ACREAGE RESPONSE OF FLUE CURED VIRGINIA TOBACCO IN KHYBER PAKHTUNKHWA

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ABSTRACT:- This study investigates the acreage response of Flue Cured Virginia (FCV) tobacco to its own price and area under maize crop in three major FCV producing districts of Khyber Pakhtunkhwa i.e., Swabi, Mardan, and Charsadda. Data used in the study cover time series data for 1971-2011. The newly developed Auto Regressive Distributed Lag (ARDL) model for cointegration was used to estimate the short-run and long-run elasticities. The study found a long-run price elasticity of 0.33, thereby revealing that FCV acreage response to its own price is relatively inelastic. The short-run acreage response was also low (0.13) and therefore relatively inelastic. This implies that price policy could not be used as the sole instrument to affect area under FCV. The provision of some other non-price incentives may also play a significant role in increasing area under FCV in the study area. The results also show that area under maize crop negatively affect area under FCV, thereby indicating that maize crop could be considered as competing crop to FCV in the study area. The results of this study could help policy makers in identifying important determinants of acreage response of FCV tobacco crop in the study area.

Key Words: Flue Cured Virginia Tobacco; Acreage Response; Auto Regressive Distributed Lag Model; Cointegration; Pakistan.

INTRODUCTION

Tobacco crop is of high economic significance for Pakistan in terms of valuable foreign exchange as about Rs.2334.28 million (US$ 24.571 million) worth of tobacco and cigarettes were exported by Pakistan during 2010-11. It is also a high value cash crop for the farmers of Khyber Pakhtunkhwa and Punjab. Being a highly labor intensive crop, it provides farm level employment to nearly 80,000 people, nearly 50,000 people in cigarette factories and one million people in marketing of tobacco and its products (Pakistan Tobacco Board, 2014). Thus activities in the tobacco growing sector also create demand for goods and services from agronomy support sectors such as fertilizers, pesticides, seeds, utilities, etc., giving rise to household's food and non-food expenses and revenues for public exchequer.

Agricultural supply response analysis is a good tool used to examine the effectiveness of agricultural pricing policies regarding allocation of farm resources and provides inputs for economic policy formulation for enhancement of

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agricultural production. In the literature, supply response is being studied both on product and aggregate levels. The former focus on the change in composition of the product or the area planted with respect to the change in the commodity price while the later incorporate change in total agricultural output with the change of agricultural prices against industrial prices (Ozkan et al., 2011).

Recent supply response research studies in agricultural economics mostly focus on econometrics techniques like cointegration and error correction using time series data. Mesike et al. (2010) analyzed supply response of rubber farmers to its own price and other non-price factors in Nigeria using cointegration and Vector Error Correction (VEC) technique. Similarly Anwarul Huq and Arshad (2010) used the same technique to study supply response of potato crop in Bangladesh. Chinyere (2009), Kuwomu et al. (2011), Nkang et al. (2007), Ogundari and Nanseki (2013), and Ozkan et al. (2011) also used the same approach to estimate supply response for various agricultural commodities.

In Pakistan, tobacco crop is planted over more than 50,000 ha producing about 100,000 t of tobacco leaves. In Khyber Pakhtunkhwa, tobacco crop is grown in Swabi, Mardan, Charsadda, Mansehra, Bunair, Malakand and Nowshehra districts, while in Punjab, it is grown in almost all districts except hilly areas like Rawalpindi, Islamabad and Chakwal. The major tobacco growing districts of Punjab are Sahiwal, Rajanpur, Toba Tek Singh, Vehari, Faisalabad, Jhang, etc. The major tobacco types grown in Pakistan are FCV, Dark Air Cured (DAC), Hookah and white patta (WP) (Table 1).

FCV is not only the main source of livelihood of tobacco farmers but also contributing considerably in

Table 1. Various types of tobacco grown in Pakistan

Type	Popular Name	Growing Areas	Usage	Area (ha)
Flue cured virginia (FCV)	Virginia or cigarette tobacco	Charsadda, Mardan, Swabi, Nowshera, Buner, Mansehra, Malakand Agency	Cigarettes	27064
Light air-cured tobacco	Burley	Dir and Swat Districts	Cigarettes	183*
Dark air cured virginia (DAC)	DV	Gujrat, Mandi Bahauddin, Okara,Vehari	Cigarettes	716
Dark sun cured rustica (black leaf)	Naswar tobacco snuff tobacco	Attock, Rajanpur, DG Khan, Vehari, Dadu, Pishin/Qila	Snuff	>7000
Sun cured rustica (white patta)	Chelum tobacco naswar tobacco	Charsadda, Mardan, Swabi, Nowshera	Chelum, naswar, cigarettes	4960
Light sun-cured virginia	Desi, Hookah tobacco	Pakpattan, Sahiwal, Faisalabad, Sheikhupura, TT Singh, Kasur, Bahawalpur and Bahawalnagar	Hookah	>4000

*Source: Pakistan Tobacco Board (2014), * Figure relates to 2007-08.*

government treasury. For example, the Federal government gets Rs. 46-47 billion annually as central excise duty while the Pakistan Tobacco Board earn Rs. 60-65 million annually in terms of cess whereas the government of Khyber Pakhtunkhwa receives more than Rs. 100 million in the form of provincial tobacco development cess (Khan, 2013). Khyber Pakhtunkhwa is the major tobacco producing province of Pakistan. Of the total area under tobacco in Pakistan, almost 63% is cultivated in Khyber Pakhtunkhwa which produces 77% of the total tobacco production (Table 2). This implies that increase in tobacco production in the province is attributed to increase in per hectare yield.

The objective of this study is to estimate responsiveness of Flue Cured Virginia (FCV) to price and non-price factors like area under competing crops such as maize crop in Khyber Pakhtunkhwa both under long and short term conditions. Specifically, the study focuses on three major FCV producing districts of Khyber Pakhtunkhwa i.e., Swabi, Mardan and Charsadda.

MATERIALS AND METHOD

The analysis covers data from 1971 to 2011, and estimates the supply elasticities of FCV in response to price changes in these districts using an adapted Nerlovian model. Consequently, supply response of FCV tobacco was modeled in cointegration framework, specifically, Auto Regressive Distributive Lag (ARDL) model.

Data were sourced from Crops Area and Production (by districts), Pakistan Economic Survey and Pakistan Tobacco Board (2014). Variables used in the analysis include area under FCV tobacco in Khyber Pakhtunkhwa, prices of FCV, area under WP and area under maize crops in three districts: Swabi, Mardan, and Charsadda. Prices data were deflated by 1980's prices as they were relatively stable; therefore, the decade was selected to deflate nominal prices.

The Nerlovian expectation model has been used as a framework in this study to investigate FCV acreage response in Khyber Pakhtunkhwa, specifically, the three major FCV producing districts i.e., Swabi,

Table 2. Province-wise area and production shares of tobacco across decades

	Area (%)				Production (%)			
Decade	Punjab	Sindh	KPK	Baloch-istan	Punjab	Sindh	KPK	Baloch-istan
1970s	38.4	1.0	57.0	3.6	32.9	0.9	62.2	4.0
1980s	39.4	0.7	56.3	3.7	31.5	0.6	63.7	4.2
1990s	34.5	0.6	60.0	5.0	24.0	0.4	70.9	4.7
2000s	34.6	0.3	61.8	3.2	21.4	0.2	76.1	2.3
2011-12	33.6	0.3	62.8	3.3	20.8	0.2	76.7	2.3

Source: GoP (2009) and GoP (2013)

Mardan, and Charsadda. Majority of the agricultural supply response empirical studies follow the Nerlove (1958) model. This model has the feature of capturing dynamics of agriculture by including price expectation and adjustment cost. However, the model has been criticized extensively on the basis that it can give spurious regression in non-stationary time series data (McKay et al., 1999). To overcome these limitations of the traditional Nerlovian model, this study used cointegration and error correction model that estimate both the long run and short run elasticities.

The single equation two steps Engle-Granger procedure has been used widely for investigating cointegration between variables. However, this technique has some limitations; for example, it identifies a single cointegrating relation only despite the fact that there may be more than one cointegrating relations. Secondly, it is a two-step procedure where one regression is run to estimate residual series and that residual series is tested for unit root. Thus error in the first step is ultimately carried into the second stage estimation. Thirdly, this procedure works efficiently in long time series data only.

Johansen cointegration technique is another technique extensively used in the literature to overcome some of the limitations of Engle-Granger procedures. Nevertheless, this technique has also some limitations. For instance, like Engle-Granger, Johansen technique also needs a large data series for the validity of the results. Secondly, Johansen technique can only be used when all the series integrated are of the same order.

To avoid limitations of the cointegration techniques mentioned above, this study uses Auto Regressive Distributed Lag (ARDL) or bound test developed by Pesaran et al. (2001). This technique has some unique advantages for instance (i) it is valid even in small data series, (ii) it does not require, that all series to be integrated are of the same order, (iii) it gives unique cointegration vector rather than assuming only one cointegration relation, and (iv) this technique provides more choices like decision about number of endogenous and exogenous variables to be included in the model, optimal number of lags to be used, and order of the vector autoregressive (VAR).

ARDL Bound Test Procedure

The ARDL model used in this study is defined and given below:

$$\ln A_t^{FCV} \quad {}_o \quad {}_1 \ln A_{t\ 1}^{FCV} \quad {}_2 \ln P_{t\ 1}^{FCV} \quad {}_3 \ln A_{t\ 1}^{maize} \quad \overset{m}{\underset{j\ 1}{}} \ {}_j \ \ln A_{t\ j}^{FCV} \quad \overset{m}{\underset{j\ 1}{}} \ {}_j \ \ln P_{t\ j}^{FCV} \quad \overset{m}{\underset{j\ 1}{}} \ {}_j \ \ln A_{t\ j}^{maize} \quad {}_t \quad \ldots\ldots\ldots\ldots(1)$$

where,

Δ	=	a change operator
ln	=	natural logarithm
A_t^{FCV}	=	area under FCV tobacco (ha)
P_{t-1}^{FCV}	=	price of FCV (paisa kg^{-1})
A_{t-1}^{maize}	=	area under maize crop (ha)
m	=	optimal lag length and is based on Schwarz information criterion (SC) and Akaike information criterion (AIC).

$_{1},\ _{2},\ _{3},\ _{j},\ _{j}$

and $_{j}$ = parameters that are to be estimated

$_{t}$ = error term of the model

The null hypothesis of no-cointegration of equation 1 is defined as:

$H_0:\ _1 =\ _2 =\ _3 = 0$

The Wald test statistics or F-statistics is used for confirming the existence of co-integration among the variables. This study covers data for 40 years; therefore, critical values developed by Narayan (2005) are used instead of using critical values developed by Pesaran et al. (2001).

Once the existence of cointegration among variables is confirmed, the long-run equilibrium elasticities can be estimated as follows:

$$\ln A_t^{FCV} \quad _1 \quad \sum_{j\,1}^{m} \ _{1j} \ln A_{j\ i}^{FCV} \quad \sum_{j\,0}^{m} \ _{1j}$$
$$\ln P_{j\ i}^{FCV} \quad \sum_{j\,0}^{m} \ _{1j} \ln A_{j\ i}^{maize}$$
$$_t \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Number of lags for equation (2) is selected by either Schwarz Bayesian criterion (SBC) or by Akaike Information criterion (AIC). Pesaran and Shin (1999) suggested selection of maximum of 2 lags for annual data.

The short-run dynamics in the ARDL specification can be obtained by the following error correction model (ECM):

$$\ln A_t^{FCV} \quad _2 \quad \sum_{j\,1}^{m} \ _{2j} \quad \ln A_{j\ i}^{FCV}$$
$$\sum_{j\,0}^{m} \ _{2j} \quad \ln P_{j\ i}^{FCV} \quad \sum_{j\,0}^{m} \ _{2j}$$
$$\ln A_{j\ i}^{maize} \quad EC_{t\ 1} \quad _t \ \ldots\ldots\ldots(3)$$

where,

EC_{t-1} = an error correction term which is defined as:

$$EC_t \quad \ln A_t^{FCV} \quad _1 \quad \sum_{j\,1}^{m} \ _{1j} \ln A_{j\ i}^{FCV}$$
$$\sum_{j\,0}^{m} \ _{1j} \ln P_{j\ i}^{FCV} \quad \sum_{j\,0}^{m} \ _{1j} \ln A_{j\ i}^{maize} \ ..(4)$$

The coefficients of short-run equation represent the short-run dynamics,

= the speed of adjustment by which the model converges to its equilibrium.

RESULTS AND DISCUSSION

Unit Root Test

Although ARDL approach does not require pre-testing of stationarity of variables, still unit root test has been carried out to make sure that series are not integrated of order 2 i.e., I(2) because then ARDL gives spurious results. Augmented Dickey-Fuller (ADF) was used to test the series for unit root. The optimal lag length was chosen using Schwarz Information Criterion (SIC). The results of unit root show that FCV area and maize area have unit root while FCV price and white patta area have no unit root at level (Table 3). Thus variables are either integrated of order 1 or 0.

Bounds Test

As a first step in ARDL procedure, bounds test for cointegration among variables was carried out using equation (1) to verify existence of

Table 3. Augmented Dickey-Fuller unit root test results

Variables	Level			First Difference		
	Lags	Test statistics	95% Critical value	Lags	Test statistics	95% Critical value
FCV area**	1	-3.02	-3.53	0	-5.25	-2.94
FCV price**	3	-3.93	-3.54	-	-	-
White patta area*	0	-3.11	-2.94	-	-	-
Maize area*	0	-2.21	-2.94	0	-5.54	-2.94

** =with intercept only, **= with intercept and trend*

unique cointegration vector. The results indicate a unique cointegration vector when FCV area is used as dependant variable (Table 4).

Table 4. Bounds test for cointegration

Dependent Variable	F-Statistic	Outcome
F_a^{fcv} (A^{fcv} A^{maize})	4.15*	Cointegration
F_p^{fcv} (P^{fcv} \ A^{fcv} A^{maize})	1.32	No cointegration
F_a^{fcv} (A^{maize} \ A^{fcv} P^{fcv})	7.05	Cointegration

*The critical values bounds for F-statistic for restricted intercept and no trend for k=3 and n=40: lower bound I(0) = 3.100 and upper bound I(1) = 4.088 using Narayan (2005) critical values. * = Significant at 5% level*

Long-run Equilibrium Elasticities

After confirming existence of cointegration among variables, equation (2) was estimated for long-run coefficients (Table 5). Results of ARDL (2, 1, 0) show that area under FCV responds positively to its own price but its magnitude is low which implies that FCV area is relatively price inelastic. This low magnitude of elasticity could be attributed to the existence of hysteresis in agriculture sector (Muchapondwa, 2009). Area under maize crop was also used in this study as a competing crop for FCV tobacco in the study area. The coefficient of maize area showed that it negatively affect area under FCV tobacco. It implies that maize crop could be considered as competing crop for FCV tobacco in the study area.

Table 5. Long-run equilibrium elasticities using ARDL approach

Variable	Coefficient	Std. error	Probability
FCV Price	0.33***	0.094	0.001
Maize Area	-1.25*	0.740	0.100
Constant	22.40**	8.051	0.009

Area under FCV is dependent variable and selection of lags for ARDL model is based on Schwarz Bayesian criterion.
, **, and * = Significant at 10%, 5%, and 1%, respectively.*

Short-run Elasticities

The short-run coefficients of FCV price and area under maize crop are non significant (Table 6). It is worth mentioning here that coefficients of FCV price and maize area in the short run are lower than the coefficients in the long-run. It is quite under-

Table 6. Short-run elasticities and error correction using ARDL approach

Variable	Coefficient	Std. error	Probability
FCV Price	0.13^{ns}	0.114	0.271
Maize Area	-0.523^{ns}	0.355	0.151
EC (-1)	-0.42**	0.131	0.003

*Area under FCV is dependent variable and selection of lags for ARDL model is based on Schwarz Bayesian criterion. ns = Non significant coefficient at 5%. ** = Significant at 5%. EC(-1) = first lag of error correction term.*

standable because in the short-run with fixed area of land, farmers are unable to increase area under FCV. Coefficient of error correction term is negative and highly significant. It implies that shocks in the model returns back to its equilibrium by 42 % each year.

It is therefore concluded that both short as well as long-run elasticities fell in the inelastic zone i.e., the FCV tobacco farmers are relatively not responsive to FCV tobacco prices. This result is consistent with Leaver (2004) and Askari and Cummings (1977) whose results showed that tobacco farmers in Zimbabwe and Malawi, respectively, were relatively unresponsive to tobacco prices. The short-run elasticity in this study has been lower than the long-run price elasticity which is again consistent with results obtained by Leaver (2004) although, both the short- and long-run elasticities were higher than the elasticity estimates of the current study. The inelastic supply response of FCV tobacco does not mean that price incentives are not important for FCV acreage but, it is also likely that some non-price incentives could dominate the positive effect of price incentives (Mythili, 2008). The study also found that area under maize crop negatively affect (although significant at 10%) area under FCV tobacco. This indicates that maize crop could be declared as competing crop to FCV tobacco in the study area

RECOMMENDATIONS

Tobacco Board should announce tobacco prices that are substantially higher than the competing crops so that FCV farmers response positively by increasing area under FCV tobacco.

Price policy should also be made effective and it should be implemented in true sense.

In the long-run, a blend of price and non-price incentives to be extended to FCV tobacco farmers to increase area under FCV crop in the three major FCV producing districts of Khyber Pakhtunkhwa.

The non-price incentives may include better access to input markets, provision of agricultural credit, well organized output market, well coordinated market information system etc. The FCV tobacco involves an intensive use of firewood, which causes deforestation.

Other technologies like the use of sugarcane waste must be used as alternative sources of energy.

Provision of coal to the farmers at the reasonable prices or subsidized rate by the government is also suggested.

The substantial price rise for maize could force FCV producers to shift some area from FCV tobacco to maize crops.

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