Factors that affect residential demand for electricity economics essay

In this chapter the methodology of the research is going to be discussed. The chapter is going to focus on the framework of analysis, in which the variables are discussed in detail. In this chapter the research hypotheses are also stated. The elements of research design will focus on the type of research, how it will be carried or what type of data will be used and it forms an integral part of the chapter. This chapter will pay a special attention to data used in the research; the chapter discusses the source of data and any limitations regarding the collection or use of data. The chapter ends with a discussion of how the data will be used to make regressions and how the regression will be interpreted.

Framework of Analysis

The paper attempts to study the main factors that affect residential demand for electricity; this is to try and balance the supply of electricity with the fast growing demand in the economy. The electricity crisis is a growing concern for the country. This is reflected in the theoretical framework. The dependant variable considered is the consumption of electricity in the residential sector. The demand of electricity in this sector, as shown by the literature, is dependent on factors such as price of electricity, income of people, price of substitutes, price of electrical appliance and the number of electricity connections. Here it is important to note that this research uses consumption of electricity and not demand of electricity. In Pakistan there are other factors which affect the consumption of electricity such as worker remittances from abroad and generation of electricity; as there is a shortage of electricity one can only consume what is made available by the grid.

One of the most important factors effecting electricity consumption like most other goods is its price. Hence this study will be trying to analyze the impact of any price change on consumption of electricity. It is proposed that the price elasticity of demand for residential electricity is found otherwise a simple linear relationship is also acceptable. This will help us anticipate the responsiveness of domestic demand for electricity to a change in price; helping us make decisions on any policy regarding price changes.

The impact of income on electricity consumption is of paramount importance. The importance of this variable lies in its ability to predict future demand of electricity. It is very easy to find forecasts for national income of countries hence income elasticity of demand is going to help us estimate future demand for electricity. Again it would be preferred if the income elasticity of demand is calculated, whereas if this is not possible only a linear relation too is quite useful.

Then we have important variables such as price of natural gas and price of electrical appliances. The significance of these variables derives from the fact that natural gas is a substitute to electricity and appliances are complimentary goods. So the demand for natural gas or electrical appliances will affect the consumption of electricity directly. The higher the demand for electrical appliances, the higher will be the demand for electricity. A higher demand for natural gas will result in a lower demand for electricity. Knowing price has an inverse relation with normal good’s demand the price of natural gas has been hypothesized to have a positive relation with demand of electricity. The price of electrical appliances however, is going to have a negative impact on electricity consumption.

Over the years the government has been trying to improve infrastructure all across the country, this has resulted in the electrification of many villages. A growing population in the cities means new houses being built and electricity connections demanded. The growing number of electricity connections is going to increase the household consumption of electricity. Hence the effect of growing electricity connections is included in our study, through the variable electricity connections.

The generation of electricity as already discussed will be an important variable in determining consumption of electricity. This is because no matter how high is the demand for electricity one can only consume if electricity is supplied. Also the worker remittances form a big portion of income for people in Pakistan. This raises the living standards for the beneficiaries and increases the demand of all goods including electrical appliances and electricity.

Statement of research hypotheses

H0: Increase in electricity tariffs has insignificant relation with domestic demand of electricity.

HA: Increase in electricity tariffs has significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

H0: Increase in price of natural gas has an insignificant relation with domestic demand of electricity.

HA: Increase in price of natural gas has significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

H0: Increase in electricity connections has insignificant relation with domestic demand of electricity.

HA: Increase in electricity connections has significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

H0: Increase in Per-Capita income has insignificant relation with domestic demand of electricity.

HA: Increase in Per-Capita income has significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

H0: Increase in appliance ownership has insignificant relation with domestic demand of electricity.

HA: Increase in appliance ownership has significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

H0: Increase in Worker Remittances has insignificant relation with domestic demand of electricity.

HA: Increase in Worker Remittances has a significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

H0: Changes in Electricity Generation has insignificant relation with domestic demand of electricity.

HA: Changes in Electricity Generation has a significant relation with domestic demand of electricity.

H0: B0 = 0

HA: B0 =/= 0

Elements of Research Design

3. 3. 1 Type of research

My research is applied research as questions are asked about a specific problem; that is controlling electricity consumption by households. The research is done with the attention to apply the results of the findings to solve the electricity crisis.

3. 3. 2 Study Settings

The research is conducted under non-contrived settings.

3. 3. 3 Nature of Data

The data used in this research is going to be of time series in nature. The data will be gathered from WDI and government and private reports. The data used will be gathered for the latest 20 year that is available.

3. 3. 4 Unit of Analysis

The unit of analysis used for the purpose of the study is sectoral in nature and is about Pakistan

3. 3. 5 Reference Period

The reference period preferably is 1980 to 2009. It is this time period when Pakistan has started facing chronic problems of electricity shortage.

Data Collection Preferences

The nature of data to be used was secondary; hence the data could have been calculated through numerous sources. Care has been taken that the data is collected by the best source possible and that it is as consistent as possible.

To collect data for the dependant variable, the consumption of electricity by household sector, the Economic Survey of Pakistan has been chosen. The data could have been collected from sources like WAPDA’s data bases and from the world development index (WDI). The data found in WDI was not separated into sectors, hence this option was ruled out.

The data for price of electricity was available in different sources like the Private Power and Infrastructure Board (PPIB) website, the economic survey of Pakistan and electricity bills. The problem with electricity bills was that they were monthly bills and had to be accumulated and averaged to find yearly values. Also there were inconsistencies regarding the tariff structure of Pakistan as already discussed. Whereas the data provided in Economic Survey of Pakistan is in the form of indexes and hence consistent. So it will be useful to use Economic Survey of Pakistan values.

Similarly the data for natural gas prices was easily available from OGRA reports, from Sui Northern Gas Pipelines Limited (SNGPL) prices, and from the Economic Survey of Pakistan. Natural gas before the year 2000 was stated in volume consumed, after that the energy equivalent is used as the unit for pricing Natural Gas. Again the Economic Survey of Pakistan is the best and most consistent source with data stated in price indexes.

The data for variables like electricity generated, worker remittances and per capita income WDI, is preferred over other sources this is because of its world wide appeal as a reasonably correct source of data. Also because in other sources although data is easily available on these variables but it is either not complete or has the problem of being inconsistent. For example

the data on electricity generated was not available as a total value but a lot of summation is required to get to the final total generation value. Also data is not available in other sources from as early as 1980.

Data Collection and related procedures

The data on most variables was easily available from 1980 to 2009, also this time frame easily covered two eras of energy crisis the early 1990s and the late 2000s. The data for the dependant variable, the consumption of electricity by household sector, was collected from the source that was preferred, that is the Economic Survey of Pakistan. This data was in the form of 1000s GWh. To use it the data was converted to GWh by simply multiplying by 1000. The only problem was that the data was only available from 1988. The values for first eight years had to be interpolated. This was done by using Minitab; the mathematical form used to interpolate data was T6. This was found to be the best fit for existing values hence the predicted values were generated using this approach.

Electricity connections were again collected from the Economic Survey of Pakistan. This is because this data was not available in WDI and there was a minimum data available in WAPDAs sources.

The price of electricity and the price of natural gas both have been collected from the Economic Survey of Pakistan. These values have been collected in the form of indexes as there were inconsistencies involved in actual price data. These inconsistencies included changing of scientific unit in case of natural gas and changing of tariff tiers in case of electricity.

The data on complimentary goods that is electrical appliances was searched thoroughly. While searching, the criteria set for any option was it should not have changed much in the last 30 years also the data for as long a time period as possible is available. Price of 60 watt light bulb was chosen as its technology has not changed by much and its prices were known from 1986 onwards. The rest of the prices were interpolated using the function of T10.

Both per capita income and worker remittances have been taken from WDI. This source had a complete record of data over these years hence there was no need to find any other source for the data of these variables.

Statement of Analytical Approach and Methodology