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Original Article

RURAL/URBAN MIGRATION AND WAGE DETERMINATION: AN EMPIRICAL ANALYSIS

Zainab Zaheer[1], Prof. Dr. Abdul Ghafoor Awan[2]

1. **M.Phil. Economics, Department of Economics, Institute of Southern Punjab, Multan, Pakistan.** **Zeenatkhan666@gmail.com**
2. **Dean, Faculty of Management Sciences, Institute of Southern Punjab, Multan, Pakistan.** **drabdulghafoorawan@gmail.com. OIRCID ID: https://orcid.org/ 0000-0001-5767-6229**

Abstract

The primary objective of this study is to assess the impact of rural-urban migration on wages in Pakistan, utilizing secondary data from 1992 to 2022. The analysis considers wages as the dependent variable, while rural-urban migration, per capita income, GDP, and population growth are treated as independent variables. To conduct empirical analysis, various statistical methods such as descriptive statistics, correlation matrix, the ARDL Model, were used. The results reveals that rural-urban migration in Pakistan is influenced by a complex interplay of push and pull factors such as pursuit of higher education, better healthcare facilities, improved job opportunities, and marriage. The empirical findings demonstrate statistically significant positive relationship between wages and both GDP and urbanization while negative relationship between wages and population growth, as well as per capita income. The study underscores the need for policies that address the challenges of urbanization and population growth while promoting economic opportunities to improve wage levels and living standards for the migrants.

Key words: wages; urbanization; per capita Income; GDP; population growth.

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1. Introduction

Wages are the main cause for that people to start migration from rural to urban areas. In the rural areas there are low wages compared to industrial sector and as such people start migrating to urban areas to seek high wages and better living standards. Many people migrate due to lack of basic life necessities, such as health, employment, education and inadequate and social status. Similarly, the highly educated also migrate to big cities because the jobs relevant to their education are not available in their rural areas. Some families migrate to the urban areas because they want to give better education to their children as good and higher education facilities are not available in their home towns. Imran, et al. (2013) argues that one third of the rural population in Pakistan lives below poverty line, and there are no chances of improvement in near future due to financial constraints. Therefore, people are forced to migrate to urban areas in search of better earning opportunities. This is the reason that ratio of urban population has increased from 37.9% in 2013 to 40.54% in 2018 whereas the ratio of rural population has decreased from 62.1% in 2013 to 59.46% in 2018%. The Neo-classical theory postulates that migration mostly depends upon the wage differentials and people generally migrate for better economic opportunities and bright future.Todaro (1969), and Harris and Todaro (1970) also confirmed that wage or earning differences in the urban and rural areas is the major driver of migration. Safi1, Haq & Iqbal (2017) in their empirical analysis of understanding internal migration state that gender and marriage have statistically negative impact on migration, indicating that males are more inclined to migrate but when they are married, they are reluctant to migrate. It means unmarried younger persons are more inclined to migrate to search for better earning opportunities. Income is major driver of

migration. Karachi, Lahore, Faisalabad, Multan, Hyderabad, Islamabad, Peshawar and Rawalpindi are the major cities of Pakistan where majority of migrants move. The size of these cities is rapidly expanding exponentially. Karachi and Lahore are projected to be ranked as 12th and 18 largest cities in the world by 2050 (World Urbanization Prospects, 2019). The fast growth of urbanization has also played a vital in the development of informal sector which provides 72% of total employment in Pakistan (Saba et al. 2023).

Internal migration has been increasing due to lack of basic needs and high wages and housing problems occurs due to this rural-urban migration. The one of main cause of migration of people from rural areas to urban areas is poverty (Kousar et al. 2016) Advanced technologies and rapid industrialization in the urban areas increase migration from rural to urban areas. It will cause shortage of houses in the urban areas (Jabeen et al. 2015), but this affects the nutritional factors of children (Brauw and Mu 2011). immigration is also increasing and highly educated and skilled workers are migrating to abroad for high wage. But international migration has negative impact native wages as both have imperfect substitution (Dustman and Pretson, 2011).

The above discussion highlights main drivers of rural-urban migration. Thus, the primary objectives of the study are the followings:

- To scrutinize the key factors such as economic disparities and wage differentials, which drive rural urban migration.
- To examine the demographic characteristics and identify specific groups such as young, highly educated and unmarried males who are more likely to migrate.
- To evaluate the impact of rural-urban migration on urban areas, and issues such as rapid urbanization, the growth of informal sector, and the housing shortages, produced as a result of migration.

- To analyze the association between rural-urban migration and other socioeconomic factors, such as poverty, education, and access to basic living necessities.

In the light of above objectives, the main research question could be:

What are the main determinants of rural-urban migration in Pakistan, and what are their impact on both rural and urban areas?

This study could contribute to the existing body of knowledge in several ways: First, it provides empirical evidence on the main drivers of rural-urban migration, which can valuable insights for policymakers and development planners. Second, this study has identified special groups who are more interested in migration and the policymakers can focus on them for intervention and support programs. Third, this study has also examined the impact of migration on cities, highlighting the problems and opportunities associated with rapid urbanization. Fourth, this study also helps develop understanding of the complex association between rural-urban migration and other socioeconomic determinants.

By exploring these objectives and main research question, the study can provide valuable insights into the determinants of rural-urban migration in Pakistan and long-term impact on its socioeconomic landscape.

2 Theoretical frameworks

2.1 Malthusian theory of population growth

Thomas Malthus was presented his theory of population growth in his book "Essay on the Principle of Population." Published in 17778, which postulates that population is growing at a geometric rate (e.g. 1.3.9.27.81, etc.) while food production is increasing at arithmetic rate (e.g. 2+4+6+8, etc.) and if this rate is continued the natural resources would be depleted and natural disasters like widespread unemployment, famine, hunger, poverty,

earthquakes, etc. would take place. He emphasized to control population growth to prevent future disasters.

2.2 The Marxian Theory of Wages

Carl Marks presented this theory in which argues that surplus labor supply causes wages to decline as well as unemployment. He further argues that the capitalist system produces "workers reserve army" (surplus labor) that continuously tends decline wages. This divides the society into excess employees and unemployed. The unemployed labor force is will to work at lower wages. He opined that free market intentionally creates surplus labor and low wages trajectory to maximize profit by capitalists. He suggests that government intervention is necessary to remove this distortion.

2.3 Lewis's theory of migration

Lewis (1954) disclosed that people exit agricultural sector and join industrial sector for expectation of high earning but it negatively affects wage rates. He further states that agriculture sector has excess supply of labor and as such the wages are low there compared to industrial sector where demand of labor is high due to expansion of industries and therefore, the wages are higher there. This attracts the surplus labor to move from rural to urban areas. However, human capital theory states that costs and returns play major role in migration of the labor from rural to urban areas.

2.4 Empirical review of literature

Previous literature is reviewed to understand current trends of research and findings of other scholars on the relationship between rural-urban migration and wages. The brief review of relevant studies is discussed in the following:

Ikramullah et al (2011) have argued that economic and the social measurements of rural towards urban migration of Pakistan resulted from the current surveys in the Pakistan. Industrial sector increased employment opportunities in urban areas increased, resulting migration from rural to urban

areas. Dustmann and Preston (2011) have examined the effect of migration on wages and its effect on labor market in the host countries. They used three level CES model. In the three level CES model the immigrants and the natives were authorized to be the imperfect substitutes within the age, -education and predicted wage affect which based on elasticity of substitution at every level. Manacorda et al (2012) and Gross, Schmitt, (2012) have analyzed the impacts of the immigration on the structure of the wages in the light of evidence from Britain. They examined the relationship between natives and immigrant was imperfect substitute in the production. Kanwal et al (2015) have found the socioeconomic determinants of rural-urban migration in Pakistan. When economic growth increased, it brought structural change, which reduced share of the agricultural sector and increased share of industrial sector. Awan et al., (2015) investigated the determinants of rural women and their labor supply in the agriculture sector. This study indicated that main causes of women labor supply were financial problems, size of family and husband's health were major element. Jabeen et al. (2015) have analyzed the crises of housing in Pakistan and reviews about the population growth rate and analyzed deficiencies in housing policies and the laws. The Pakistan has law and the policies for buildup housing sectors but there was a gap in productive implementation. Kousar et al. (2016) has analyzed impacts of the migration process on the poverty in rural areas in Faisalabad district of Pakistan. They argued that the society has transformed from agriculture sector to industrial sector and shortage in the opportunities of employment, shortage of health care, and the education expedited rural-urban migration in Pakistan. Imran et al., (2016) have analyzed relationship between rural-urban migration and crop productivity in Pakistan. Rural-urban migration not only increase burden on urban areas but also decreased agriculture productivity. Due to high population

growth Pakistan faced high rate of rural-urban migration. Jabeen at al., (2017) have analyzed urbanization in governance perspective. Urbanization in the Pakistan required to tremendous attention on the governance structure and policies included, approach to education, homes, transport, the employment and the public health at the upgrade level. Mukhtar et al (2018) have argued migration from rural towards urban areas improved per capita income and the welfare of household. They contended that raising income id the major driver of migration from rural to urban areas. The rise in prices of houses and scarcity of houses created unaffordability of houses. Awan and Liaqat (2018) have analyzed an overview rural urban migration. This study disclosed that the government has not invested in the development of rural areas and the residents faced lack of infrastructure, limited approach to health and education facilities. Wang, Dong et al., (2018) examined the transitions in returns of education for off-form wage employment. They investigated that returns to education highly exchange with educational factors. Tertiary education has balanced a high rate of return about 10%, whereas the returns on high school education and below have slowly decreased. Umair and Naz (2019) investigated trends of contrasting of demographic and socio-economic characteristics of the rural-urban migration, The also studied the groups of different ages, difference of gender, and rate of learning and level of education, the marital status and employments rate and concluded that there are many factors that drive rural-urban migration. Marta et al., (2020) have analyzed the motives of migration and also their impacts on the welfare of household migrated from rural to urban areas. The migration has positive and significance effect on per capita income of household because the working age workers living in the rural areas have fewer earning opportunities and, as such

they prefer to migrate to urban areas to seek high earning opportunities in the industrial and service sectors. Urooj et.al (2020) observed the intentions to urban migration among youth. Positive link of the migration intension with the income of people, resources, gender, level of education, the migrated members of household and the friends and the relatives who migrate has examined. And there was adverse link of the land, satisfaction from educational facilities, compensation from job opportunities and the transport availabilities with the migration purpose.

2.5 Hypotheses Development

In the light of reviewed literature, the following hypotheses are developed. These hypotheses will be tested through statistical techniques, using time series data.

H_0: Wages does not have significant impact on the migration from rural to urban areas.

H_1: Wages have significant impact on the migration from rural to urban areas.

H_0: GDP does not have significant impact on the migration from rural to urban areas.

H_1: GDP has significant impact on the migration from rural to urban areas.

H_0: Population growth does not have significant impact of rural-urban migration.

H_1: Population growth have significant impact on rural-urban migration.

H_0 : Per capita income does not have significant impact on rural-urban migration.

H_1: Per capita income has significant impact on rural-urban migration.

2.6 Novelty of study

The previous studies mostly focus on economic factors like wages and employment opportunities that drive rural urban migration in Pakistan. Some studies discussed social factors like education and healthcare, but there is a lack of deeper analysis on how these factors influence migration decisions. The existing literature also discussed the impact of migration on both rural and urban areas, but there is a lack of discussion on social structure and resource allocation. The study can offer a more nuanced understanding of the determinants of migration by employing relevant theoretical frameworks, like Lewis's theory of migration and Human Capital Theory. This study also provides fresh insights into skill and education mismatch and recommends that successful integration can be achieved in urban areas by bridging skill and education mismatch through policy intervention.

2.7 Conceptual Model

In the light of objectives and hypotheses of the study the following conceptual model has been displayed to highlight relationship between independent and dependent variables. The model is exhibited in Figure 1.

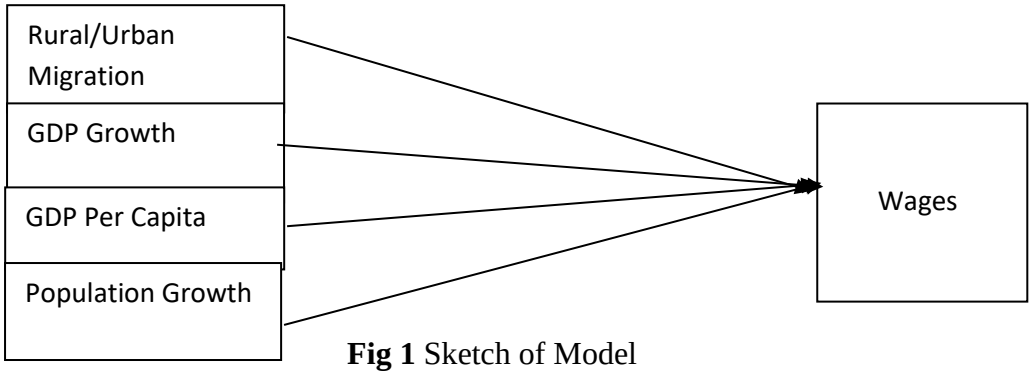

Fig 1 Sketch of Model

3. Data and Methodology

3.1 Research design

Research methodology is a technique that is used for collection of data, selection of variables, sample of study, data collection procedure and analysis of data to determine relationship between dependent and independent variables. It allows researchers to critically evaluate the data and check its validity and reliability. The data and analytical techniques are different for qualitative and quantitative study. This study is quantitative in nature and uses time series data from 1992 to 2022. The data was collected from World Development Indicators, International Labor Organization (ILO) Pakistan Economic Survey, and the State Bank of Pakistan. These sources are authentic and valid.

3.2 Selected variables

The selected variables for studying rural-urban migration and wage determination are following:

3.2.1 Dependent variable

Wages

3.2.2 Independent variable

- Rural-urban migration (Urbanization)
- GDP Growth
- Per capita income
- Population growth annual

3.3 Econometric model

$$Y = b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + £$$

Where:

Y: Dependent variable.

b_1,b_2,b_3,b_4:Coefficients for the independent variables X_1,X_2,x_3,X_4, respectively.

x_1: Rural-urban migration (Urbanization)

x_2: Per capita income.

x_3: GDP Growth rate.

x_4: Population growth rate annual.

$£$: Error term measures variability in dependent variable Y, not explained by independent variables.

The dependent variable, wage, was adopted from the studies of Dustmann and Preston (2011); Manacorda et al (2012). The variable, rural-urban migration (Urbanization) was adopted from the studies of, (Ikramullah et al 2011), (Kanwal et al 2015), (Imran et all. 2016), and Jabeen at al., (2017). The GDP growth variable was adopted from the study of Kanwal et al (2015) and the variable per capita income was adopted from the study of Mukhtar et al (2018) and Urooj et.al (2020). The variable, population growth, is adopted from the studies of James (2013).

3.4. Description of variables.

3.4.1 Wages

This variable can be defined as a fixed regular payment paid to a worker for work or services provided to employer. It can be paid on a daily or weekly or monthly basis. It is mostly fixed on the basis of inflation rate so that the worker can meet the expenses of his living. Although different countries have fixed minimum wages but the employers do not follow them due to availability of cheap labor. Low wages are the phenomenon of underdeveloped countries

although low wages are paid to immigrants even in the developed countries.

3.4.2 Rural to Urban Migration / urbanization

The variable rural to urban migration can be described as the population movement from rural to urban areas. People move from rural to urban areas for better earning opportunities, better education and health, improving per capita income and enjoying better living standard. This causes urbanization, population density, unemployment, housing problems, sanitation issues, high crime rates and ethnic conflicts as are generally observed in different urban areas of Pakistan (Connell, (1976; Lucas. (1998); Card, 2001), Gross, Schmitt, (2012), Urooj, et al. (2020).

3.4.3 Per capita income

When total gross domestic product (GDP) is divided into total population GDP per capita or per capita income is generated. If GDP growth is equitably distributed it reflects the distribution of income among the population and living standard of people. The Americans and Europeans are rich because their per capita income is high compared to most of Asians. This is used to compare the living standard and consumption level of people in different countries. The World Bank divides the countries into high, medium and low-income countries (The World Bank, 2019).

3.4.4 GDP (gross domestic production) growth

The gross domestic products (GDP) is defined as the production of goods and services in a specific period in a country is known as GDP. It is measured at market prices. All countries strive to increase GDP growth because wealth is produced and national income is increased as a result. The countries are compared on the basis of their GDP growth. If GDP growth is maintained upward for a longer period of time the country become rich and prosperous.

The best recent example of high GDP growth countries are Chine and India which have become engine of growth in Asia as compared to their peers while Pakistan and Afghanistan are bad performers because they could not sustain GDP growth at desired level, resulting poverty, income inequality, and terrorism Basnett & Sen, 2013; Shinnying, Lin, Shang, 2015); Bove & Elia, 2017); Yusoff, et al. (2023).

3.4.5 Population growth rate

Population growth is the percentage increase in population in a year. If population growth is high, it increases demand of goods and services and reduces per capita income. Pakistan's population growth is highest in the region and is above 2 percent per year. As per 2023 census, Pakistan population has exceeded 240 million. Malthus theory of population growth can be applied in Pakistan where population is rising without any check (James, 2013), Pakistan Economic Survey, 2023).

3.4.6. Analytical Techniques.

In order to anal analyze data and nature of relationship between dependent and independent variables in the long run the following econometric techniques were used.

- Descriptive statistics
- Correlation Matrix
- ADF (Augmented Dickey-Fuller) Test
- Multiple Regression Analysis
- Heteroscedastic Test
- Auto Correlation Test
- Granger Causality test
- CUSUM Test
- Normality Test

4. Results

4.1 Descriptive Statistics

Descriptive statistics are used to calculate, describe, and summarize collected data into logical and meaningful way. It provides simple summaries about the sample and its measures, such as measures central tendency and dispersion of values from the mean. The descriptive statistics provides important insights into the relationship between dependent variable, wages, and independent variables. The descriptive statistics results are presented in Table 1.

Table 1

Descriptive Statistics results

	Wages	Urbanization	GDP growth	POP growth	Per capita income
Mean	38.35079	64380899	4.273408	2.333982	1.813946
Median	37.15652	64313863	4.260088	2.235149	1.700963
Maximum	55.62033	88979079	7.831256	3.297471	5.447802
Minimum	34.07763	40818200	1.014396	1.204056	-2.970295
Std. Dev.	4.695110	14362926	1.783861	0.632827	2.107144
Skewness	2.133376	0.000698	0.260395	-0.252026	-0.116332
Kurtosis	8.117453	1.825065	2.531235	1.939562	2.584437
Jarque-Bera	53.64215	1.668072	0.593245	1.665806	0.274081
Probability	0.000000	0.434293	0.743324	0.434785	0.871935
Sum	1112.173	1.87E+09	123.9288	67.68547	52.60442
Sum Sq. Dev.	617.2337	5.78E+15	89.10050	11.21317	124.3216
Observation	29	29	29	29	29

s					

Table 1 shows the result of descriptive statistics. The mean of wage is 38.35079 with standard deviation 4.695110. The mean of per capita income is 1.813946 with standard deviation 2.107144. The mean of population growth is 2.333982 with standard deviation 0.632827. The mean of GDP growth is 4.273408 with standard deviation 1.783861. The skewness values of population growth and per capita income are -0.252026 and -0.116332 respectively which are negatively skewed and all other variables are positively skewed. Kurtosis measure the peak of variables distribution around its normality. Wages are leptokurtic. Population growth, urbanization, GDP growth and per capita income are platykurtic. Jarque Bera test were used for testing the joint hypothesis about the normality of skewness and kurtosis. The value of this test should not be zero, if its value is zero, which is represented the data of all variables, is not normally distributed. These results show non-negative value of Jarque Bera test, proving that data of all variables are normally distributed.

4.2 Correlation Matrix

Correlation matrix is used for identification of different patterns of relationship between pair of variables. A correlation matrix is a square matrix showing the correlation coefficients between two variables. This matrix often examines how different variables relate in multivariate analysis and statistics. This also depicts the linear relationship between two variables. By looking at the correlation coefficients between two variables, we can learn how they are related and how changes in one variable may affect the other variables. The estimated results are exhibited in Table 2.

Table 2

Results of correlation Matrix

	Wages	Urbanization	GDP growth	POP growth	Per capita income
Wages	**1**	**0.69212322...**	**0.21361404...**	**-0.7348779...**	**-0.0493217...**
Urbanization	**0.69212322...**	**1**	**0.04722233...**	**-0.9112509...**	**0.25548594...**
GDPG.	**-0.21361404**	**0.04722233...**	**1**	**-0.1941656...**	**-0.1884486...**
POPG...	**0.7348779...**	**-0.9112509...**	**-0.1941656...**	**1**	**-0.0420231...**
Per Capita...	**-0.0493217...**	**0.25548594...**	**-0.1884486...**	**-0.0420231...**	**1**

Table 2 shows that the results of correlation matrix. Population growth is negatively and significantly correlated with wages which is dependent variables. Urbanization is strongly positively correlated with wages. GDP growth is weakly correlated with wages of workers. Per capita income is weakly and negatively correlated with wages. Population growth rate and per capital income have negative correlation with wages while urbanization and GDP growth have positive correlation with wages. Thus, the results show mixed correlation between independent and dependent variables because some have positive correlation with dependent variable while others have negative correlation with it.

4.3 Augmented Dickey Fuller (ADF) Test

This test is applied to test null and the alternative hypothesis. It provides p and t values to check stationarity of time series. In statistics, Augmented Dickey–Fuller (ADF) test is commonly used to check stationarity and presence of unit root in a time series data. The alternative hypothesis says that the data is stationary. The results oof ADF Test are shown in Table 3.

Table 3

Augmented Dickey Fuller (ADF) Test results

Variables	Level		First Difference		Second Difference		Decision
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	Intercept	Intercept & Trend	
Wages	t=-2.402381 P=0.1493	t=-3.488756 P=0.0583	t=-6.259905 P=0.0000	t=-6.150203 P=0.0001	t=-6.7110766 P=0.0000	t=-6.57494 P=0.0000	I (0)
GDP growth	t=-6.709891 P=0.0000	t=-6.822804 P=0.0000	t=-9.720098 P=0.0000	t=-9.660761 P=0.0000	t=-7.674598 P=0.0000	t=-7.568346 P=0.0000	I (0)
P	t=-5.668869 P=0.0000	t=-5.613890 P=0.0001	t=-6.923711 P=0.0000	t=-6.822136 P=0.0000	t=-7.150871 P=0.0000	t=-7.066206 P=0.0000	I (0)
Urbanization	t=2.813055 P=1.0000	t=-2.073982 P=0.0545	t=-1.478590 P=0.0535	t=-3.324178 P=0.7905	t=-3.77125 P=0.0059	t=-3.737110 P=0.0296	I (0)
Population growth	t=-0.806660 P=0.8085	t=-3.644693 P=0.0358	t=-5.819542 P=0.0000	t=-5.853502 P=0.0001	t=-6.357719 P=0.0000	t=-4.943651 P=0.0013	I (0)

The results shows that all variables are stationary at level. So, we can only use OLS technique for further analysis.

4.4 Multiple Regression

Multiple Regression method is used to determine unknown parameters of model in the linear regression model. It is a common technique for estimating coefficients of linear regression equations which describe the relationship between one or more independent quantitative variables with dependent variable. The Ordinary Least Squares (OLS) is also known as the best technique of the regression. It is a dynamic model which enables us to determine the behavior of variables but also predict about their behavior in future. Table 4 contains estimated results of Multiple regression analysis.

Table 4

Multiple Regression Analysis results

Dependent Variable: WAGES				
Method: Least Squares				
Date: 05/19/24				
Time: 18:40				
Sample (adjusted):2149				
Included observations:29 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Urbanization	1.29E-07	1.30E-07	0.994449	0.3299
GDP growth rate	0.254971	0.380554	0.669999	0.5093
Population growth	-2.687934	2.899576	-0.927009	0.3632
Per capita income	-0.328018	0.352704	-0.930010	0.3616
C	35.81636	15.16135	2.362347	0.0266

R-squared	0.567598	Mean dependent var	38.35079
Adjusted R-squared	0.495531	S.D. dependent var	4.695110
S.E. of regression	3.334750	Akaike info criterion	5.402258
Sum squared resid	266.8933	Schwarz criterion	5.637998
Loglikelihood	-73.33274	Hannan-Quinn criter.	5.476089
F-statistic	7.875964	Durbin-Watson stat	1.418898
Prob(F-statistic)	0.000334		

Table 4 shows the result of Multiple Regression. The coefficient value of all variables is statistically significant. The coefficient value of urbanization is 1.29, which shows that one unit increases in urbanization is associated with an increase in wages by 1.29% if all other factors remain constant. The coefficient value of population growth -2.68, which shows one unit increases in population growth rates is associated with a decrease in wages by 2.68 units in the long run if all other factors remain constant. The coefficient value of GDP growth is 0.25, which indicates that one-unit changes in GDP growth rate is associated with increase in wages by 25%. It means that relationship between GDP growth and wages is positive in the long run if all other factors remain constant. The coefficient value of per capita income is -0.32, which suggests that one unit increases in per capita income is associated with a decrease in wages by 32% in the long run. The value of t-statistic is 2 according to the rule of thumb which shows the coefficient is significant. The p-value t- value is 0.02 which is less than 0.05 shows that which shows that coefficient is significant at 5% level. The r-square value is 0.56 which shows that 56% variation in wages is due to combined change in independent

variables. The value of adjusted R^2 is always equal or smaller than R-squared. It measures how much good your model is for predicting. The adjusted R square value is 0.49 which shows the model is good because it shows about 49% variation in dependent variable due to combined change in the independent variables. The t-value is nearer to 2 shows that there is no serial correlation in the model. F- static value is smaller than 0.01 which shows that all variables of the model jointly significantly affect dependent variable at 1% significance level.

4.5 Serial Correlation LM test

Serial Correlation LM Test is a statistical tool, which is used to detect the autocorrelation in the model. It is particularly valuable where lagged values of the dependent variable are included as regressors. The estimated results of LM test are shown in Table 5.

Table 5

Serial Correlation LM test results

Null hypothesis: No serial correlation up to19 lags

F-statistic	18.25987	Prob. F (15,9)	0.0001
Obs*R-squared	28.07741	Prob. Chi-Square (15)	0.0211

The above result shows that the value of p is significant. Therefore, we accept the null hypothesis, which states that there is no serial correlation in the model.

5.6 Heteroscedasticity (ARCH) Test

It is a statistical tool to examine the volatility in time series in order to forecast future volatility. Table 6 contains estimated results of Heteroskedasticity test.

Table 6 Results of Heteroskedasticity Test: ARCH

F-statistic	0.813875	Prob.F(4,24)	0.5288
Obs*R-squared	3.463868	Prob.Chi-Square (4)	0.4834
Scaled explained SS	9.115703	Prob.Chi-Square (4)	0.0583

The above results show that the value of p is 0.5288 which is insignificant. In this context, we can accept null hypothesis which states that there is no heteroscedasticity in this model.

5.7 Granger Causality Test

The Granger causality test is used to check causality between variables. It shows unidirectional or bidirectional hypothetical association between variables (Granger, 1969). It can guide us to decide whether one time series is useful for forecasting another. The estimated results of Granger causality test are presented in table 7.

Table 7

Results of Granger Causality Test

Pairwise Granger Causality Tests Date: 05/19/24 Time: 19:00 Sample:154 Lags:2			
Null Hypothesis:	Obs	F-Statistic	Prob.
URBAN_POPULATION does not Granger Cause WAGES	27	2.56623	0.0996
WAGES do not Granger Cause URBNIZATN		5.41075	0.0123
GDPGWTH does not Granger Cause WAGES	30	0.18188	0.8348
WAGES do not Granger Cause GDPGWTH		0.80919	0.4565
POPGWTH does not Granger Cause WAGES	30	3.33964	0.0518

WAGES do not Granger Cause POPGWTH		1.64154	0.2139
PRCPTINCM does not Granger Cause WAGES	27	3.13572	0.0634
WAGES do not Granger Cause PRCPTINCM		2.34041	0.1198
GDPGWTH does not Granger Cause URBNIZATN	47	2.66069	0.0817
URBNIZATN does not Granger Cause GDPGWTH		0.77228	0.4684
POPGWTH does not Granger Cause URBNIZATN	47	0.70026	0.5022
URBNIZATN does not Granger Cause POPGWTH		7.96213	0.0012
PRCPTINCM does not Granger Cause URBNIZATIN	47	0.29519	0.7459
URBNIZATIN does not Granger Cause PRCPTINCM		2.31709	0.1110
POPGWTH does not Granger Cause GDPGWTH	51	1.58138	0.2167
GDPGWTH does not Granger Cause POPGWTH		0.15680	0.8553
PRCPTINCM does not Granger Cause GDPGWTH	47	0.60933	0.5485
GDPGWTH does not Granger Cause PRCPTINCM		2.32653	0.1101
PRCPTINCM does not Granger Cause POPGWTH	47	0.93982	0.3988

POPGWTH does not Granger Cause PRCPTINCM		1.15307	0.3255

Table 7 illustrates the result of Granger causality test. The first pair of variables shows that no granger causality between wages and urbanization. The second pair shows the bidirectional causality between GDP growth and wages. The third pair shows that there is unidirectional causality between wages and population growth. Fourth pair shows that there is unidirectional causality between wages and per capita income. The fifth pair shows that there is unidirectional causality between GDP growth and urbanization. The sixth pair shows that there is unidirectional causality between urbanization and population. There is bidirectional causality between urbanization and per capita income in seventh pair. Eighth pair shows that bidirectional causality between population growth and GDP growth. Ninth pair shows that bidirectional causality between GDP growth and per capita income. Tenth pair shows that there is bidirectional causality between per capita income and population growth.

5.8 Normality Histogram test

This test is commonly applied to check whether the sample is selected from normally distributed population. An informal approach to testing normality is to plot the data in a histogram to examine a normal probability curve. It is generally performed to verify whether the data involved in the research have a normal distribution. The estimated results are depicted in Figure 2.

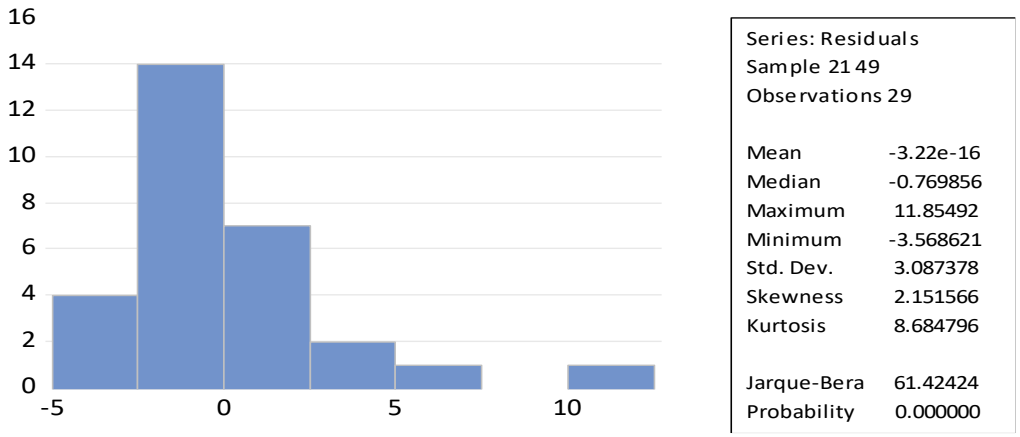

Fig 2 Normality Histogram

The result in this figure shows the average, median, minimum and maximum. The skewness value is = 2.151566, which exhibits the normal symmetry. The kurtosis value is 8.68 that predicts a wider shape with fatter tails, which are positive lapto kurtic value. Jarque Bera value is not very high, indicating the normality in series. The probability value is 0 which indicates normal distribution of data.

5.9 CUSUM Test

In statistics, the CUSUM (or cumulative sum control chart) is a sequential Analytical technique developed by Brown, Durbin and Evans in 1975 It is typically used for detecting stability of parameters during study period. A plot with a constant upper bound and lower bound for a specified significance level is used as a test for parameter stability. If the CUSUM statistic is beyond the outside of the bounds, we reject null hypothesis. The plot also provides additional information on the timing of the structural break. CUSUM charts are used to decide whether a process is in statistical control by detecting a shift in the process mean. Figure 3 shows the results of CUSUM Test.

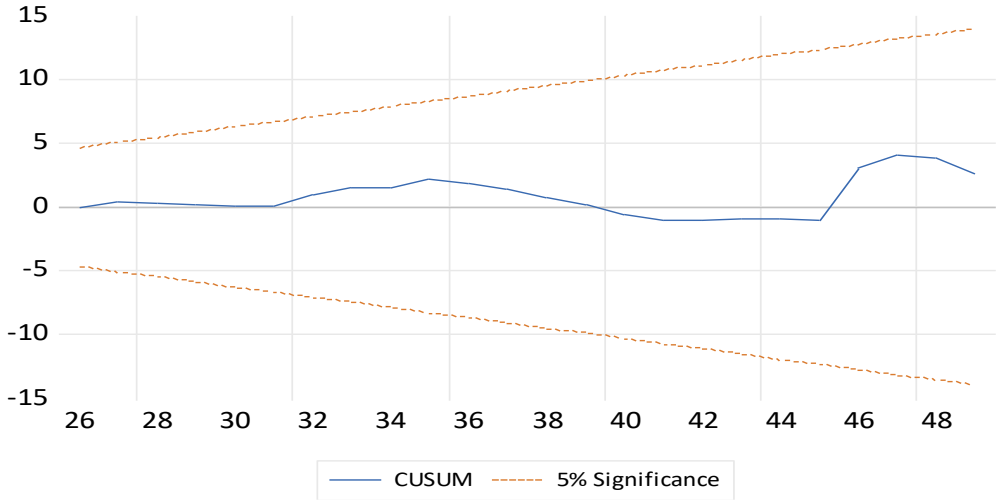

Fig 3 Results of CUSUM TEST

Fig 3 shows that the blue line does not intersect or touch the two red lines which are above and below the blue line, with no significant shift in 5% of significance level. It indicates that the model was stable during the study period.

5. Discussion

This study socioeconomic determinants of rural-urban migration, using 30-year time series data spanning 1992 to 2022 and applying econometric techniques such as descriptive statistics, correlation matrix, ADF test, Multiple regression and Granger causality test to determine relationship between variables in the long run. The findings of the study are briefly explained as under: -

The results of descriptives statistics show central tendency and dispersion of wages and other variables.

As per empirical results, wages have a mean of 38.35 and a standard deviation of 4.69, showing some variability around the mean whereas GDP

growth and urbanization are positively skewed while per capita income and population growth are negatively skewed. Wages are leptokurtic, suggesting a sharper peak that a normal distribution. In contrast, other variables are platykurtic, suggesting a flatter distribution. The Jarque-Bera test reveals that the data are normally distributed. The results of Correlation matrix reveal that wages are negatively correlated with population growth and positively correlated with urbanization. However, per capita income and GDP growth have weak correlations with wages. Urbanization is negatively correlated with population growth and positively correlated with wages. The results of ADF test demonstrates that all variables are stationary at the level, so we can use OLS method for further analysis. The dynamic regression analysis reveal that population growth negatively impacts wages while urbanization positively impacts wages. Per capita income has negative relationship with wages while GDP growth has positively association with wages. In this way, population growth and per capita income have negative impacts on wages while urbanization and GDP growth have positive impacts on wages in the long run. The model explains 56% variations in dependent variable (wages) on account of combined variation in all independent variables as the value of R-squared = 0.567598). The F-statistic suggests that the model is significant at the 1% level. The results of LM test show that there is no serial correlation among independent variables of the model. The results of ARCH test reveal that there is no heteroscedasticity in the model, suggesting that error term is homoscedastic. The Granger causality test demonstrates bidirectional and unidirectional causality between various pairs of variables. As per results, wages and urbanization exhibit no Granger causality while there is bidirectional causality between GDP growth and wages. Similarly, there is

bidirectional causality between per capita income and urbanization. The histogram of normality test shows that the data are normally distributed and the values of skewness and kurtosis confirm the symmetry and distribution shape. The results of CUSUM test reveal that there is no significant changes in the model and it was found to be stable during the study period.

These empirical results contribute to strengthening the understanding of the dynamic link between wages, urbanization, GDP growth, per capita income and population growth. The study provides deeper insights into how these variables interact and influence each other in the context of wage determination.

5.1 Policy Implications

The findings of this study can be used by policymakers to design interventions, considering positive impact of GDP growth and urbanization on wages. The understanding of the negative impacts of population growth and per capita income can facilitate in designing population control and urban planning policies. Moreover, the bidirectional causality between certain variables can provide valuable insights into taking evidence-based economic planning and allocation of resources to uplift vulnerable and poverty-hit regions in Pakistan.

5.2 Limitations

Despite valuable contribution, this study has certain limitation regarding sample size and specific period of study which may restrict to capture all possible variations and influence of external factors in Pakistan and also limit the generalization and applicability of the results in other countries. Additionally, the use of secondary data in the study may cause biases or inaccuracies in the viability of the analysis. The model just explains only 56% of the variance in wages, ignoring 44% variation, which indicates that other unobserved factors may also play a significant role in wage differentials.

5.3 Suggestions for Further Research

In the light of above limitations, it is suggested that sample size and period of study may be extended to validate the findings. More variables, such as technological advancement, education levels, and employment rates, could provide a more comprehensive analysis. The robustness of results can be checked by employing latest econometric models and techniques. The future studies can use primary data to examine the causes of migration by conducting interviews of different groups of migrants.

Data statement

The data that is used in the empirical analysis of this study will be made available on reasonable request.

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Declaration of Competing Interests

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