Term of Trade and Government Supportive Policies Effects on Productivity of Labor per Worker: An Econometric Study Case of Pakistan

[1]Muhammad Shahid, [2]Mahmood Shah, [3]Farhat Parveen,
[4]Muhammad Ehsan Elahi, [5]Sarfaraz Khan Marwat and [4]Shahid Hameed

[1]Government Degree College, Bhakhar, Pakistan
[2]Department of Economic, Gomal University, Dera Ismail Khan, Pakistan
[3]Women Degree College, Darya Khan, Pakistan
[4]Arid Zone Research Centre, Dera Ismail Khan, Pakistan
[5]Department of Agronomy, Gomal University, Dera Ismail Khan, Pakistan

Abstract: This research paper analyses the term of trade between agricultural and non-agricultural sector and its impact on productivity of labor per worker. The findings of this research paper in short run and long run is different from previous studies that the deteriorated Net Barter term of trade (BTOT) between agriculture and non agriculture along with government assisted policies raises the productivity of labor per worker in case of Pakistan. As 1 % increases the net barter term of trade raises the productivity of labor worker per by 24.7 % in short run and 9 % in long run. The other variables in the study like Foreign Direct Investment (FDI), Exchange Rate (ER) and Inflation Rate (INF) in the study are statistical significant at 5%. Further to check the stability of the model Cumulative Sum of Recursive Residual (CUSUM) and CUSUM sum of square tests is applied test the stability of the model. Both CUSUM and CUSUM sum of square graphs lies in between 5% critical bound limits confirms no structural breaks in the model. The study concludes that the deteriorated term of trade of agricultural sector but government supportive and Assistance rates policies in favor of agric sector has increased the productivity of labor per worker of this sector in case of Pakistan. I have reviewed all the literature but not found such type of research in case of Pakistan.

Key words: Government, Labor, Econometric, Lag, Keynesian, CUSUM

INTRODUCTION

The issue of term of trade between agric and non-agric sector has been a debatable topic in the academic of economic literature. The Keynesian economists also discussed the term of trade which alters real income, saving, investment, consumption and the interest rate. The other economists are of views that fluctuations in term of trade bring drastic changes in the government funds, capital formation, savings, investment, real incomes, infrastructure, production, innovation and technological development in agric and non-agric sectors. Further it also affects both the big and small farmers [1].

The World Bank launched a research project which has measured relative amounts of assistance rates to agricultures and non agriculture through this formula.

$$RAA = 100 * \left[\frac{100 + NRA^{ag}}{100 + RNA^{nag}} \right] - 1$$

RAA = Relative Rate of Assistance,
NRA^{ag} = Nominal Rate of Assistance to Agriculture,
NRA^{nag} = Nominal Rate of Assistance to non-agricultural sector where RAA, NRA and NRA are in percentage,

NRA is provided by the government to create a gap between domestic agriculture farmer's prices and the prices of producers under free market. The negative value of RRA reflects anti agricultural policy of the country. When the value of RRA becomes zero means both agricultural and non agricultural sectors are assisted in equal rates. The positive value of RRA represents

Corresponding Author: Muhammad Shahid, Government Degree College, Bhakhar, Pakistan.

favorable assistance rate of the government to the agriculture sector and increases the productivity of labor in agric sector [2, 3].

Anderson *et al.* [3] examined the relative supportive rate of agriculture and non agriculture sector through a formula. According to which if the value of Relative Rate of Assistance RRA is negative reflects anti agricultural policy of the government and if the value of RRA is zero assigns the equal weight to the both sectors while the positive value of RRA favors the assistance rate to agriculture sector. In case of Pakistan RRA are positive raises the productivity of labor per worker.

Kazi [4] adopted another method to measure the domestic term of trade for the period 1984 to 2012. The data of Household Income and Expenditures Survey was applied to measure the agricultural and manufacturing consumption of commodities by household. He concludes that domestic term of trade for agricultural and non agricultural sector favors and expands agriculture productivity. Broda and Tille [5] discussed the role of term of trade, exports manufacturing of developed countries and economies from term of trade. These economies along with international trade bring positive change in the productivity of agricultural sector and industrial sector and raise the efficiency of labor.

Price support policy, input subsidies on seeds, fertilizers, tractors, harvesters, pesticides, livestock in agriculture sector and many govt. measures have many secrets and revolutionary effects agriculture field the term of trade and its productivity was improved. It not only raises the productive efficiency of small and big farmers but also induces the technological, innovational inputs and infrastructure facilities in farther rural areas. (Khan and Ahamad [6]).

Blattman [7] examined the impact of term of trade on real economic growth along with changing scenario of world integration and disintegration. Whenever the prices of trend of domestic are changed it alters the production behavior not only inter sector term of trade but also internationally term of trade. Baxter and Kouparitsas [8] found more expansion of term of trade in developing countries rather than developed countries. Further they revealed that the changing accounts of term of trade bring change the productivity of both sectors.

The domestic net barter term of trade between agriculture sector and industrial sector makes the comparison of exchange of commodities ratio exported from the agricultural sector to the manufacturing sectors and the imported items from the industrial sector to the non industrial sector. To analyze the relative performance of agricultural and non-agricultural sector the value of commodities exchange ratio is considered reliable source to estimates the relative performance of rural and modern sector. This research paper estimates term of trade between of agric and non agric sector which does not favour the agriculture sector. But government relative assistance rates to agric sector have raised the productivity of labor per worker in this sector. The graphical trend picture of the deteriorated term of trade of the agriculture sector along with the government assistance rate, supportive policy has encouraged productivity of labor shown by the Fig. 1.

But with government assistance rate, supportive policies and encouraging policies have made this sector productive and profitable. The measures taken by government in favor of agriculture support are as follows.

Subsidies on Agricultural Inputs: The government of Pakistan is making efforts to supply the agricultural inputs at the lowest prices. Many direct and indirect financial supports in the form of subsidy on fertilizers, pesticides, agric machineries, livestock, electricity, gas, water management projects and agriculture satellite information projects has been given for many years. To expand the agric sector government has allocated Rs. 21 billion in form of subsidy (Pathan [9]).

Agriculture Credit Policies: Cheaper and concessional loans are issued and distributed by Zari Traqiati Bank and other commercial banks for agric inputs. Many attractive and beneficial schemes for farmers like green tractor, laser level landing and tube well, poultry and fish farm schemes are also introduce by these commercial institutions.

Price Control Policy: For making the agriculture sectors more protective and productive the government has founded Agriculture Price Commission in 1981. The equilibrium price of wheat, sugarcane, rice, cotton, onion, potato and seeds in trading market are settled at low level. The government intervenes in the competitive market and fixed the Minimum Support Price that is higher than equilibrium price made this sector protective and productive.

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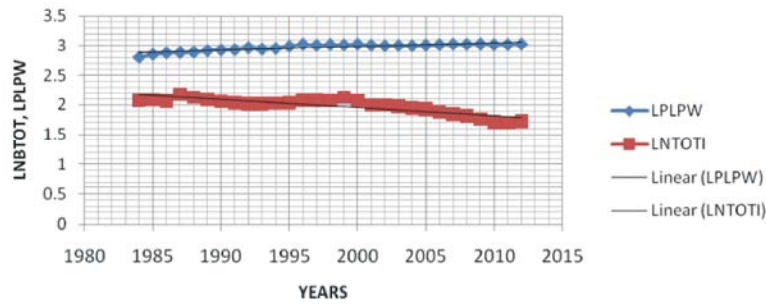
Fig. 1: Term of trade along with govt. assistance rate

Tax Free Sector: There emerge a lot of defects in agric sectors presented as follow.

- The farmers and tenures exercise their life without documentation record of inputs expenditures and income of outputs from land.
- This rural sector does not follow the monetary system or banking sector in the transaction of crops. Parle to currency sector the barter sector is also exercised in farther rural areas. Hence the accurate incomes information is spurious and hard to tax.
- In National and Provincial Assembly two thirds of land lord favor the agric policies and resist to legalize taxable sector. These measures make hard to impose tax on this sector which raises the productivity of this sector.

Chishti and Malik [10] investigated international completion in agriculture which has raised the productive efficiency of labor. With price support policy agricultural producers have gained surplus in domestic level while they have to suffer international market because of perfect competition.

Objectives:

- To analyze govt. supported polices and domestic term of trade of trade between agric and industrial sector and examine its impact on productivity of labor per worker along with injection of some economic variables.
- To investigate the factors which affect the agricultural productivity of labor per worker in short run and long run with inclusion of some important variables.
- To recommend the policy measures which are beneficial in promoting the agricultural productivity per labor per worker in case of Pakistan.

MATERIALS AND METHODS

The study was conducted at Department of Economics, Gomal University, D.I.Khan. Time series data was used from 1984 to 2012 to measure the results. Auto Regressive Distributive Lag (ARDL) econometric technique and Cumulative Recursive Residual CUSUM, CUSUM sum of square tests were applied to examine the stability of the model in short run as well as in long run. Econometric view (E-Views) / SPSS package was used to analyze data. The model is as under:

$$LAPLPW = \beta_0 + \beta_1\ LNBTOT + \beta_2\ LFDI + \beta_3\ LER + \beta_4\ LINF + ui$$

APLPW = Average Productivity of Labor per Worker
NBTOT = Net Barter Term of Trade for measurement of Domestic Term of Trade
FDI = Foreign Direct Invest, ER = Exchange Rate, INF = Inflation Rate

(Five different variables as Average Productivity of Labor per Worker APLPW, Net Barter Term of Trade NBTOT, Foreign Direct Invest FDI, Foreign Exchange Rate ER and Inflation Rate INF have been applied in my study). Data source has been taken from World Development Indicator WDI and State Bank of Pakistan for the period of 1984 to 2012.

RESULTS AND DISCUSSION

Table Unit Root Test

Variables	ADF Test-Statistics (at level)	ADF Test-Statistics (at 1st Difference)	Stationary Status
LPLPW	-3.4251**	-1.63521	I(0)
LNBTOT	-1.38425	4.6354*	I(1)
LFDI	-2.039892	-5.216564*	I(1)
LER	-3.699**	-.0232	I(0)
LINF	-3.689**	-7.43	I(0)

Note: * and ** represent significance level at 1% and 5% respectively

Co Integration: To examine the short-run and long-run relationship among foreign direct investment, governance, market size, openness and infrastructure the present research uses the error-correction version of ARDL model of equation (A) by following Pesaran and Pesran [11] and Pesaran and Shin [12], as;

$$
\begin{aligned}
\Delta logAPPLW_t = {}& \alpha_0 \\
& + \sum_{i=1}^{N} \alpha_1 \Delta logAPPLW_{t-i} \sum_{i=0}^{N} \alpha_2 \Delta logNBTOT_{t-i} + \sum_{i=0}^{N} \alpha_3 \Delta logFDI_{t-i} \\
& + \sum_{i=0}^{N} \alpha_4 \Delta logER_{t-i} + \sum_{i=0}^{N} \alpha_5 \Delta log\ INF_{t-i} \\
& + \beta_1 logAPPLW_{t-1} + \beta_2 logNBTOT_{t-1} + \beta_3 logFDI_{t-1} + \mu
\end{aligned}
\tag{1}
$$

The first step in ARDL approach to co-integration is to examine long-run relationship among the variables by carrying out familiar F-statistic on the differenced variables components of Unrestricted Error Correction Mechanism (UECM) model for the joint significance of the coefficients of lagged level of the variables.

$$
\begin{aligned}
\Delta logAPPLPW \\
= \alpha_0 + \sum_{i=1}^{N} \alpha_1 \Delta logAPPLPW_{t-i} \\
+ \sum_{i=0}^{N} \alpha_2 \Delta logNBTOT_{t-i} + \sum_{i=0}^{N} \alpha_3 \Delta logFDI_{t-i} + \sum_{i=0}^{N} \alpha_4 \Delta logFDI_{t-i} \\
+ \sum_{i=0}^{N} \alpha_5 \Delta log\ ER_{t-i} + \sum_{i=0}^{N} \alpha_6\ INF + \mu_t
\end{aligned}
\tag{2}
$$

To create error correction mechanism in this equation, first Lag of the level of each variable is added to the equation (B) and a variable Addition Test is conducted by calculating F-test on the joint significance of all the added lagged level variables.

Bound Test Explanation

F-Calculated	95% confidence interval		90% confidence interval	
7.411	Lower Limit	Upper Limit	Lower Limit	Upper Limit
	3.366	4.799	2.772	4.027

Source: Author's own calculations

The value of F-Calculated statistics is beyond lower limit 3.366 and upper limit 4.799 at 95 % and exceeds lower limit 2.772 and upper limit 4.027 at 90 % confidence interval rejects null hypothesis states no co integration exists among variables and accepts alternative hypothesis which expresses the co integration found among coefficients.

Table Short Results of the Model and Interpretation

Variables	Coefficients	S.E	T-Ratios	P-Values
LPLPW	0.247	153	1.613	0.123
LBTOT	0.171	0.062	2.739	0.013
LNTOT(-1)	- 0.102	0.058	-1.747	0.097
LFDI	0.029	0.010	2.768	0.012
LFDI (-1)	-0.028	0.012	-2.255	0.036
LER	0.165	0.045	3.612	0.001
LINF	0.320	0.011	2.741	0.013
LINF(-1)	0.038	.0110	3.471	0.003

In Table no. 4.4 the most important results in short run that 1% rise in term of trade brings positive change in agricultural productivity of labor per worker by 17% and its lag value discourage the APLPW by 10% while one percent increases in FDI expands the APLPW by 2%. Further 1% change in exchange rate and inflation encourage the agriculture productivity of labor per worker by 16.5% and 32% respectively when the lag vale of inflation LINF (-1) adds the APLPW by 3%.

Goodfit Model Explanation	
R^2	0.973
Adjusted R^2	0.962
D.W-Statistics	2.300
F(7, 19)	87.290

The value of R^2 is .97 means 97% variation in the model is the result of explanatory variables and the other variation is due to residual term. The model is highly good fit having the high value of R^2 and the value of adjusted R^2 also shows validity of the model adjusted with degree of freedom. In micro fit ARDL econometric technique Durbin Watson value does not matter.

Diagnostic Test		
PROBLEM	LM-VERSION (P.V)	F-VERSION (P.V)
Serial Correlation	(0.303)	(0.411)
Functional Form	(0.885)	(0.909)
Normality	(0.818)	Not applicable
Hetroscedasticity	(0.854)	(0.860)

The Lagrange Multiplier test confirms no serial correlation as the probability value of LM- VERSION and F-VERSION is more than 10%. The Ramsey test satisfied correct functional form and data is normally distributed having no hetroscedacity.

Table Long Run Estimation of the Model

Variables	Coefficients	S.E	T-Ratios	P-Values
LPLPW				
LNTOT	0.090	0.031	2.864	(0.010)
LFDI	0.009	0.012	0.094	(0.926)
LER	0.220	0.026	8.172	(0.000)
LINF	0.094	0.021	4.356	(0.000)

Source: Author's own calculations

In table 4.6 the results of long run are the most important and Net barter term trade, exchange rate and inflation variables are statistical significant at 1% and 5%.

Stability Test: Brown, Durbin and Evan (1975) devised a Stability Test for confirmation the stability of the model in short run variables as well as long run coefficients. Pesaran and Pesran [8] applied this test practically, if the graph of Cumulative Sum of Recursive Residual CUSUM lies in between en 5% critical bound limits and the graph of CUSUM sum of square lies in between 5% critical bound limits which confirm structural stability of the model in short run and long run. Stability of the model is checked through CUSUM and CUSUM Square tests in Figures (a) and (b).
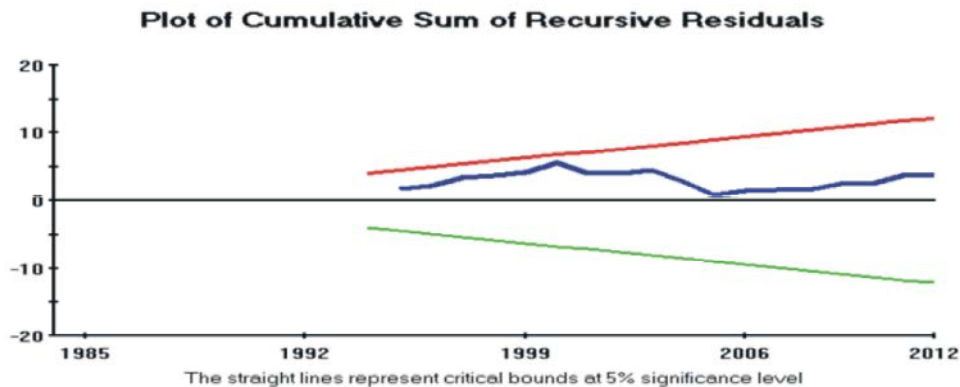

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Fig. (a)

Plot of Cumulative Sum of Squares of Recursive Residuals

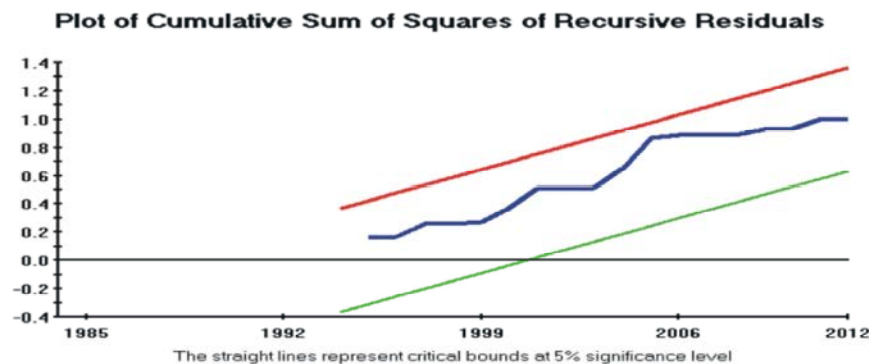The straight lines represent critical bounds at 5% significance level

Fig. (b)

The CUSUM and CUSUM Square tests confirm that the results are stable as the calculated lines lie inside the critical bounds at 5 percent level of significance which proposed models stable. The following results show that the lines are within the critical bounds, so model has no structural breaks. It can also conclude that there is no structural break in model. The model can be used for prediction purpose.

Error Correction Model Explanation

Variables	Coefficients	S.E	T-Ratios	P-Values
dLNBTOT	0.171	0.062	2.734	(0.012)
dLFDI	0.029	0.010	2.768	(0.002)
dLER	0.165	0.045	3.612	(0.002)
dLINF	0.032	0.011	2.741	(0.012)
ecm(-1)	-0.752	0.153	-4.899	(0.000)

Source: Author's own calculations

The 4.9 error correction model depicts of short run results and explains all variables are significant statistically. The model is highly significant with negative sign of adjustment coefficient. The value of ecm (-1) -.75 illustrates 75% disequilibrium in previous will converge to equilibrium in the present year.

CONCLUSION

The findings of this research paper in short run and in long run are different from previous studies that the deteriorated Net Barter term of trade (BTOT) between agriculture and non agriculture along with government assisted policies raises the productivity of per labor per worker in case of Pakistan. As 1 % increases the net barter term of trade raises the productivity of labor worker per by 24.7 % in short run and 9 % in long run. The other variables in the study like Foreign Direct Investment FDI, Exchange Rate ER and Inflation Rate INF in the study are statistical significant at %, 5% and 10%. Further to check the stability of the model Cumulative Sum of Recursive Residual CUSUM and CUSUM sum of square tests is applied test the stability of the model. The both CUSUM and CUSUM sum of square graphs lies in between 5% critical bound limits confirms no structural breaks in the model. The negative value of Error Correction Model ECM (-1) represents that the model is highly significant. The value of adjustment coefficient is .75 purposed that disequilibrium in productivity of labor per worker in previous in the model will adjust it to equilibrium in the current year.

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