30)	(196.40)	(204.06)	(203.04)
Post ↓100% tax	-18.06*	-23.49	-20.15	-23.55	-1.53	---
	(9.714)	(20.13)	(45.63)	(19.18)	(44.97)	
rho	---	0.7769	0.8619			
		(0.055)				
AR1				0.7712	-0.1575	-0.1574*
				(0.06)	(0.088)	(0.088)
Constant	-83.44	-112.79	-68.69	-114.32	---	---
	(131.3)	(275.54)	(380.16)	(262.77)		
DW statistic		2.058				
Observations	132	132	132	132	132	132
R-squared	0.896	0.665				
AIC		1781.07	1712.08	1786.01	1769.03	1763.25

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CONCLUSION AND RECOMMENDATIONS

The results suggest that the impact of an increase in taxes is not equivalent to that from a decrease in taxes. An increase in taxes will reflect more greatly than an equivalent decrease. An increase in taxes will also be reflected in lowered demand for sorghum and this is translated into lower market prospects for farmers growing this crop. Besides, looking at the letter and spirit of what led to the increase, how the increase in tax was expected to stimulate agricultural activity was not clear. Likewise, looking at the excise revenue collections, following the move to increase the tax; it is not certain that the revenue target was met. The results also suggest that if the tax reviews were designed with demand elasticities in the

background, they may not have taken into account this behavioural anomaly; that tax changes can alter behaviour differently.

Another fundamental issue concerns the reasons leading to the decision to introduce the sorghum beer. Going by international experience which suggests a clear link between the affordability of alcoholic beverages and levels of illicit activity it is important to weigh these tax changes against such vices. For instance, many OECD countries did not adjust duties on beverages, partly because of concerns about the link between high taxes and illegal trade. If people drink less beer because it is taxed more, one may go further to ask what it is they do in turn. Whereas some may just keep on drinking as much as before as South African National Treasury (2002) suggests is true of (low-income) sorghum beer drinkers, others may do so at the expense of reduced food consumption for families. Alternatively, drinkers may turn to soft drinks or to an illegal alternative such as illicitly sold home brew or smuggled products. The ready availability of such alternative channels is undoubtedly one reason for the relatively high price elasticities for alcoholic products observed in some African countries. When consumers substitute taxed beverages for local brews or illegal beverages, the government loses revenue.

Concluding, we submit here that several policies of government seem to work at cross purposes. The excise increase seems to be at odds with the stated commitment to increase production of drought tolerant sorghum. For instance, the stated administrative difficulty in collecting excise revenue is not clear especially at a time when KRA has been undertaking extensive reorganization of its operations through tax reforms. Besides, how the tax changes introduced during the 2013 budget speech were intended to stimulate agricultural activity was not immediately clear.

> *".....it has been difficult administratively to differentiate between various beer products and senator keg, thereby posing a threat to revenue collection. ... I expect this measure to stimulate agricultural activity in these regions where these products are grown. Hon Members, this measure will generate an additional Ksh 6.2 billion to the exchequer."* **Budget speech, 2013**

Just like it happens in South Africa, the leading beer volume producer in Africa, the use of survey information provided by industry should be promoted for policy decision-making in the sense of regulatory impact assessments (RIA). This would encourage constructive dialogue between industry and government. In effect, since demand elasticities are not static, tax rates need to be continually adjusted to reflect changes occurring in the underlying circumstances. In this paper, the results suggest that elasticities for sorghum beer were not consulted or if they were, then they may have been stale estimates of a related product. Further, research is suggested to establish in a dynamic context, what would be an appropriate period for a tax on a new commodity. Furthermore, for this sorghum beer, application of the Ramsey Rule is precluded by lack of information about the demand elasticities. For instance, we have not been able to trace any indication of a specific study examining the demand elasticities for this particular sorghum beer following its launch.

We speculate that the lingering effects of contract cancellations can be more damaging. We have described the willingness of EABL to engage with more inclusive business models as a genuine economic component of their business—rather than as part of its corporate responsibility programmes. We therefore maintain that it is the responsibility of government policy to promote such inclusive business models agro-industries that have taken such strides. On the production front however, capacity building for farmers and setting up of structures that enable them to meet the high expectations for quality as demanded by EABL needs to be undertaken. The further encouragement of sorghum growing will undoubtedly cushion farmers from climate change impacts while it's processing can boost manufacturing meet the targets stated in Vision 2030 while offering farmers a consistent income source.

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