How Urbanization Effect Agriculture Output in Perspective of Pakistan

Muhammad Arif
PHD Scholar, Department of Economics, The Islamia University Bahawalpur, Pakistan
m.arif7837@gmail.com

Dr. Abid Rashid Gill
Associate Professor, Department of Economics, the Islamia University Bahawalpur, Pakistan
abid.rashid@iub.edu.pk

Abstract

This analysis attempts to explore the impact of urbanization on agriculture output in Pakistan. The NARDL model is employed to analyze the asymmetric effects of urbanization on agriculture output by using yearly data from 1970 to 2020. The outcomes display that urbanization has asymmetric and statistically significant impacts on agriculture output. Similarly, labour force participation rate and gross fixed capital formation are found to be positive and significant factors of agricultural output, while foreign direct investment and external debt turn out to be negative and significant factors of agriculture output in Pakistan. Environmental degradation is found to be inversely but insignificantly related to agriculture output. It is concluded that urbanization is significantly influencing the agriculture output in Pakistan, so to control the negative consequences of urbanization on agriculture output, agriculture land of the country should be protected. Policies need to be designed to protect the urbanization on agriculture lands.

Keywords: *Urbanization, Agriculture Output, NARDL, Pakistan*

JEL Code: Q15, O18

Introduction

Due to the rapid increase in population and economic growth, urbanization is an inevitable phenomenon. Urban settlements encroaching on agricultural lands have disastrous repercussions (Shalaby, 2012). In most developing-world cities that are expanding rapidly, where globalization, significant economic restructuring, and a lack of rural employment opportunities have provoked an exodus from rural areas to urban centers, urbanization is particularly rapid and poses the greatest threat to arable lands (Shalaby, 2012; Jiang et al., 2013). Generally, urbanization is sustained by the agricultural land being transformed or converted, with an expansion of the network of accessible transportation that makes it easier for the workforce in rural areas to leave such places (Ujoh & Ifatimehin, 2010). Urbanization is the horizontal or vertical expansion of urban areas nearby agriculture land. It is an ordinary process that consumes numerous hectares of arable land every year (Tiwari et al., 2012). It occurs due to the conversion of non-urban land into urban land. Once transformed, urban land cannot easily be converted back to its original land use (Atu et al., 2012). It also involves changing the physical structure of urban areas inside and outside, destroying agricultural farmlands and natural beauties (Milesi et al., 2003; Shalaby, 2012). Urban areas grow haphazardly over the country's fertile arable land since urbanization is defined by how different individuals or households, enterprises, corporations, and firms consider fit to locate and build (Bakoji et al., 2020).

Economic and social growth has been considerably accelerated by rapid urbanization. Global cities are the backbones of their respective nations' economies and hubs of innovation (De Sherbinin et al., 2007), but urbanization has also led to a lot of environmental issues that range from local to global in scope (Zhao et al., 2006). These include a significant decline in the production of natural vegetation and the storage of carbon, as well as increasing air and water pollution, a reduced water supply, local climate change, and increased energy consumption (Jago-on et al., 2009; Yuan, 2008; Liu & Diamond, 2005). As a result, factors including poor soil quality, nutrient depletion, and climate change are responsible for the slow development of agricultural output (Mendelsohn, 2009; Amari et al., 2021). For instance, crops and livestock output, hydrological balance, input supply, and other factors of the agriculture system are all influenced by climatic changes. It is also clear that increasing pest infestation, decreased soil fertility, irrigation supplies, and decreased agricultural potential are all direct results of climate change, mostly caused by CO_2 emissions (Kwakwa, 2021; Ehigiamusoe et al., 2022). Food production and delivery are impacted by an increase in extreme weather occurrences, such as rainfall variations (Maria et al., 2013; Malhi et al., 2021). Due to climate change, a rise in degraded land accelerates desertification and causes nutrient-poor soils (Arora, 2019). Biophysical processes like the nutrient cycle, water cycle, biodiversity, and how these processes are controlled in agricultural and land use activities are all impacted by climate change (Toor et al., 2020). As a result of climate change and its effect on the agriculture sector, Pakistan is particularly susceptible to climate change and has been classified as the 12^{th} most negatively impacted country (Awan & Yaseen, 2017). Due to its ability to keep heat in the upper atmosphere, the massive use of fossil fuels is likely the key factor of greenhouse gas emissions (GHG). This increase in average global temperature accelerated global warming and sparked widespread climate change consequences (Awan & Yaseen, 2017).

The agriculture sector is important in accomplishing Sustainable Development Goals. The rationale is that a strengthened agriculture sector can advance food security, enhance income generation, and increase employment, all of which enhance economic growth and development (Diao et al., 2007; Dorosh & Thurlow, 2018; Ayinde et al., 2021). Pakistan's economy is viewed as being based primarily on agriculture (Rehman et al., 2015). The agriculture sector contributes 22.7 percent to the GDP, and about 37.4 percent of the workforce in Pakistan is employed in this sector (Pakistan Economic Survey, 2021-22).

Agricultural production is significantly affected by urbanization on agriculture land and the intensity of usage of agriculture land (Hualou & Jian, 2010; Jiang et al., 2012). In Pakistan, enormous green spaces have already been transformed into housing societies due to population and urbanization trends. This is a worrying issue for Pakistan since rising housing demand harms agricultural lands and could endanger the nation's future food security (Shah et al., 2021). Pakistan is considered the most urbanized nation in South Asia since urbanization has rapidly increased. Currently, at 37.44 percent, the urban population is probable to reach 50 percent by 2025 (Pakistan Economic Survey, 2021-22). An increase in rural-to-urban migration is the primary driver of urban expansion. Land management and the transformation of cultivated and forested lands to non-agriculture uses are the key issues with land and city plans; they impede the economic development of urban areas and influence the utilization of available natural and human resources. Pakistan already has a food shortage, thus, it cannot afford to lose more agricultural land, especially on the outskirts of cities (Kugelman, 2014). Migration is the main cause of urbanization in Pakistan; in previous decades, Afghans and Muslims from India came to Pakistani cities to escape conflict in their native countries. Pakistanis from the countryside are now migrating to the cities in search of new jobs and improved basic amenities, as well as to flee conflict, insecurity, and natural disasters. The rise in the nation's urban population can also be attributed to this rise in total population (Kugelman, 2013). By considering the importance of urbanization in influencing agriculture production, this investigation analyses the impact of urbanization on agriculture output in Pakistan.

Literature Review

Due to rapid urbanization in most countries like Pakistan, agricultural land is starting to decline. The literature review of urbanization's impact and other factors on agriculture output is also presented in a chapter. It was observed that some studies found a positive impact of urbanization on agriculture output (Iheke & Ihuoma, 2016; Zhong et al., 2020), while some studies found an adverse effect of urbanization on agriculture output (Wagan et al., 2018; Waseem et al., 2019;

Deng et al., 2020; Shah et al., 2021; Avazdahandeh & Khalilian, 2021; Factura et al., 2022). The positive association suggests that these countries working on intensive land cultivation use modern agriculture techniques to attain higher productivity per acre. On the contrary negative association between urbanization and agriculture output suggests that an increase in urbanization reduces the agricultural land area and leads to a decline in agricultural production. These countries must work on modern agriculture techniques to increase productivity per acre.

On the contrary, urbanization also substantially influences environmental degradation and, in turn, influences agriculture output. Such as Tan et al., (2022) examined the impact of environmental degradation on agricultural production, along with vegetable and cereal production, in 35 European countries. Environmental degradation includes loss of biodiversity, deforestation and agriculture emissions. The study also points out that an increase in forest area has an optimistic influence on agricultural, vegetable and cereal production; biodiversity loss harms these sectors. Ali et al., (2021) observed the influence of climate change on agriculture productivity in Pakistan. The findings explored that temperature and precipitation have a detrimental influence on agriculture output. Pinto et al., (2021) examined 167 patterns of environmental degradation in the agricultural world and discovered that Russia, which is part of the European continent, had the worst environmental conditions. On the other hand, Africa, North America, and Oceania dominated the other positions. Where agricultural activity was most nascent, in Central America and Europe, degradation rates were the lowest. Kwakwa et al., (2022) studied the influence of overall and sectoral carbon emissions on agriculture production in Ghana using data from 1971 to 2017. The study directed that carbon emissions negatively influence agricultural growth, while economic growth, labour, and capital were positive factors of agriculture output. According to Arooj et al., (2018), environmental degradation was to blame for the decline in wheat yield. The outcomes suggested that proper management was required to improve wheat production and lessen environmental degradation. Keeping in view the literature review, this article explores how urbanization effect agriculture output in Pakistan. This article is the first to explore urbanization's asymmetric effects on agriculture output using the NARDL model and measures the environmental degradation by using ecological footprints per capita and will provide important implications to policymakers.

Research Methodology

This article used yearly data from 1970 to 2020. The dependent variable is agriculture output (AGS), whereas the core independent variable is urbanization (URBGR), and the independent variables are labour force participation rate (LFPR), gross fixed capital formation rate (GFCF), inflation rate (INF), external debt (EDT), foreign direct investment (FDI) and environmental degradation (EDG). For asymmetric analysis, urbanization is separated into positive changes (URBGR_POS) and negative changes (URBGR_NEG). The data of variables AGS, LFPR, GFCF, INF, URBGR, EDT, and FDI is taken from World Development Indicators (WDI) and

Pakistan Economic Surveys (PES). The data on environmental degradation, measured by ecological footprints per capita, is collected from Global Footprint Network. To inspect the long-run impacts of urbanization and other variables on agriculture output in Pakistan nonlinear ARDL model is used. The NARDL model is developed by Shin et al., (2009). The NARDL model incorporates nonlinearity using a partial sum of decomposition into the ARDL model established by Pesaran et al., (2001). By modeling the long-run association and the pattern of dynamic adjustment instantaneously in a cohesive manner, the NARDL model captures both the short-run and long-run asymmetries in the transmission mechanism. If the variables are integrated in a mixed order of integration, we can use nonlinear autoregressive distributed lag mode (NARDL). The functional form of the nonlinear ARDL model is as follows:

$$AGS = f(LFPR, GFCF, INF, URBGR^{+}, URBGR^{-}, EDT, FDI, EDG) \qquad (1)$$

The econometric form of the NARDL model is as follows:

$$AGS_i = \beta_o + \beta_1(LFPR)_i + \beta_2(GFCF)_i + \beta_3(INF)_i + \beta_4(URBGR)_i^{+} + \beta_5(URBGR)_i^{-} + \beta_6(EDT)_i + \beta_7(FDI)_i + \beta_8(EDG)_i + u_i \qquad (2)$$

Equation 1 shows the long-run effects of parameters. To determine the short-run coefficient of the parameters and also analyze the error correction term following model is constructed:

$$\Delta AGS = \beta_0 + \sum_{I=1}^{n} \beta_1 \Delta AGS_{t-j} + \sum_{I=0}^{n} \beta_2 \Delta LFPR_{t-j} + \sum_{I=0}^{n} \beta_3 \Delta GFCF_{t-j} + \sum_{I=0}^{n} \beta_4 \Delta INF_{t-j} + \sum_{I=0}^{n} \beta_5 \Delta URBGR^{+}_{t-j}$$
$$+ \sum_{I=0}^{n} \beta_6 \Delta URBGR^{-}_{t-j} + \sum_{I=0}^{n} \beta_7 \Delta EDT_{t-j} + \sum_{I=0}^{n} \beta_8 \Delta FDI_{t-j} + \sum_{I=0}^{n} \beta_9 \Delta EDG_{t-j} +$$
$$+ \gamma_1 ECM_{t-1} + u_{1t} \qquad (3)$$

Analysis

The descriptive statistics of variables are displayed in Table 1. It is found that the mean value of agriculture share in GDP is 25.140, maximum value is 33.432, minimum value is 20.678, S.D. is 3.307, skewness value is 1.092; it depicts that the distribution is positively skewed, and value of kurtosis is 3.146 it depicts the leptokurtic distribution. Similarly, the mean LFPR is 48.582, maximum value is 52.363, minimum value is 28.960, standard deviation is 5.514, value of skewness is -2.940, which depicts the negatively skewed distribution, the value of kurtosis is 10.196 it depicts the leptokurtic distribution.

Table 1
Descriptive Statistics

Variables	Mean	MAX	MIN	S.D.	Skew	Kurt	JB	Prob.
AGS	25.140	33.432	20.678	3.307	1.092	3.146	10.179	0.006
LFPR	48.582	52.363	28.960	5.514	-2.940	10.196	183.513	0.000
GFCF	15.648	19.112	11.330	1.839	-0.401	2.260	2.530	0.282
INF	9.829	38.512	3.259	6.343	2.331	10.095	153.165	0.000
URBGR	3.483	4.505	2.650	0.621	-0.008	1.539	4.538	0.103
EDT	42.172	72.435	25.793	10.195	0.255	2.870	0.587	0.746
FDI	0.737	3.668	-0.063	0.767	2.341	8.653	114.499	0.000
EDG	0.722	0.855	0.603	0.075	-0.098	1.720	3.563	0.168

Source: Author's Calculations

Correlation matrix specifies the level of association between two variables. Table 2 points out that AGS is directly associated with the inflation rate (0.162), URBGR (0.642), and external debt (0.354) while negatively correlated to the LFPR (-0.565), GFCF (-0.264), foreign direct investment (-0.541), and environmental degradation (-0.772).

Table 2
Correlation Matrix

Correlation	AGS	LFPR	GFCF	INF	URBGR	EDT	FDI	EDG
AGS	1.000							
LFPR	-0.565	1.000						
GFCF	-0.264	0.174	1.000					
INF	0.162	0.128	0.080	1.000				
URBGR	0.642	-0.282	-0.155	0.050	1.000			
EDT	0.354	-0.078	-0.028	0.200	0.634	1.000		
FDI	-0.541	0.213	0.343	-0.024	-0.495	-0.403	1.000	
EDG	-0.772	0.361	0.291	0.037	-0.836	-0.392	0.697	1.000

Source: Author's Calculations

The ADF test is used to observe the order of integration of variables. The outcomes are revealed in Table 3. It is found that the variables LFPR, GFCF, inflation rate, urban population growth rate, and FDI are integrated at a level. In contrast, agriculture output, external debt, and environmental degradation are integrated at a 1st difference. Hence, the mix integration order describes that the non-linear ARDL model is important to investigate the long-run estimation of the parameters.

Table 3
Unit Root Analysis

Variables	Level		1st Difference		Outcomes
	T-Test	Prob.	T-Test	Prob.	
AGS	--	--	-7.010	0.000	I(1)
LFPR	-4.598	0.001	--	--	I(0)
GFCF	-2.974	0.044	--	--	I(0)
INF	-6.090	0.000	--	--	I(0)
URBGR	-3.758	0.028	--	--	I(0)
EDT	--	--	-6.712	0.000	I(1)
FDI	-3.060	0.036	--	--	I(0)
EDG	--	--	-9.436	0.000	I(1)

Source: Author's Calculations

To apply the nonlinear ARDL model, finding the long-run cointegration of variables in a model is first significant. For this purpose, NARDL bound test analysis is conducted. The F-statistic (3.6680) value turns out to be greater than the upper bound values at 5 percent, suggesting the occurrence of long-run cointegration among variables in a model.

Table 4
NARDL Bound Test Analysis

Test	**Value**	**K**
F	3.6680	8
Critical Bound Values		
Significance	**I0 Bound**	**I1 Bound**
10%	1.95	3.06
5%	2.22	3.39
2.5%	2.48	3.7
1%	2.79	4.1

Source: Author's Calculations

Table 5 displays the long-run estimates of the nonlinear ARDL model. It is found that the urban population growth rate has an asymmetric and statistically significant impact on agriculture output in Pakistan. It is evident that positive changes in urbanization adversely affect agriculture output. The coefficient of the variable point out that increase in urbanization leads to the 8.2391 units decline in agriculture output. Similarly, negative changes in urbanization positively affect the agriculture output in Pakistan. The coefficient value specifies that a decline in the urban population growth rate leads to a rise in agriculture output by 1.9750 units. Urbanization causes ongoing agricultural land loss, which puts pressure on farmers and lowers the productivity and efficiency of the agricultural sector. Due to a decline in physical activity, urbanization is also linked to dietary trends toward more processed and prepared foods (Shah et al., 2021; Luo et al., 2014). Wagan et al., (2018) and Waseem et al., (2019) also confirmed this association. The variable labour force participation rate is directly and significantly linked to the AGS in Pakistan. The coefficient value of LFPR displays that a unit increase in LFPR is likely to increase the agriculture output by 0.2076 units. The favorable link might be due to an efficient and productive agricultural labour force that could actively contribute to the many tasks allotted to them, such as operating tractors to till the ground and carrying out planting, weeding, and harvesting (Khaledi & Shirazi, 2013). These outcomes are also verified by Raza & Siddiqui (2014); Shah et al., (2021); Sertoglu et al., (2017) and Kim (2011). Capital is also important in influencing agricultural output. It is evident from the analysis that gross fixed capital formation is directly and significantly associated with the AGS. The coefficient value of GFCF shows that a unit increase in GFCF likely increases the agriculture output by 0.4320 units. This may be because agricultural capital facilitates agricultural activities more quickly, such as faster planting, weeding, crop harvesting, quicker cow milking, quicker domestic animal spraying, and quicker grain milling, which helps to increase/improve the quantity and quality of agricultural products (Kim, 2011). These results are also verified by Shah et al., (2021), Khaledi & Shirazi (2013). The variable external debt turns out to adversely and significantly influence the AGS in Pakistan. The coefficient value shows that a unit increase in external debt is likely to decline the agriculture output by -0.1180 units. This is because an increase in external debt likely caused a budget deficit, which could result in a misallocation of resources to other economic sectors (Brownson et al., 2012). These results are also found by Ukpe et al., (2017). Foreign direct investment also turns out to be adversely and significantly associated with the AGS. The coefficient value specifies that a unit increase in FDI is likely to decline the agriculture output by -0.9386 units. This might be due to unfavorable government policy, technological gap, under qualified human skills, unsuccessful R&D and lack of absorption capacity, which leads to defects in the economy (Yousaf et al., 2011). These outcomes are also supported by Ajmair (2018); Iddrisu et al., (2015). Heteroskedasticity and autocorrelation are also checked by using Breusch-Pagan-Godfrey (BPG) and Breusch-Godfrey (BG) LM test. The results of both tests show the absence of heteroskedasticity and autocorrelation in a model.

Table 5
NARDL Long-Run Estimates

DV: AGS				
Selected Model ARDL(1, 2, 1, 0, 2, 1, 1, 0, 0)				
Variables	**β**	**S.E.**	**T-Test**	**P-value**
LFPR	0.2076	0.0786	2.6384	0.0129
GFCF	0.4320	0.1000	4.3182	0.0001
INF	0.0527	0.0287	1.8333	0.0764
URBGR_POS	-8.2391	3.2005	-2.5742	0.0150
URBGR_NEG	1.9750	0.6864	2.8770	0.0072
EDT	-0.1180	0.0312	-3.7785	0.0007
FDI	-0.9386	0.3448	-2.7216	0.0106

EDG	6.5559	7.6718	0.8545	0.3994
C	14.9202	5.5252	2.7003	0.0111
BPG Test				
F-Test	0.6943	**P-Vale. F(16,31)**		0.7777
Obs*R^2	12.663	**P-Value. Chi^2(16)**		0.6972
BG LM Test				
F-Test	1.0696	**P-Value F(2,29)**		0.3563
Obs*R^2	3.2975	**P-Value. Chi^2(2)**		0.1923

Source: Author's Calculations

The short-run ECM model is presented in Table 6. The positive change in urbanization and lag value of positive change in urbanization shows a positive and significant association with agricultural output. Similarly, the variables of negative shock in urbanization and foreign direct investment show a negative and significant association with agriculture output in Pakistan. The ECM term shows the short-run dynamics. The ECM(-1) term turns out to be negative and also statistically significant; the negative value indicates the convergence toward long-run equilibrium.

Table 6
NARDL Short-Run Estimates

DV: AGS				
Selected Model ARDL(1, 2, 1, 0, 2, 1, 1, 0, 0)				
Variables	**β**	**S.E.**	**T-Test**	**P-value**
D(LFPR)	0.0211	0.0415	0.5082	0.6149
D(LFPR(-1))	-0.0730	0.0412	-1.76980	0.0866
D(GFCF)	-0.0140	0.1212	-0.1154	0.9088
D(INF)	0.0425	0.0226	1.8798	0.0696
D(URBGR_POS)	18.6113	8.4597	2.1999	0.0354
D(URBGR_POS(-1))	16.9219	6.0813	2.7825	0.0091
D(URBGR_NEG)	-9.7323	3.2809	-2.9663	0.0058
D(EDT)	-0.0264	0.0358	-0.7399	0.4649
D(FDI)	-0.7574	0.2807	-2.6976	0.0112
D(EDG)	5.2906	5.9389	0.8908	0.3799
ECM(-1)	-0.8070	0.1498	-5.3871	0.0000

Source: Author's Calculations

CUSUM and CUSUM of squares graphs are used to determine the model stability. Figure 1 clearly shows that recursive residuals are within the upper and lower bound lines at a 5 percent level of significance; it points out that the model parameters are dynamically stable.

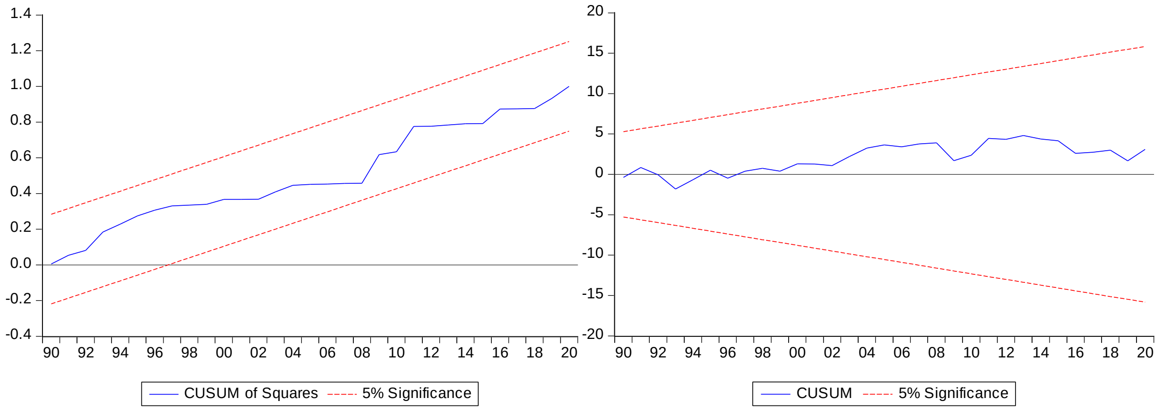

Figure 1 Model Stability Test

Source: Author's Calculations

The Jarque-Bera test is employed using the histogram normality test to determine the residuals' normality in a model. Figure 2 specifies that the Jarque-Bera value turns out to be statistically insignificant. It points out that the model residuals are normally distributed.

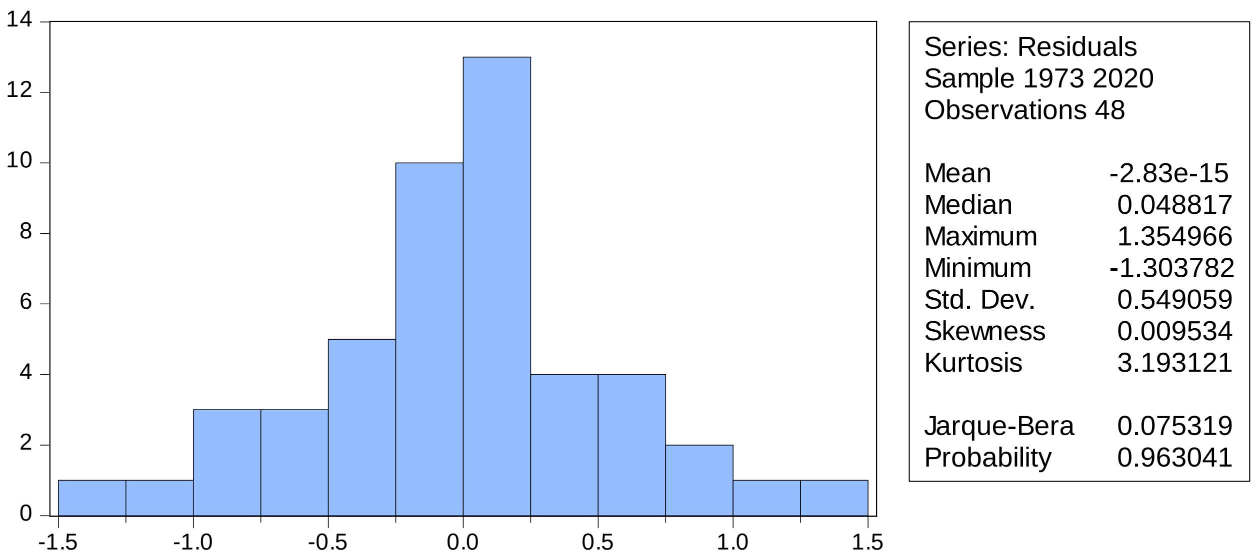

Figure 2: Residuals Normality Analysis

Source: Author's Calculations

Conclusions and Recommendations

An increase in agricultural output not only improves the economic growth of a country but also ensures food security. However, an increase in population leads to rapid urbanization and environmental degradation, affecting agriculture output. The primary aim of this article is to analyze how urbanization effect agriculture output in Pakistan. To achieve this objective, we use yearly data from 1970 to 2020. To analyze the long-run estimation of the parameters nonlinear ARDL model is used. The NARDL model is employed to analyze the asymmetric effects of urbanization on agriculture output. The findings show that the urban population growth rate has an asymmetric and statistically significant impact on agriculture output in Pakistan. It is evident that positive changes in urbanization adversely affect agriculture output. The coefficient of the variable point out that increase in urbanization leads to the 8.2391 units decline in agriculture output.

Similarly, negative changes in urbanization positively affect the agriculture output in Pakistan. The coefficient value specifies that a decline in the urban population growth rate leads to an increase in agriculture output by 1.9750 units. On the other hand, the labour force participation rate and GFCF are found to positively and significantly influence the agriculture output, while foreign direct investment and external debt adversely influence the agricultural output in Pakistan. Environmental degradation is found to negatively but insignificantly influence the agriculture output in Pakistan.

This study has some important policy implications, such as controlling the negative consequences of urbanization on agriculture output, agriculture land of the country should be protected. Policies need to be designed to protect the urbanization on agriculture lands. Policymakers should also ensure the efficient use of external debt in the agriculture sector to improve agriculture infrastructure. Similarly, to improve the level of agricultural output in Pakistan, the government should provide subsidies and credit facilities to the farmers. More research is also needed for better seed verities and usage of modern technologies.

This study also has some limitations. The agriculture sector is vital for many economies. The agriculture sector consists of crops, forestry, livestock, and fishing. This study analyses the asymmetric impact of urbanization. The influence of urbanization on the agriculture sector is seen; however, future studies could also analyze the link between urbanization and subsectors of agriculture in Pakistan. On the other hand, urbanization significantly influences the groundwater level, but this association is not considered due to the unavailability of time series data. Future studies could also explore urbanization’s impact on groundwater levels in Pakistan.

References

Ajmair, M. (2018). Determinants of Agricultural Sector Growth in Pakistan: A Time Varying Parametric Approach. *Journal of Economics and Sustainable Development*, *9*(19), 80-86.

Ali, U., Jing, W., Zhu, J., Omarkhanova, Z., Fahad, S., Nurgazina, Z., & Khan, Z. A. (2021). Climate change impacts on agriculture sector: A case study of Pakistan. *Ciência Rural*, *51*(8), 1-12.

Amari, K., Huang, C., & Heinlein, M. (2021). Potential impact of global warming on virus propagation in infected plants and agricultural productivity. *Frontiers in Plant Science*, *12*, 649768.

Arooj, S., Naqvi, S. A. A., & Makhdum, M. S. S. A. (2018). Impact of Environmental Degradation on Wheat Production in Pakistan. *Appl. Environ. Biol. Sci.*, 8(1), 29-34.

Arora, N. K. (2019). Impact of climate change on agriculture production and its sustainable solutions. *Environmental Sustainability*, *2*(2), 95-96.

Atu, J. E., Offiong, R. A., Eni, D. I., Eja, E. I., & Esien, O. E. (2012). The effects of urban sprawl on peripheral agricultural lands in Calabar, Nigeria. *International Review of Social Sciences and Humanities*, *2*(2), 68-76.

Avazdahandeh, S., & Khalilian, S. (2021). The effect of urbanization on agricultural water consumption and production: the extended positive mathematical programming approach. *Environmental Geochemistry and Health*, *43*(1), 247-258.

Ayinde, A., Ayansina, S., Ibrahim, S., & Oyebode, D. (2021). Nexus Between Job Stress And Employees Retention In The Agricultural Development Programmes: Evidence From Oyo State Agricultural Development Programme. *Ethiopian Journal of Environmental Studies & Management*, *14*(1).

Bakoji, Y. M., Elizabeth, E., Philip, A. H., Isa, M. S., & Abba, U. J. (2020). Urbanization and its Impact on Agricultural Lands in Growing Cities in Developing Countries: A Case Study of Makurdi, Benue State Nigeria. *International Journal of Economy, Energy and Environment*, 5(4), 41-46.

Brownson, S., Vincent, I. M., Emmanuel, G., & Etim, D. (2012). Agricultural productivity and macro-economic variable fluctuation in Nigeria. *International Journal of Economics and Finance*, *4*(8), 114-125.

De Sherbinin, A., Schiller, A., & Pulsipher, A. (2007). The vulnerability of global cities to climate hazards. *Environment and urbanization*, *19*(1), 39-64.

Deng, Z., Zhao, Q., & Bao, H. X. (2020). The impact of urbanization on farmland productivity: Implications for China's requisition–compensation balance of farmland policy. *Land*, *9*(9), 311.

Diao, X., Hazell, P. B., Resnick, D., & Thurlow, J. (2007). *The role of agriculture in development: Implications for Sub-Saharan Africa* (Vol. 153). Intl Food Policy Res Inst.

Dorosh, P., & Thurlow, J. (2018). Beyond agriculture versus non-agriculture: Decomposing sectoral growth–poverty linkages in five African countries. *World Development*, *109*, 440-451.

Ehigiamusoe, K. U., Lean, H. H., & Somasundram, S. (2022). Unveiling the non-linear impact of sectoral output on environmental pollution in Malaysia. *Environmental Science and Pollution Research*, *29*(5), 7465-7488.

Factura, H., Cimene, F. T. A., Nacaya, I. M. Q., & Otterpohl, R. (2022). Impacts of urbanization on farming communities of Cagayan de Oro City and pathways to sustain food production. *Journal of Agricultural Research*, *60*(1), 67-71.

Hualou, L., & Jian, Z. (2010). Grain production driven by variations in farmland use in China: an analysis of security patterns. *Journal of Resources and Ecology*, *1*(1), 60-67.

Iddrisu, A. A., Immurana, M., & Halidu, B. O. (2015). The impact of foreign direct investment (FDI) on the performance of the agricultural sector in Ghana. *International Journal of Academic Research in Business and Social Sciences*, *5*(7), 240-259.

Iheke, O. R., & Ihuoma, U. (2016). Effect of urbanization on agricultural production in Abia State. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, *5*(2), 83-89.

Jago-on, K. A. B., Kaneko, S., Fujikura, R., Fujiwara, A., Imai, T., Matsumoto, T., ... & Taniguchi, M. (2009). Urbanization and subsurface environmental issues: an attempt at DPSIR model application in Asian cities. *Science of the total environment*, *407*(9), 3089-3104.

Jiang, L., Deng, X., & Seto, K. C. (2012). Multi-level modeling of urban expansion and cultivated land conversion for urban hotspot counties in China. *Landscape and urban planning*, *108*(2-4), 131-139.

Jiang, L., Deng, X., & Seto, K. C. (2013). The impact of urban expansion on agricultural land use intensity in China. *Land use policy*, *35*, 33-39.

Khaledi, K., & Shirazi, A. H. (2013). Estimates of factors affecting economic growth in the agricultural sector in the Fifth Development Plan of Iran (emphasis on investment). *World Applied Sciences Journal*, *22*(10), 1492-1499.

Kim, J. W. (2011). The economic growth effect of R&D activity in Korea. *Korea and the World Economy*, *12*(1), 25-44.

Kugelman, M. (2013). *Urbanization in Pakistan causes and consequences*. NOREF Expert Analysis.

Kugelman, M. (Ed.). (2014). *Pakistan's Runaway Urbanization: What Can be Done?*. Asia Program, Woodrow Wilson International Center for Scholars.

Kwakwa, P. A. (2021). The carbon dioxide emissions effect of income growth, electricity consumption and electricity power crisis. *Management of Environmental Quality: An International Journal*, *32*(3), 470-487.

Kwakwa, P. A., Alhassan, H., & Adzawla, W. (2022). Environmental degradation effect on agricultural development: an aggregate and a sectoral evidence of carbon dioxide emissions from Ghana. *Journal of Business and Socio-economic Development*. 2(1), 82-96.

Liu, J., & Diamond, J. (2005). China's environment in a globalizing world n*ature*, *435*(7046), 1179-1186.

Luo, J., Zhan, J., Lin, Y., & Zhao, C. (2014). An equilibrium analysis of the land use structure in the Yunnan Province, China. *Frontiers of earth science*, 1-12.

Malhi, G.S., Kaur, M. and Kaushik, P. (2021). Impact of climate change on agriculture and its mitigation strategies: a review, *Sustainability (Switzerland)*, 13(3), 1-21.

Maria, D. S., Diego, B., & Giovanni, S. (2013). Measuring the effect of climate change on agriculture: A literature review of analytical models. *Journal of development and agricultural economics*, *5*(12), 499-509.

Mendelsohn, R. (2009). The impact of climate change on agriculture in developing countries. *Journal of Natural Resources Policy Research*, *1*(1), 5-19.

Milesi, C., Elvidge, C. D., Nemani, R. R., & Running, S. W. (2003). Assessing the impact of urban land development on net primary productivity in the southeastern United States. *Remote Sensing of Environment*, *86*(3), 401-410.

Pakistan Economic Survey (2021-22). *Agriculture*, Ministry of Finance.

Pakistan Economic Survey (2021-22). *Population*, *Labour Force and Employment*, Ministry of Finance.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Pinto, N. G. M., Rossato, V. P., Müller, A. P., & Coronel, D. A. (2021). Environmental degradation and agriculture: an approach in countries by middle of indexes. *Ciência Rural*, *52*(6), 1-12.

Raza, J., & Siddiqui, W. (2014). Determinants of Agricultural Output in Pakistan: A Johansen co-integration approach. *Academic Research International*, *5*(4), 30-46.

Rehman, A., Jingdong, L., Shahzad, B., Chandio, A. A., Hussain, I., Nabi, G., & Iqbal, M. S. (2015). Economic perspectives of major field crops of Pakistan: An empirical study. *Pacific science review b: humanities and social sciences*, *1*(3), 145-158.

Sertoglu, K., Ugural, S., & Bekun, F. V. (2017). The contribution of agricultural sector on economic growth of Nigeria. *International Journal of Economics and Financial Issues*, *7*(1), 547-552.

Shah, S. Z. A., Asghar, M. M., & Riaz, U. (2021). Does Urbanization Influence Agriculture Output in Pakistan?. *International Review of Basic and Applied Sciences*, 9(3), 368-376.

Shalaby, A. (2012). Assessment of urban sprawl impact on the agricultural land in the Nile Delta of Egypt using remote sensing and digital soil map. *International Journal of Environment and Sciences*, *1*(4), 253-262.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2009). Modelling asymmetric cointegration and dynamic multipliers in an ARDL framework. In *International Conference on Applied Economics and Time Series Econometrics, Leeds University Business School UK*.

Tan, D., Adedoyin, F. F., Alvarado, R., Ramzan, M., Kayesh, M. S., & Shah, M. I. (2022). The effects of environmental degradation on agriculture: Evidence from European countries. *Gondwana Research*, *106*, 92-104.

Tiwari, M. K., Saxena, A., & Katare, V. (2012). Mapping and evaluation of urban sprawl using an integrated approach of Remote Sensing and GIS Technique. *International Journal of Advanced Technology & Engineering Research (IJATER)*, *2*(1), 21-29.

Toor, M., Rehman, F., Adnan, M., Kalsoom, M. and Shahzadi, L. (2020). Relationship between environment and agriculture: a review, *SunText Review of BioTechnology*, 1(2), 1-5.

Ujoh, F., & Ifatimehin, O. O. (2010). Understanding urban sprawl in the Federal Capital City, Abuja: Towards sustainable urbanization in Nigeria. *Journal of Geography and Regional Planning*, *2*(5), 106.

Ukpe, U. H., Umeh, J. C., Ater, P., & Asogwa, B. C. (2017). Effects of public external debt and private investment on agricultural growth in Nigeria: From 1980-2016. *Agri Res & Tech: Open Access Journal*, *10*(2), 1-5.

Wagan, S. A., Memon, Q., & Noonari, S. (2018). A comparative study of urbanization's impact on agricultural land between China, Pakistan, and Germany. *J Resour Dev Manag*, *41*, 44-50.

Waseem, L. A., Farhat, K., & Naqvi, S. A. A. (2019). Urbanization Impacts on Urban Agriculture Land Conversions and Crop Production in Metropolitan, Lahore, Pakistan. *Pakistan Geographical Review*, 74(1), 48-60.

Yousaf, U., Naqvi, F. N., Nasir, A., Bhutta, N. A., & Haider, A. (2011). Impact of foreign direct investment on economic growth of Pakistan. *European Journal of Economics, Finance and Administrative Sciences*, *32*, 95-100.

Yuan, F. (2008). Land-cover change and environmental impact analysis in the Greater Mankato area of Minnesota using remote sensing and GIS modelling. *International Journal of Remote Sensing*, *29*(4), 1169-1184.

Zhao, S., Da, L., Tang, Z., Fang, H., Song, K., & Fang, J. (2006). Ecological consequences of rapid urban expansion: Shanghai, China. *Frontiers in Ecology and the Environment*, *4*(7), 341-346.

Zhong, C., Hu, R., Wang, M., Xue, W., & He, L. (2020). The impact of urbanization on urban agriculture: Evidence from China. *Journal of Cleaner Production*, *276*, 122686.