Quraishi, U. Ali, H. Iftikhar, M., and Iftikhar, N. (2022). Factors Affecting Household Access to Clean Water Supply in Residential Areas of Pakistan. *Bulletin of Business and Economics*, 11(2), 372-381. https://doi.org/10.5281/zenodo.7009921

FACTORS AFFECTING HOUSEHOLD ACCESS TO CLEAN WATER SUPPLY IN RESIDENTIAL AREAS OF PAKISTAN

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ABSTRACT

The present study used secondary data of PSLM to gather the information about household approaches to pure water because access to safe water is most important for the development of human demographic factors that influence the household approach to clean supply of water in poor developing areas of Pakistan. In Pakistan, the majority of households do not have access to safe drinking water. This study used a multivariate model to analyze and determine the factors that influence the household approach to improved water. The results of this study indicate that occupancy status, gender, dwelling type, and cost of paying for the water of households affect positively and higher significantly. The estimated coefficients of how much time spend to reach the main hub of water, and the area to reach the main point of water have positive coefficients and are statistically significant at the 1 percent level of confidence. The results of the study indicate that the. of rooms, make water safer to drink and who installed the water delivery system has positive coefficients and significant at the 1 percent level of confidence. The study also suggested important policy recommendations to improve the socioeconomic status of households' approach to a clean supply of water.

Keywords: Access to Clean Water Supply, Multivariate Model, Improve Socioeconomic Status
JEL Codes: Q53, C50, Z13

I. INTRODUCTION

Access to improved water is most important for public health because it is used for drinking, food production and use for domestic purposes (Akoteyon et al., 2019; Agbadi et al., 2019; Ali, 2018; Ali and Bibi, 2017; Rauf et al., 2015; Ali 2015;). According to the report of the world health organization (2021), approximately one to four people in low and middle income countries have lacked safe access to drinking water in their homes. Pakistan is located in North-West, South-Asia, and is the sixth highest populous country in the world. The Pakistan Social Living Standards Survey (PSLM) data indicate that 30 percent of households use the motor pump as the main source of drinking water. The provincial level comparison indicates that in Punjab 42 percent, Sindh 9 percent, Balochistan and Khyber Pakhtunkhwa 29 and 20 percent, respectively households are using motor pump water as the main source for drinking water. In Pakistan, 10 percent of households are using filtration plants as the main source of water. The provincial level comparison indicates that in Punjab 18 percent, Sindh 2 percent, Balochistan and Khyber Pakhtunkhwa both 0 percent of households are using filtration plants as the main source of drinking water. In Pakistan, 23 percent of households are using the hand pump. At the provincial level, 22 percent, 36 percent, 13 percent and 4 percent of households are using hand pumps as the main source of clean water supply in Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan respectively. In Pakistan, 22 percent of households are using tap water as the main source of water. At the provincial level, 13 percent, 35 percent, 30 percent and 32 percent of households are using tap water as the main source of drinking water supply in Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan respectively (PSLM, 2020).

Water is considered a basic human need to survive an active and healthy life, but millions of families and institutes in rural and urban areas of Pakistan have a poor approach to clean water resources. According to the present report of the world health organization indicates every year 2.1 billion communities do not have an approach to a clean supply of water and every year 3.4 million deaths occur due to a shortage of poor approaches to clean drinking water. So, a poor clean water supply brings a negative impact on women's and children's health.

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Many communities in rural and urban areas of Pakistan face severe health diseases with a shortage of clean water supply (WHO, 2021). With growing numbers of families and industrialization Pakistan faces a conflict of clean water supply so poor access to clean water supply is considered a big issue in developing areas of Pakistan. Not use of proper water management policies is considered a major problem in developing areas of Pakistan. To reduce the risk of water management Pakistan government has made the first national water supply, but due to lack of knowledge and not use of proper management policies current government does not pay proper attention to getting access to the clean or safe water supply. Climate change or environmental degradation creates many problems to get access to the clean water supply (Audi and Ali, 2017; Audi and Ali, 2017; Senturk and Ali, 2021; Arshad and Ali, 2016; Ashraf and Ali, 2018). A proper policy should be made to get an approach a clean supply of water in rural and urban areas of Pakistan (Akbar et al., 2021; Asif, 2013; Sajid and Ali, 2018; Ali et al., 2015). According to some nutritionists, household approaches to pure water reduces the risk of diseases, so, it maintains the good health of communities or families (Asif, 2013). Numerous factors that affect the household approach to the pure water in Pakistan are household head occupancy status, gender, household dwelling type, how much time spend to reach the main hub of water, the area to reach the main hub of water, cost pay for water, make the water safer and who installed the water delivery system. So, the present study will explore these factors that influence the household approaches to the pure water supply in developing areas of Pakistan.

II. LITERATURE REVIEW

This section deals with theoretical clarification and empirical literature. It discusses the concepts of household access to clean water supply, review of improved water supply, and their impacts. Lee and Schwab (2005) examined the scarcities in the distribution of water in poor developing countries. For data analysis, this study used secondary data. The objective of this study is to improve health and decreases the disease burden of the poor class. The study also showed that there is a strong correlation between human health and the approach to pure water. The further result suggested that scarcity of water resources is a big issue in low income countries because of the household's poor income approach to clean water. The above study also recommends modern policy tools to increase household access to clean water supply in developing countries. Boateng et al. (2013) analyzed the factors that influence household approaches to pure water in Ghana. The study also showed to improving household approaches to pure water is most important for the health of both rural and urban classes. This paper applied a multivariate regression model. For analysis of this study, STATA software has been used. The fundamental aim of this model is to examine the relationship between socio-economic factors that affect globally over one billion households that are without adequate access to the clean water supply. Further results showed that good quality water schemes have been made to increase the knowledge of households to know the quality of water that increase household approach to the pure water in urban and rural areas of Ghana.

Rauf et al. (2015) analyzed the factors that improve household approaches to clean water in southern Punjab Pakistan. Cross sectional data has been used in this study. For analysis of this study, data was collected from the integrated economic survey of households (2010-2011). Multinomial logistic regression has been used in this study. The final result of this study showed that household size, dwelling status, distance to reach the main hub of water, and no of living rooms have negative coefficients and statistically significant effects on household choice of drinking water. Further results showed that education, location of rural & urban respondents and gender have positive impacts on household approaches to the pure water in southern Punjab Pakistan. The above study also suggested important policy recommendations to improve the socioeconomic status of households to improve the drinking water choice of rural and urban households.

Ezenwaji et al. (2016) analyzed the household relationship between demand & supply of water in Nigeria. The present study is based upon primary data. For data, analysis information is collected from stratified simple random sampling. Two hundred households were selected for this technique. A multivariate model is used in this study. The final result of this study indicated that different other factors affect household access to safe water demand and supply in Enugu. This study recommends policy implications to improve the household approach to the pure water demand and supply to meet the development criteria of human wellbeing in 2030.

Muelenar *et al.* (2016) examined different factors that affect household health in Malawi due to the lack of clean water supply. This study is based upon secondary data. The sample size of this study is selected thirty households in the Malawi city Mzuzu. For data analysis, this study used Fisher's exact test. For this study following categories have been made. In the first category, nine households are divided into boiled water, ten households are divided into the water guard chlorination category and further nine households are divided into the tulip filter water category. The result of this study showed that household access to the clean water supply is affected by different socioeconomic factors. The final result of this study showed that filter water has good taste and quality as compared to boiled or water guard chlorination. So, this study suggested some educational planning and development policies to improve household approaches to clean water to reduce the chronic diseases of health.

Duran et al. (2017) analyzed the factors that affect scarce water quality and quantity in Mexican. Secondary data has been used in this study. This study showed that household access to clear water has positive impacts on human health and community development. Their study also found that access to good quality water is important for the sustainable development of industry and households. He found that the growing population day by day increases the problem of poor water supply in the Mexican economy. The final result of the study showed that global changes in temperature had negative impacts on the quantity and quantity of water supply on social wellbeing and economic prosperity. So, this argues some important policy implications that have a positive impact on the household approaches to clean water in Nigeria. The main motive of the study is to know the impacts of sustainable development goals on household approaches to safe water. Secondary data has been used in this study. Obtaining detailed data on household approach to the pure water annually from central bank report and national bureau of statistics of Nigeria. The final result of this study showed that household access to safe water supply in a poor segment of Nigeria had a negative impact on community development and health as compared to the rich segment of the Nigerian community. The empirical result of this study showed a positive relationship found between the household approaches to pure water and the sustainable development of that country. It is also emphasized that efforts are to be made to improve rural urban household approaches to safe water.

Angoua et al. (2018) analyzed different tools that improved household approaches to pure water and hygiene in African countries. Secondary data have been used for data collection. For analysis, this study used a multivariate logistic model. This study aims to check different factors that affect the household approach to clean water. The final result indicated that there is a positive correlation between education and household approach to pure water and a negative relationship between household size and religion but religious variables do not play important role in determining household approaches to clean water. In the end, this study suggests some policy recommendations to increase the socioeconomic status of poor income families in this way we increase the poor household approach to pure water and hygiene. He et al. (2018) analyzed the geographical heterogeneity and inequality of household approaches to pure water and hygiene in Nepal. This study used secondary data. To conduct this study data was collected from the Nepal socioeconomic and survey of health. Obtaining detailed data on households to improve water resources for this purpose Nepal has been divided into seven provinces and seventy-five districts. To measure inequalities Gini method was used in Nepal. This study indicated that provinces number four, six and seven are contained lower household size in the hilly region and province number two is contained a higher number of households. Further study showed that province number three contained more urbanized communities. The final result of this study showed that the inequality ratio is higher in poor low-income families and lower inequality ratio in a highly educated and small household size. So, this study suggested some important policy implications to improve the economic status of households in Nepal.

Agbadi et al. (2019) examined a multivariate analysis to improve the household approaches to pure water in Ghana. For analysis, this study used secondary data. To obtain information data collected from Demographic Household Surveys (2014) of Ghana. For purpose of this study, a robust Poisson method is used that increases Ghanaian household approaches to clean water and toilet facilities. The regression result of this study showed that household head and household demographic factors have significant effects on access to clean water supply and sanitation. Further results indicated that there is a positive correlation between household head education & especially house wife education, income and some variables like the size of household, distance from the main source of water and cost of water have negative impacts on the access to the improved water supply. Policymakers should implement such government and development policies that encourage households' socioeconomic status to increase access to clean water supply. Akoteyon (2019) analyzed the socioeconomic factors that affect household approaches to clean water in Nigeria. This study is based on primary data. For data analysis, this study used simple random sampling techniques. A proper questionnaire is prepared to gather information from 200 households. The final result of this study showed that household main access to water supply, salary ratio and assessment are the important features that influence the household approach to improve water resources in metropolis areas of Nigeria. This study recommends a policy implication to improve the health of middle income countries and their approach to the clean water supply. A proper investment in clear water supply infrastructure in poor income countries given a positive impact on the poor class health of Nigeria.

Gomes et al. (2019) examined demographic factors that influence the household approaches to pure water in poor and lower income countries. This study is based on panel data. For analysis of this study, data were collected from the World Health Organization and the united nation international children's education fund (2015). The objective of this study is to know the important factors that affect household approaches to clean water. Further also captured the socioeconomic variables that are net factor income from abroad, education level of women, agriculture, increasing number of population & poor control of administrative to improve household approaches to the clean water. The result of this study showed that there is a positive correlation between education, income and

household approaches to pure water. So, measuring socioeconomic factors to the improved water supply at the household level is a good measure to know this concept for the future research topic. Sharpe et al. (2019) examined product designs that support clean water, sanitation and energy services delivery in developing countries. The main reason behind this study is that number of households in poor countries are not well aware of development to improve services of clean water, sanitation & energy services delivery. For analysis of this study different design phases like need, planning, prototyping, field testing, development and demonstration have been used. The final result showed a positive relationship between income & cost, literacy rate and household approaches to pure water. The above study argues some important policy implications that have a positive impact on household approaches to clear water and hygiene.

Deshpande et al. (2020) examined inequalities of household approaches to safe water and hygiene in lower income families. Secondary data has been used in this study. For analysis of this study, data was collected from a health survey of households' socioeconomic resources. The objective of the study is to check different factors that influence household approaches to clean water in poor income countries and increase health problems. The result of this study indicated that is a positive correlation between literacy rate, income and household approaches to safe water. So, measuring inequalities of household access to safe water geographically is a good measure to know this concept. Especially when the resource available for this measure is limited. Simelane et al. (2020) examined different factors that affect the household approach to improving the clear water facilities in Eswatini. Secondary data has been used in this study. For analysis of this study, data was collected from the multilevel indicator of the cluster survey. Bivariate and multivariate regression analyses have been used to compare results between income, and household approaches to clean water resources. The results of this study showed that education has a positive relationship with household access to clean water supply and a negative relationship with household size. The final results of this study showed that poor income households suffered more health problems and access to the clean water supply as compared to higher income households. And poor families, children and adults are experiencing many diseases.

Tseng et al. (2020) analyzed the willingness of household approaches to improve the pure water & hygiene facilities in India. This study is based upon secondary data. The sample size of this study is selected thirty-two healthcare facilities in India. For data analysis, this study used the costing method technique. The result of this study showed that household access to the clean water supply is a widespread problem in global public health. Further results showed that improving infection prevention and controls in India had more cost to decrease the risk of severe diseases. This study recommended that to increase household access to clean water supply and prevent infectious diseases proper policies should be made to solve this problem in India. Oskam et al. (2021) examined socioeconomic factors that influence household approaches to pure water in Africa. Secondary data have been used to collect this information. Multinomial logistic models have been used to understand this concept. For data analysis, this study used predictors like household head & house wife education, employment status and gender. The final result of the study showed that household preferences to increase the approaches of pure water are mainly determined by household education, size and employment level. The summary of this literature provides a review of the household approach to the pure water supply. So, the present study will explore these factors that influence the household approaches to the pure water supply in developing areas of Pakistan.

III. DATA AND METHODOLOGY

III.I. DESCRIPTION OF THE VARIABLES

This study used secondary data from PSLM 2019-2020. The study examined the socio-economic variables that are affecting the household access to clean water resources in residential areas of Pakistan, such as household occupancy status, gender, household dwelling type, time to reach the main water source, distance to reach the main water source, cost pay for water, make water safer and who installed water delivery system of the household. In this study, our dependent variable is the main source of clean water for the household, such as the inside dwelling and outside dwelling for the main water source.

III.II. DATA SOURCE

The data of this study are obtained from Pakistan Social and Living Standards Measurement (PSLM) 2019-20 survey, collected by the Federal Bureau of Statistics, Pakistan. This survey provides the socio-economic factors such as household head occupancy status, gender, household dwelling type, time to reach the main water source, distance to reach the main water source, cost paid for water, make the water safer and who installed the water delivery system of the household. A sample of both rural and urban households was taken for analysis.

III.III. ECONOMETRIC MODEL

This study used the Multivariate regression model (MVRM) because the nature of this data is most suitable to use the multivariate regression method. The Stata software has been used for model estimation.

The general form of the multivariate regression model

$$Y_i = \sum_{n=1}^{k} B_n X_{in} + u$$

$$Y_i = B_1 X_{i1} + B_2 X_{i2} + B_3 X_{i3} + ...B_k X_{ik} + \mu$$

Now, the above equation in summation form

Where Yi = dependent variable

- Xi= independent variable
- μ= error term
- *i*= observation 1,……k

Table 1. Description of the variables used in the model

Variables	Description and measurement
Main source of clean water for the household (MWS)	Inside Dwelling 1= Piped water 2= Hand pump 3= Bore Hole (Motor Pump) /Tube Well 4= Closed well 5= Open well 6= Protected Spring 7= Un protected Spring Outside Dwelling 8= Piped Water/ Public Tap/ Standpipe 9= Hand pump 10= Motorized pumping / Tube well 11= Closed well 12= Open well 13= Protected Spring 14= Un Protected Spring 15= Pond/Canal / River / Stream 16= Bottled Water 17= Tanker /Truck/water bearer =18= Filtration Plant 19= Others (specify-----)
Independent variable	
Occupancy status	1= Owner occupied (not self-hired) 2= Owner occupied (self-hired) 3= On rent 4= Subsidized rent 5= Rent free
Gender	1= Male 2= Female 3= Jointly 4= Don't Know
Dwelling type	1= Independent house / compound 2= Apartment / flat 3= Part of the large unit 4= Part of a compound 5= Other(please specify)
Cost (CW)	Monthly pay for water in Pakistani rupees
Time to reach main water source (TMWS)	1= 1 to 15 min, 2= 16 to 30 min, 3= 31 to 45 min, 4= 46 to 60 min 5= 60 plus minute
Distance to reach main water source (DMWS)	1= 0 to 0.5 Km, 2= 0.5 to 1 Km, 3= 1 to 2 Km 4= 2.to 5 Km 5= 5 plus km
No. of Rooms	How many rooms are there in this residential building?
Make water safer to drink(MWSD)	1= Boil 2= Add bleach or chlorine/ tablet 3= Strain it with a cloth 4= Water filters (ceramic, sand and Composite etc.) 5 = Solar Disinfection 6= Let it stand and settle 7= Do not Know 8= Others (specify)
Who installed the water delivery system (IWDS)	1= Government (PHE, LG, District / Union/Village Council) 2= Community 3= Household itself 4= NGO, Private etc. 5= Don't know

Source: PSLM Survey 2019-20 Questionnaire

IV. EMPIRICAL RESULTS

This section presents the empirical results and their interpretation for various economic models. Sections 2 and 3 show the descriptive analysis of variables and socio-demographic information of households and the correlation matrix used in the empirical analysis. Section 4.3 presents the regression results of the Multivariate model.

IV. I. DESCRIPTIVE ANALYSIS AND CORRELATION

Tables 2. and 3. present the descriptive and correlation matrix of all the variables that are used in data estimation.

Table 2. Descriptive Analysis

Variable	Observation	Mean	Std. Dev.	Min	Max
MWS	160654	5.923	5.776	1	19
Occupancy status	160654	1.535	1.16	1	5
Gender	160654	1.183	0.613	1	4
Dwelling type	160654	1.441	0.901	1	5
Cost (**Rupees)**	160654	118.434	447.06	0	9800
TMWS **(Minutes)**	160654	1.168	0.544	1	5
DMWS**(Kilometre)**	160654	1.26	0.732	1	5
No. of rooms	160654	2.384	1.321	1	24
MWSD	160654	6.648	1.348	1	8
IWDS	160654	2.741	1.23	1	5

The mean value of the dependent variable MWS (y1= Inside Dwelling, y2= Outside Dwelling) is 5.923, with a standard deviation of 5.776 while the minimum value of one and the maximum value of nigh teen. The mean value of occupancy status is 1.535, while the minimum value is one and the maximum value is five. The mean value of gender of the household head is 1.183, while the minimum value is one and the maximum value is four. The true value of the dwelling type of household is 1.441, while the minimum value is one and the maximum value is five. The mean value of the cost is 118.434, while the minimum value is zero and the maximum value is 9800. Similarly, if we see the statistic of TMWS and DMWS the mean values are 1.168 and 1.26 respectively. While the minimum value of TMWS and DMWS both are 1, and the maximum values of both are 5. The mean value of no. of rooms is 2.384, while the minimum value is one and the maximum value is eight. Similarly, if we see the statistic of MWS and IWDS the mean values are 6.648 and 2.741 respectively. While the minimum value of MWDS and IWDS is 1, and the maximum values of both are 8 and 5 respectively.

Table 3. Correlation

Variables	**Y**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**
MWS (Y)	1.000									
Occupancy status (X1)	0.023	1.000								
Gender(X2)	0.031	0.125	1.000							
Dwelling type(X3)	0.009	0.101	0.117	1.000						
Cost (X4)	0.272	0.029	0.008	-0.029	1.000					
TMWS(X5)	0.427	-0.014	-0.012	-0.015	0.302	1.000				
DMWS(X6)	0.501	-0.008	0.005	-0.011	0.323	0.786	1.000			
No. of rooms(X7)	0.027	-0.121	0.017	-0.194	0.101	-0.016	0.007	1.000		
MWSD(X8)	0.076	-0.048	-0.003	0.012	-0.08	0.017	0.020	-0.04	1.000	
IWDS(X9)	0.388	-0.033	-0.004	0.017	0.161	0.241	0.233	-0.03	0.151	1.000

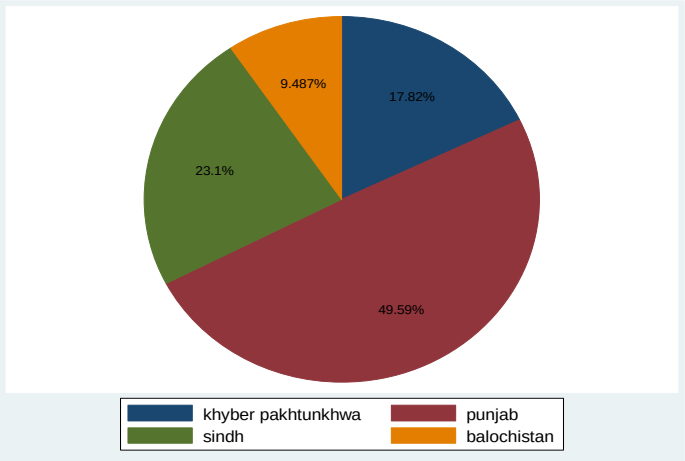
Table 3 indicates a correlation between MWS and MWS (y1= Inside Dwelling, y2= Outside Dwelling) and itself is always 1. The correlation between Y (the main source of drinking) and X1, X2, X3 and X4 are positive and show that one unit increases, the other unit increases indicating a linear correlation between the variables. The range of correlation coefficient from -1 (showing a case of negative perfect correlation) to +1 (perfect positive correlation) and 0 values indicate no correlation to all variables. The correlation between Y and X5, X6, X7, X8 and X9 shows that as one unit increases the other decreases.

IV. II. SOCIO-DEMOGRAPHIC INFORMATION OF HOUSEHOLDS

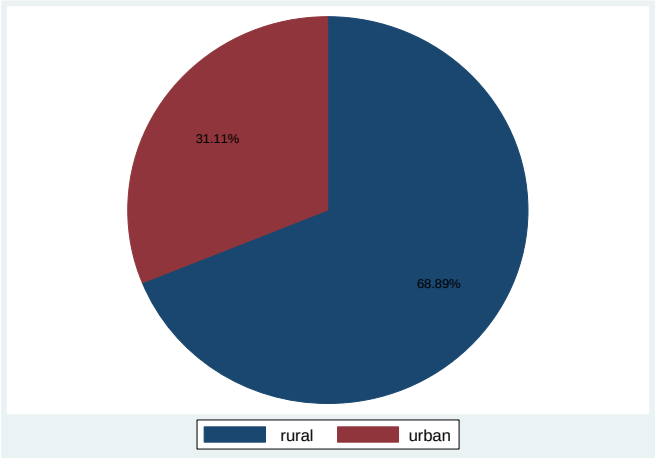
Fighter A indicates the demographic information of households. Punjab has the highest portion of the sample, which is 49.59 percent and Baluchistan has the lowest among the four provinces is 9.48 percent. While the 17.82 percent and 23.1 percent of respondents are taken from KPK and Sindh, respectively. Fighter B shows the region of households in Pakistan. Rural have the highest portion in the sample, which is 68.89 percent and urban

households head has the lowest which is 31.11 percent. Fighter C shows the gender of the household head in Pakistan. Male has the highest portion of the sample, which is 90.81 percent and the female head is 2.23 percent. While 4.79 percent and 2.17 percent of respondents are joint families and don't know, respectively. Fighter D indicates the occupancy status of households. Owner occupied (not self-hired) has the highest portion of the sample, which is 78.53 percent and subsidized rent has the lowest among the five occupancy statuses which is 0.87 percent. While the 4.86 percent, 7.29 and 8.46 percent of respondents' occupancy status are owner occupied (self-hired), rent free and on rent, respectively.

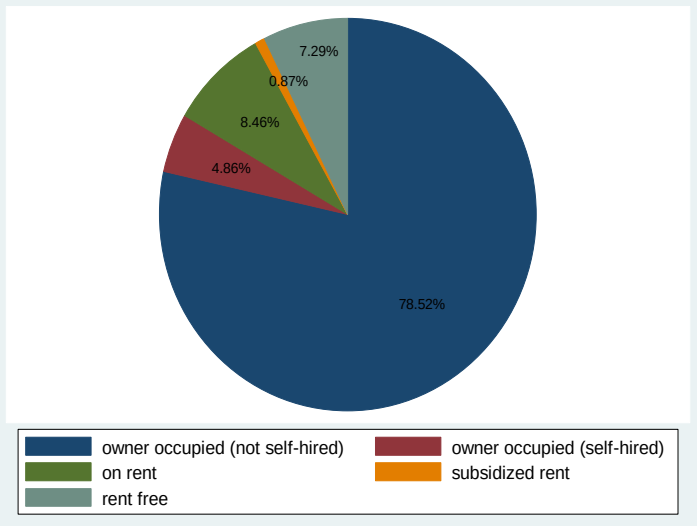
Fighter A: Demographic information of households



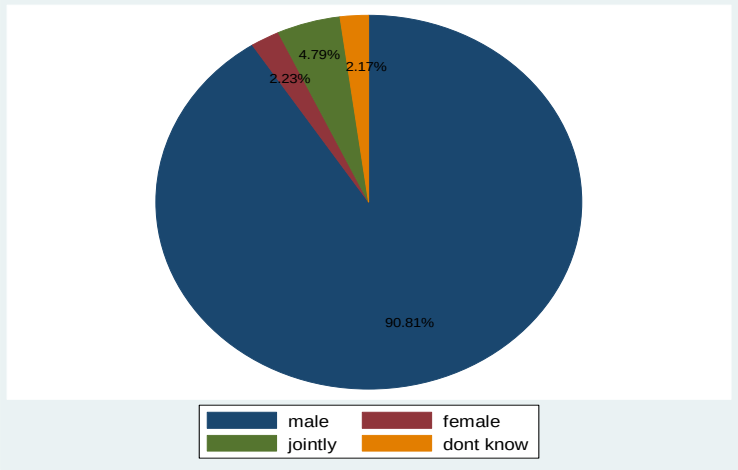
Fighter B: Region of households



Fighter C: Occupancy status of households



Fighter D: Gender of households



IV. III. MULTIVARIATE REGRESSION ANALYSIS

The socio-demographic factors of households are crucial in determining a household approach to a clean supply of water. Regression results for a household approach to improved water in residential areas of Pakistan are presented in Table 4.3

Table 4. Multivariate regression analysis

MWS(y1= Inside Dwelling, y2= Outside Dwelling)	**Coefficient**
Occupancy status	0.169***
	(0.010)
Gender	0.227***
	(0.019)
Dwelling type	0.073***
	(0.013)
Cost (**Rupees)**	0.001
	(0.000)
TMWS **(Minutes)**	0.388***
	(0.035)
DMWS**(Kilometre)**	2.982***
	(0.026)
No. of rooms	0.136***
	(0.009)
MWSD	0.155***
	(0.009)
IWDS	1.28***
	(0.010)
Constant	-3.925***
	(0.078)
Number of observation= 160654	
Parameter = 10	**RMSE** = 4.6886
R^2= 0.3412	**F-test** = 9243.508***

Note: * at ten percent level of significance, ** at five percent level of significance, *** at one percent level of significance; Figures in the bracket are Standard Errors

Table 4. presents the estimates of the coefficient of multivariate regression analysis. In this multivariate analysis, the explained variable (Y) is the household's main source of clean water supply (y1= Inside Dwelling, y2= Outside Dwelling) and independent variables are Household head occupancy status (X1), gender of the respondent (X2), dwelling type (X3), cost (monthly pay for water in Pakistani rupees) (X4), how much time spend to reach the main source of water (minutes) (X5), area to reach the main hub of water (kilometer) (X6), no. of rooms (X7), make water safer to drink (X8). And who installed the water delivery system (X9). To check whether the model is good and fitted, the following hypothesis has been made to estimate chi-square statistics. The null hypothesis is that the independent variables do not affect the dependent variable. An alternative hypothesis is that independent variables are affecting the dependent variable significantly. The root means squared error value 4.6886, parameter (10) and r-square value is 0.3412. The F-test value is 9243.508 and the probability value is 0.0000 which is highly significant at a 1% confidence level. So, we reject the null hypothesis, which means that the final model fits and is highly significant.

The occupancy status of the respondent has a positive coefficient and is significant at a level of 1 percent. Simply, we can say that a one unit increase in variable X1 (occupancy status), would expect a 0.169 increase in multivariate log-odds of being in the main source of clean water (MSW), given that all of the other variables are included in the model are held constant The gender and dwelling type of the household head has positive coefficient and significant at a level of 1 percent. One unit increase in variable X2 (gender) and X3(dwelling type) will bring 0.227 and 0.073 units respectively increase in multivariate log-odds of being in y order. The result is in line Akoteyon (2019) and Rauf et al. (2015). The cost of monthly pay water has a positive coefficient significant at a level of 1 percent. One unit increase in variable X4 (cost), would expect a 0.001 increase in the log-odds in MSW, given that all of the other variables included in the model stay constant and it is significant at 1 percent. Akoteyon (2019) reported the same result for household costs paying for preferring improved water. The time to reach the main market and distance to the main market both have positive coefficients and are significant at a level of 1 percent. One percent increase in X5 (Time to reach main water resource) and X6 (distance to a reached main water source will bring 0.388 units and 2.982 respectively increases in multivariate log-odds of being in the main source of drinking water. The result is in line with Akoteyon (2019). One unit increase in, No. of rooms has affected positive and it is statistically significant at 1 percent confidence. So, One unit increase in the variable X7 (no. of rooms), would expect a 0.136 increase in the log-odds of being in Y order. Rauf et al. (2015) reported the same result for household no. of rooms for access to the clean water supply. Households Make water safer and an installed water delivery system has a positive coefficient and is statistically significant at a level of 1 percent. One percent increase in X8 (make water safer) and X9 (installed water delivery system) will bring 0.155 units and 1.28 respectively increases in multivariate log-odds of being in the main source of drinking water. The result is in line Abubakar (2019) and Muelenar et al. (2016).

V. CONCLUSION

This study provides a theoretical framework to identify the different socioeconomic determinants that affect the household approach to increasing water resources in residential areas of Pakistan. The main finding of this study concludes that in Pakistan, households have different approaches to pure water, but adoption of the efficient water source depends on socioeconomic factors such as occupancy status, gender of household head, dwelling types of households, cost, time and distance to the main water source, no. of rooms, make water safer drink and who installed the water delivery system. This study concluded that when the occupancy status of household head increase they prefer more use of improved water. In our study of gender of the household, the head has positive coefficients and it indicates that male heads prefer improved water because it saves more time and leisure for the household. Dwelling type and cost have positive because when the cost of paying for water increases, the household prefers to install a motor pump or tube well. Time and distance to reach the main water source market have positive coefficients and it indicates that households with more time and distance are more suitable to install motor pumps. A number of the rooms indicates that families with larger no. of living rooms are more preferred to install motor pumps or tube well because they can afford a better source of water. This study concluded that making water safer to drink and who installed the water delivery system has a positive coefficient and indicate that household more prefer to use improved water source.

REFERENCES

Abubakar, I. R. (2019). Factors influencing household access to drinking water in Nigeria. *Utilities Policy*, *58*, 40-51.

Agbadi, P., Darkwah, E., & Kenney, P. L. (2019). A multilevel analysis of regressors of access to improved drinking water and sanitation facilities in Ghana. *Journal of environmental and public health*, *2019*.

Akbar, M., Khan, S. A., Dilawar, S., & Hassan, M. T. (2021). Water Crisis in Pakistan: Prospects and Implications. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *18*(1), 4884-4892.

Akoteyon, I. S. (2019). Factors affecting household's access to water supply in varied income residential areas in parts of Lagos metropolis. *Bulletin of Geography. Socio-economic Series*, *43*(43), 7-24.

Ali, A. (2015). *The impact of macroeconomic instability on social progress: an empirical analysis of Pakistan*. (Doctoral dissertation, National College of Business Administration & Economics Lahore).

Ali, A. (2018). Issue of Income Inequality Under the Perceptive of Macroeconomic Instability: An Empirical Analysis of Pakistan. *Pakistan Economic and Social Review*, 56(1), 121-155.

Ali, A. and Bibi, C. (2017). Determinants of Social Progress and its Scenarios under the role of Macroeconomic Instability: Empirics from Pakistan. *Pakistan Economic and Social Review* 55 (2), 505-540.

Ali, A., Mujahid, N., Rashid, Y., & Shahbaz, M. (2015). Human capital outflow and economic misery: Fresh evidence for Pakistan. *Social Indicators Research*, *124*(3), 747-764.

Angoua, E. L. E., Dongo, K., Templeton, M. R., Zinsstag, J., & Bonfoh, B. (2018). Barriers to access improved water and sanitation in poor peri-urban settlements of Abidjan, Côte d'Ivoire. *PloS one*, *13*(8), e0202928.

Arshad, S., & Ali, A. (2016). Trade-off between Inflation, Interest and Unemployment Rate of Pakistan: Revisited. *Bulletin of Business and Economics (BBE)*, *5*(4), 193-209.

Ashraf, I., & Ali, A. (2018). Socio-Economic Well-Being and Women Status in Pakistan: An Empirical Analysis. *Bulletin of Business and Economics (BBE)*, 7(2), 46-58.

Asif, M. (2013). Climatic change, irrigation water crisis and food security in Pakistan.

Audi, M & Ali, A. (2017). Socio-Economic Status and Life Expectancy in Lebanon: An Empirical Analysis. *Archives of Business Research*, 5(11), 159-170

Audi, M. & Ali, A. (2017). Environmental Degradation, Energy consumption, Population Density and Economic Development in Lebanon: A time series Analysis (1971-2014). *Journal of International Finance and Economics*, 17(1), 7-20.

Boateng, D., Tia-Adjei, M., & Adams, E. A. (2013). Determinants of household water quality in the Tamale Metropolis, Ghana. *Journal of Environment and Earth Science*, *3*(7), 70-77.

Deshpande, A., Miller-Petrie, M. K., Lindstedt, P. A., Baumann, M. M., Johnson, K. B., Blacker, B. F., ... & Darwish, A. H. (2020). Mapping geographical inequalities in access to drinking water and sanitation facilities in low-income and middle-income countries, 2000–17. *The Lancet Global Health*, *8*(9), e1162-e1185.

Duran-Encalada, J. A., Paucar-Caceres, A., Bandala, E. R., & Wright, G. H. (2017). The impact of global climate change on water quantity and quality: A system dynamics approach to the US–Mexican transborder region. *European Journal of Operational Research*, *256*(2), 567-581.

Ezenwaji, E. E., Eduputa, B. M., & Okoye, C. O. (2016). Investigations into the residential water demand and supply in Enugu metropolitan area, Nigeria. *American Journal of Water Resources*, *4*(1), 22-29.

Gomez, M., Perdiguero, J., & Sanz, A. (2019). Socioeconomic factors affecting water access in rural areas of low and middle income countries. *Water*, *11*(2), 202.

He, W. J., Lai, Y. S., Karmacharya, B. M., Dai, B. F., Hao, Y. T., & Xu, D. R. (2018). Geographical heterogeneity and inequality of access to improved drinking water supply and sanitation in Nepal. *International journal for equity in health*, *17*(1), 1-14.

Lee, E. J., & Schwab, K. J. (2005). Deficiencies in drinking water distribution systems in developing countries. *Journal of water and health*, *3*(2), 109-127.

Muelenaer, P. A., Redican, K. J., Marmagas, S. W., & Holm, R. H. (2016). Understanding and improving water sanitation practices to improve health outcomes in Malawi. *The Lancet Global Health*, *4*, S27.

Oskam, M. J., Pavlova, M., Hongoro, C., & Groot, W. (2021). Socio-economic inequalities in access to drinking water among inhabitants of informal settlements in South Africa. *International Journal of Environmental Research and Public Health*, *18*(19), 10528.

PSLM. (2020). *Pakistan Social and Living Standards Measurement Survey*. Pakistan Bureau of Statistics Government of Pakistan.

Rauf, S., Bakhsh, K., Hassan, S., Nadeem, A. M., & Kamran, M. A. (2015). Determinants of a household's choice of drinking water source in Punjab, Pakistan. *Polish Journal of Environmental Studies*, *24*(6), 2751-2754.

Sajid, A. & Ali, A. (2018). Inclusive Growth and Macroeconomic Situations in South Asia: An Empirical Analysis. *Bulletin of Business and Economics (BBE)*, 7(3), 97-109.

Şentürk, İ., & Ali, A. (2021). Socioeconomic Determinants of Gender Specific Life Expectancy in Turkey: A Time Series Analysis. *Sosyoekonomi*, 29(49), 85-111.

Sharpe, T., Muragijimana, C., & Thomas, E. (2019). Product design supporting improved water, sanitation, and energy services delivery in low-income settings. *Sustainability*, *11*(23), 6717.

Simelane, M. S., Shongwe, M. C., Vermaak, K., & Zwane, E. (2020). Determinants of households' access to improved drinking water sources: a secondary analysis of Eswatini 2010 and 2014 multiple indicator cluster surveys. *Advances in Public Health*, *2020*.

Tseng, K. K., Joshi, J., Shrivastava, S., & Klein, E. (2020). Estimating the cost of interventions to improve water, sanitation and hygiene in healthcare facilities across India. *BMJ global health*, *5*(12), e003045.

WHO. (2021). *progress on household drinking water, sanitation and hygiene 2000-2020*. World Health Organization.