

Analysis Of Flue-cured Tobacco Supply Elasticity In Zimbabwe 1980- 2010: An Error Correction Model Approach

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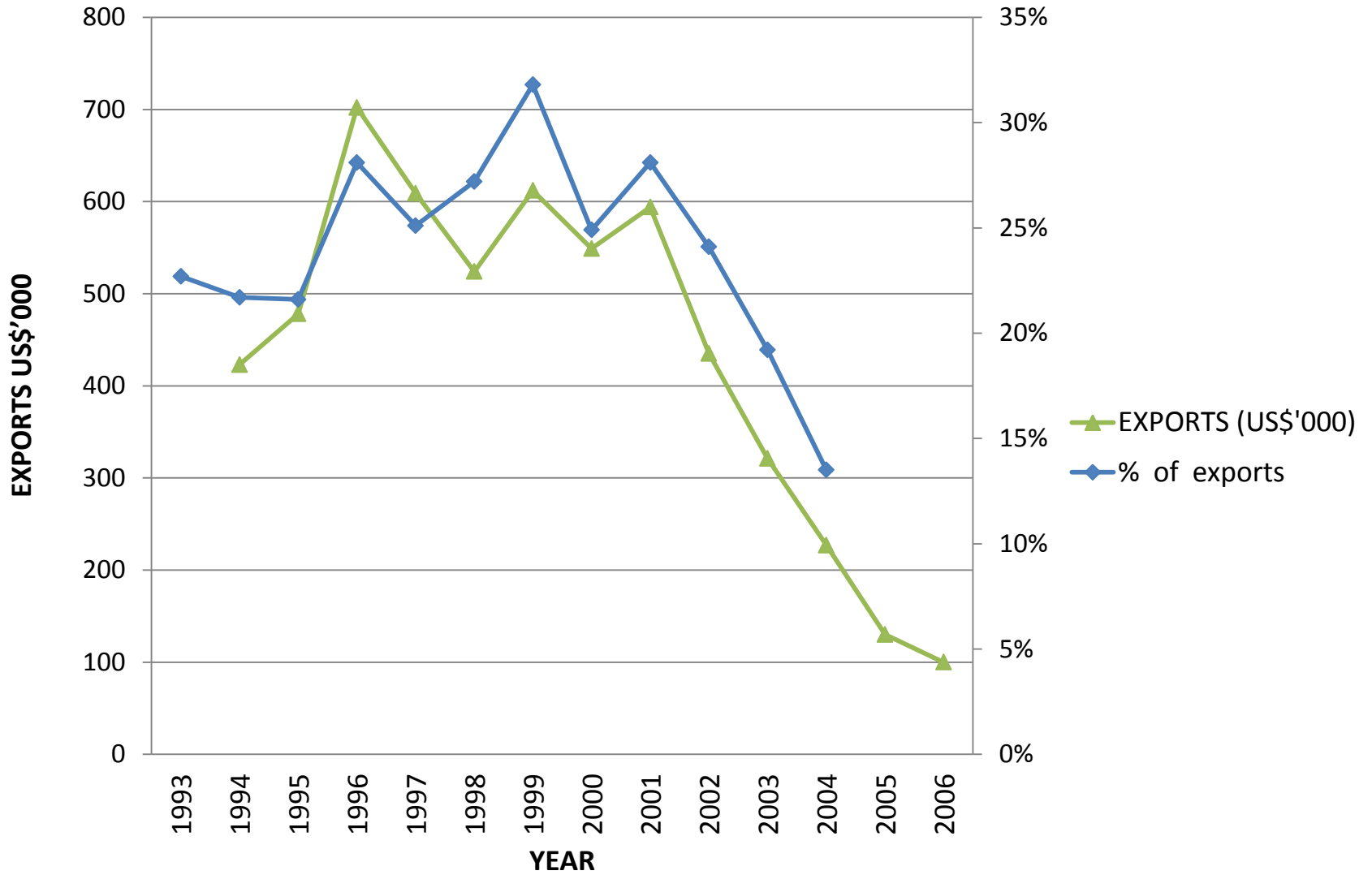
Australian Agricultural and Resource Economics Society (AARES),
55th Annual Conference, Melbourne, Australia,
February 8-11, 2011.



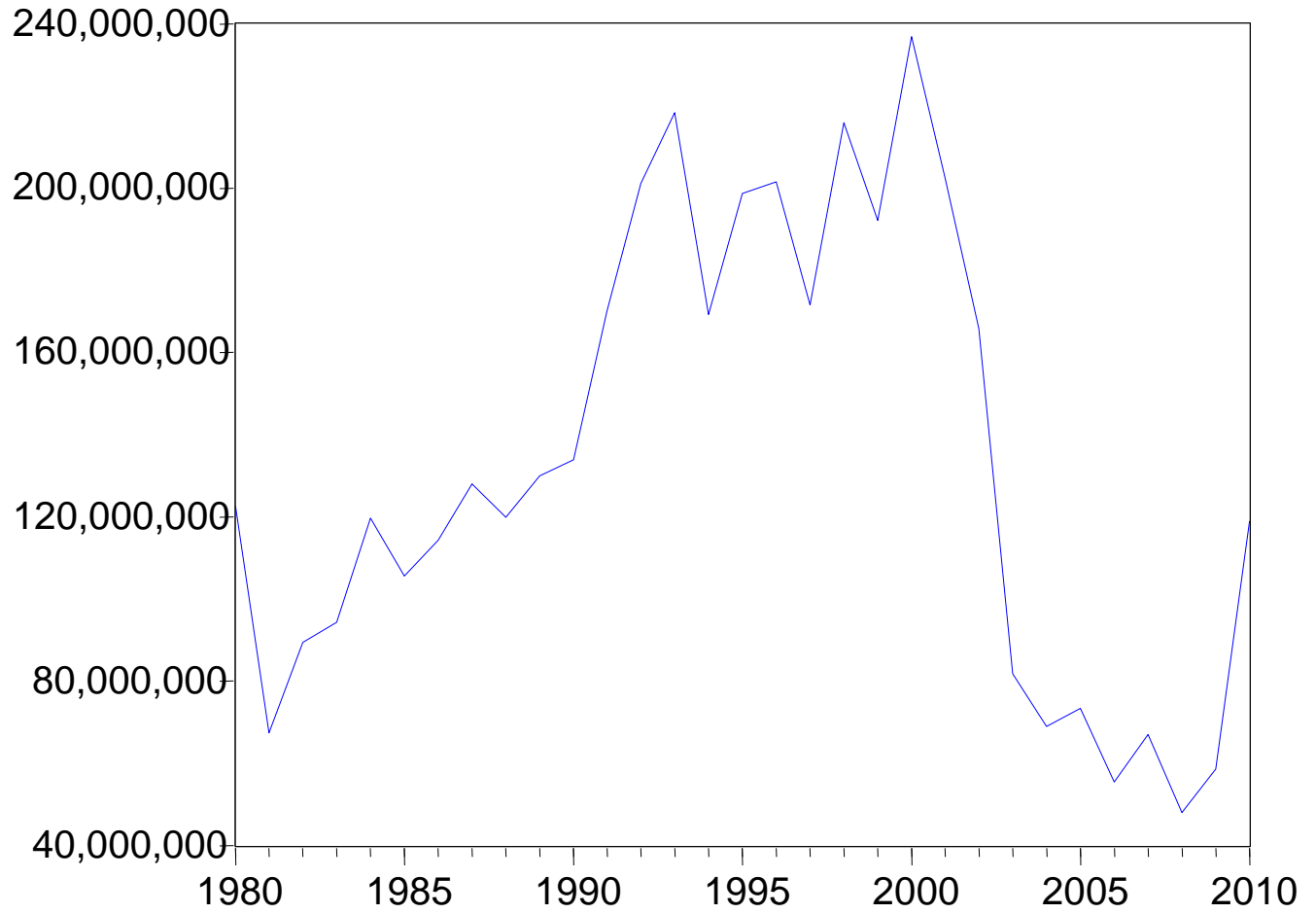
INTRODUCTION

- Flue-cured tobacco has been an important crop in Zimbabwe.
- Contributed significantly to GDP (15-20%), employment & foreign currency earnings (20-30%).
- In 2000 government embarked on controversial land reform program
- Impact on tobacco industry?????

FLUE-CURED TOBACCO EXPORT EARNINGS



Flue-Cured Tobacco Production Trend (1980-2010)



- As a result, government has directed significant resources to resuscitate tobacco industry.
- Mainly in the form of price incentives or some form of production support/ subsidy.
- Are price incentives to best approach?
- Question : Is tobacco production/ supply price elastic?
- In the short-run?
- In the long run?

- Generally agricultural supply is inelastic (Bond, 1983; Eckstein, 1985; Townsend et..al 1997; Leaver, 2000)

	Supply Elasticity	
Study	Short-run	Long-run
Townsend & Thirtle (1997)	0.28	1.36
Leaver 2000	0.34	0.81

METHODOLOGY

- Time series data was used (1980-2006)
- Challenge – non stationary data
- Leads to spurious regression – results might suggest statistically significant relationships
- Error correction method can be used to overcome this but only short run elasticities can be interpreted.
- Procedure: run regression,
 - test variables for stationarity
 - test for cointegration
 - specify error correction model

- Specification of supply response function:

$$\ln Q_t = C + \beta_1 \ln Q_{t-1} + \beta_2 \ln \text{PRICE}_{t-1} + \beta_3 \ln \text{PRICE_M}_{t-1} + \beta_4 \ln \text{COSTINDEX}_{t-1} + U_t$$

With: $\ln Q$ – natural log of tobacco output

$\ln Q_{t-1}$ – natural log of tobacco output lagged

$\ln \text{PRICE}_{t-1}$ - natural log of lagged price of tobacco

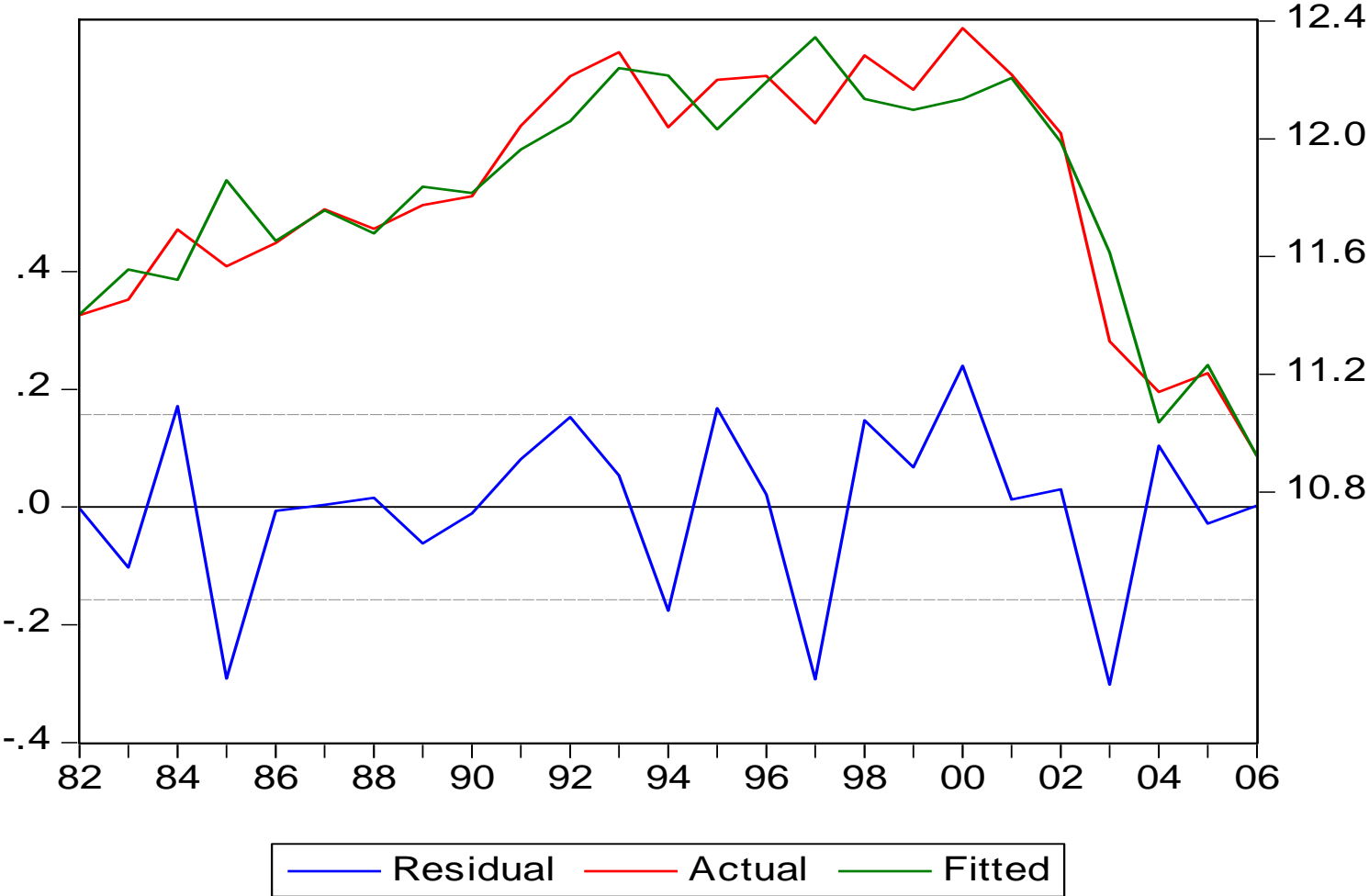
$\ln \text{PRICE_M}_{t-1}$ – natural log of price of maize

$\ln \text{Costindex}$ - natural log of production cost index

Regression results:

Independent Variables	Parameter Estimates
$\text{Ln}Q_{t-1}$	0.698 (7.589)***
LnPRICE_{t-1}	0.405 (3.148)***
LnPRICE_M_{t-1}	-0.225 (-1.743)*
LnCOSTINDEX	-0.366 (-3.450)***
Constant	6.139 (3.967)***
Adjusted R-Squared	0.852
Durbin-Watson (d-statistic)	2.58

Graph of Fitted, Actual and Residuals



ADF Unit Root Test Results

Series LNQ	Model	ADF Lags	ADF $\tau_\tau \tau_\mu \tau$	ADF $\phi_3 \phi_1$
<i>First difference</i>	Trend & intercept	0	-5.201563***	13.52872***
	Intercept	0	-4.180548***	17.47698***
	None	0	-4.263192***	
Series LnCOSTINDEX	Model	ADF Lags	ADF $\tau_\tau \tau_\mu \tau$	ADF $\phi_3 \phi_1$
<i>Second difference</i>	Trend & intercept	1	-6,564***	17.924***
	Intercept	4	1.635	13.569
	None	4	-2.258**	
Series LnPrice_M	Model	ADF Lags	ADF $\tau_\tau \tau_\mu \tau$	ADF $\phi_3 \phi_1$
<i>First difference</i>	Trend & intercept	5	-3.356*	13.326***
	Intercept	5	-2.15	10.52
	None	5	-1.751*	

ADF Unit Root Test Results cont.

Series	Model	ADF	ADF	ADF
LNPrice		Lags	$\tau_\tau \tau_\mu \tau$	$\phi_3 \phi_1$
<i>Second difference</i>	Trend and intercept	2	-4.929***	25.325***
	Intercept	0	-8.510***	72.426***
	None		-8.580***	

- * Statistically significant at 10% level
- ** Statistically significant at 5% level
- *** Statistically significant at 1% level

- The log of output and the log of price of maize had one unit root
- The log of price of tobacco and log of production cost index were stationary at second difference level
- Thus there was need to test the residuals for stationarity i.e. cointegration
- The Engle-Granger test was used.
- Critical values were calculated according to Mackinnon (1991)

Engle-Granger Cointegration Test Results

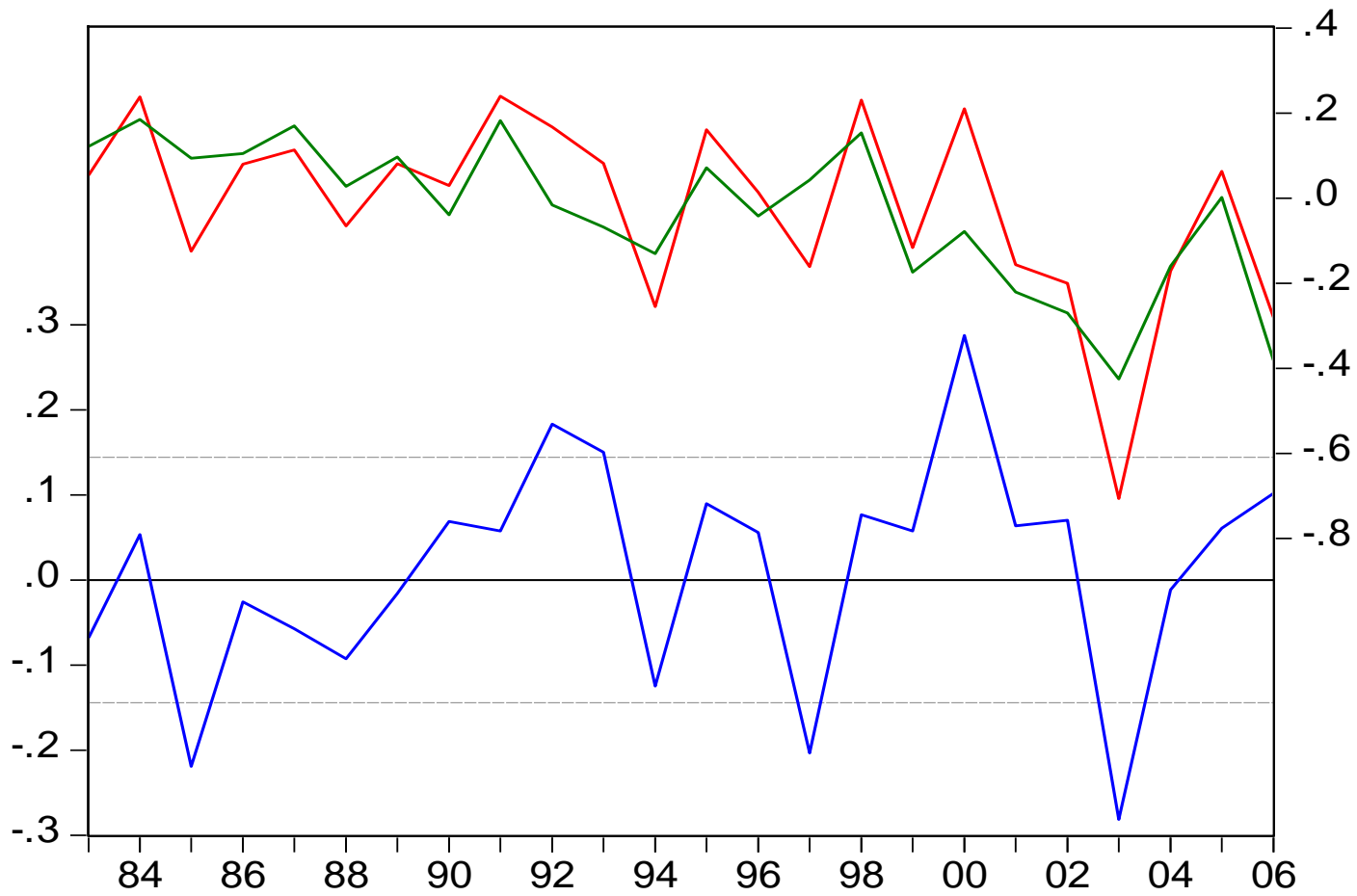
t-statistic (τ)	Critical values derived from Mackinnon tables		
	10% C(10)	5% C(5)	1% C(1)
-6.817***	-4.56699	-4.998	-5.90396

- Thus the residuals of the specified function are stationary.
- The function is cointegrated and therefore the error correction approach can be used.
- Specification of the error correction model (ECM)

$$\Delta \text{LNQ}_t = \alpha_1 \text{Resid}_{t-1} + \alpha_2 \Delta \text{LNQ}_{t-1} + \alpha_3 \Delta(\Delta \text{LNPRICE}_{t-1}) + \alpha_4 \Delta \text{LNPRICE_M}_{t-1} + \alpha_5 \Delta(\Delta \text{LNCOSTINDEX}_{t-1}) + v_t$$

ECM Estimation Results

ECM Independent Variables	Parameter Estimates
Resid _{-t-1}	-1.262 (-3.739)***
$\Delta \text{Ln} Q_{t-1}$	0.739 (3.188)***
$\Delta(\Delta \text{Ln} \text{PRICE}_{t-1})$	0.173 (-1.743)*
$\Delta \text{Ln} \text{PRICE}_M_{t-1}$	-0.24 (-2.045)*
$\Delta(\Delta \text{Ln} \text{COSTINDEX})$	-0.396 (4.323)***
R-Squared	0.639
Durbin-Watson (d-statistic)	1.859



— Residual — Actual — Fitted

Conclusion

- All variables significant
- Signs of parameters consistent with theory
- Thus short-run elasticity of flue-cured tobacco supply is 0.173 i.e. a 10% increase in price of tobacco would lead to a 1,73% increase in tobacco supply.

Thank you!

Seeking PhD opportunity in Australia

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