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Article

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International Journal of Energy Economics and Policy

Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEEP)

Reference: Lestari, Setyani Dwi/Indrabudiman, Amir et. al. (2019). Estimation with macroeconomic variables in long-term elasticity of gasoline consumption. In: International Journal of Energy Economics and Policy 9 (1), S. 326 - 329.
doi:10.32479/ijEEP.7308.

This Version is available at:

<http://hdl.handle.net/11159/2737>

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Estimation with Macroeconomic Variables in Long-Term Elasticity of Gasoline Consumption

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Received: 19 September 2018

Accepted: 28 November 2018

DOI: <https://doi.org/10.32479/ijeeep.7308>

ABSTRACT

In this study attempted to calculate the stationarity value of the baseline data in proposing approximate parameters, for a regression equation which is an estimation of time-series data from gasoline. The function of stationary data in the time series model is crucial, to propose a long-term estimate, so that a study can show the time variable used, can explain the process of cointegration analysis among the variables being carried out research. This research uses model building from Baltagi and Griffin (1983), with cointegration analysis technique for variable data of gasoline and other consumption during 1960–2017 period in U.S. From the research that has been carried out shows that the value of gasoline consumption and income per community in the U.S during the year 1960–2017 mutual cointegration in the long term. There is a significant relationship among the 4 variables in the research on long-term time scale. Thus, this study can explain how the relationship between economic variables and the level of gasoline consumption in U.S. Country during the period of research data. The results of this study support previous research conducted by Baltagi and Griffin (1983), but there are differences in the use of data, if in this study using time series data, in Baltagi and Griffin study using time series data from several countries.

Keywords: Gasoline Demand, Price Elasticity, Regression Analysis

JEL Classifications: D12, C14, Q41

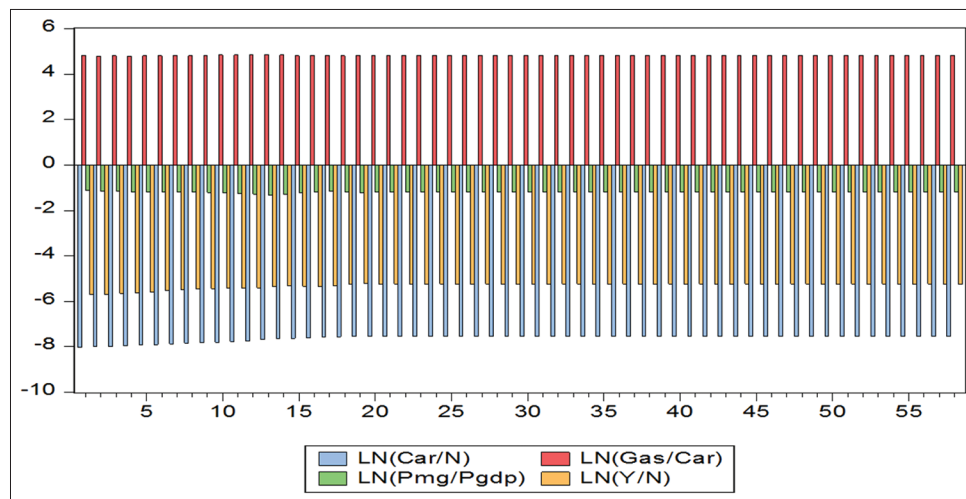
1. INTRODUCTION

In many studies, among others (Granger and Newbold, 1974; Granger and Weiss, 1983) specializes in the discussion of the use of data in research that has a time series. In their study also discussed about the function and nature of the stationary test, it is critical in the analysis of the final data. If in a study or study there are several variables that will be analyzed, then the data to be analyzed has and has a tendency will generally move in the same direction. the function of data quality is very decisive. Besides, there are advantages if the data to be in the analysis there is a correlation relationship, in addition to the test data on the stationary already qualified. It can be concluded that, for a data that has met the test stationary, then the correlation between variables to be analyzed the better. They also argue that, a data has a stationary series will be more dominantly deterministic. In the analysis of data in terms

of stationary difference, which must be a distinction of data to be analyzed with stationary test model. And there is a certainty if a data follows a stationary series, then the data may be cointegration, as will be done testing of the current study by the author. A data that has passed the stationary test for a study, then the data can be said to have been almost valid.

Turning to the model variables that will be in carefully, with the form and format of data analysis that has been described earlier, this study raised the theme of fuels and some economic variables. In a study (Bentzen, 1994; Hsing, 1990; Dahl and Sterner, 1991) reviewing how the problem of using transportation equipment in use continues to increase in the world and particularly in some countries, it becomes the main source and deals with the problem of oil demand, especially gasoline in the State in intent. The emergence of various concerns related to energy issues,

Figure 1: Research data



Source: Author data proceed

climate change, environmental changes and price changes that can lead to a huge gap in people's lives. With the emergence of these concerns, making the need for policy and management in managing gasoline in many countries, not least in Indonesia and developed countries such as U.S. Various empirical modalities are introduced in their studies and various data analysis techniques are used, to derive definite estimates, in accordance with the proposed model and aggregate. The following authors present a description of the research data in this study, during the period 1960–2017 as presented in the Figure 1.

In the time scale of a study, the short-term, long-term component model, and the gas balance and elasticity model, has been extensively reviewed in some literatures. As (Bentzen, 1994; Dahl and Sterner, 1991; Dahl, 1979; Alves and Bueno, 2003; Nicol, 2003; Kahn, 2000; Kayser, 2000) reviews how petrol demand, gasoline elasticity in a country and several countries, becomes a thorough review of the study of models and proposals of a demand and elasticity of gasoline. If in the study, some of the research they did, carried out during the data period 1960 and until the 1990s. Despite structural and behavioral changes in the 1970s and 1980s relating to prices and gasoline markets in some countries, including the United States. Some analyzes argue that implementation of implementation programs related to average economic growth for fuel and changes in land use patterns make growth rates in some countries have double income, especially for households. The per capita income value in the projection increases along with the decline in the availability of automotive mode that is used as a means of transportation. Data analysis in their research, showing changes to the price of gasoline in some countries, including in U.S.

Certainly, many researchers have investigated petrol-related in some countries. Call it (Nicol, 2003; Ramanathan, 1999; Kahn, 2000; Kayser, 2011) review will elasticity, demand and comparative as well as modeling for gasoline which is considered appropriate and appropriate to be made a benchmark analysis. Such as the problem of analysis of household demand for gasoline,

household investigation of gasoline demand, and several other studies using time series data and panel data. From some of their studies there is little to say about direct comparison of gasoline demand, gasoline elasticity and gasoline price equilibrium in some countries, be it on a long-term and short-term scale. Gasoline price elasticity models and gasoline demand still dominate several studies. But the time data for the period they do, has been able to reflect the design of an experimental research proposal.

For other discussions, such as empirical model specifications and variations of data types in some studies (Kayser, 2000; Espey, 1998; Schmalensee and Stoker, 1999; Eltony and Almutairi, 1995) reviewed empirically. The use of models and data sets is consistently analyzed for several periods. For the research they have done, there is an average value of gasoline consumption per capita and income data per capita community in the country in doing research. The amount of demand and elasticity of gasoline is estimated to range from -0.030 and -0.070 . Other values of elasticity estimates on short-term time scales ranged in values of 0.20 and 0.70 . And already on make sure the results of these studies are significant. Extremely complicated econometric modeling techniques are used to obtain maximum study results. The results of their studies vary, in the long run and in the short term. However, still the model of Baltagi and Griffin (1983) is still an option to choose which data and which variables will be in use. The results of their studies and research are considered consistent with the existing literature.

In this study the authors conclude that there is a long-term relationship between gasoline consumption, gasoline prices and per capita levels over the period of research data. For the long term the community is very responsive if there is an increase in the price of gasoline. In this study using cointegration test to see the relation between component of consumption variable, price and per capita of population in U.S. Hopefully the proposed model in this study can be used as an analytical tool for policy implications and can be used as an analytical tool for gasoline consumption, especially for U.S. Country

2. MODEL BUILDING AND RESEARCH DATA

2.1. Model Building

In this study model development is based on Baltagi and Griffin (1983), modification with time series data. So if created the form of equation that will appear as follows:

$$CG_t = \beta_0 + \beta_Y PI_t + \beta_P GP_t + \beta_P SC_t + \epsilon_t$$

Where CG_t is the consumption of gasoline for time t , PI_t real income per capita for time t , GP_t real price of gasoline for time t and SC_t car stock per capita for time t . For CG_t , PI_t , GP_t , and SC_t refer to the respective logarithms $\ln(cgt)$, $\ln(pit)$, $\ln(gpt)$, $\ln(sct)$ and ϵ_t are residual values.

We assume that G , Y and P are generally all stationary and $I(1)$ series, the approximate parameters will not be false only if the variables have at least one stable long-term relationship and their combination does not move for a certain set of parameters. If there is cointegration on that combination, ϵ_t also becomes stationary. Therefore, the test is used to test whether the three variables are indeed cointegration is to test whether ϵ_t is stationary. If the remaining ϵ_t in Eq. (2) does not move, then the long-term relationship can be determined from the equation parameter.

2.2. Research Data

The author conducted this study using Logarithm of motor gasoline consumption per auto, $\ln cpercap$: Logarithm of real per capita income, $\ln realgaspr$: Logarithm of real motor gasoline price, $\ln carpercap$: Logarithm of the stock of cars per capita of US State for the year ended from 1960–2017. The following data analysis by using descriptive statistics.

Total consumption of gasoline in use, is the number calculated from GDP in addition to the value of imports. Table 1 shows the average gasoline consumption for each year, based on per capita and real prices during the period 1960–2017. This can make an average estimate of the elasticity and demand for gasoline for each period, in much as the controlled value of the price of gasoline is difficult to predict.

3. RESULTS AND DISCUSSION RESEARCH

From this study, we look at how long-term relationships among the variables are, especially those relating to the consumption of gasoline with per-capita population in U.S during the period 1960–2017. The possibility of price elasticity and changes in consumption may occur in the driving behavior of people in U.S. Here we look at the results of the analysis by using cointegration model to answer the problems of this study.

From Tables 2 and 3 presented the relationship between gasoline price, per capita and gasoline consumption and car stock in U.S. country. The drivers' responses to gasoline prices, and per capita are mutually supportive and mutually cointegrated in the long run, thus there is a positive relationship between gasoline prices, per capita, gasoline consumption and the amount of remaining car stocks. If the fuel efficiency process by drivers can be improved, then this will have an impact on the consumption of gasoline in the community. So per capita that initially in use as gasoline consumption can be diverted to saving or other consumption.

Because people in U.S still depend much on cars, as a means of transportation, the distance of vehicle travel in value continues to increase and this affects the price of gasoline. Various other estimates, because the people in U.S more are living in the suburbs, and every day working in the city makes travel mileage which

Table 1: Result for statistic descriptive data

| Model | LN_CAR_N | LN_GAS_CAR | LN_PMG_PGDP | LN_Y_N |
|--------------------|-----------|------------|-------------|-----------|
| Mean | -7.620313 | 4.816980 | -1.202416 | -5.303698 |
| Median | -7.541937 | 4.815980 | -1.200011 | -5.233023 |
| Maximum | -7.536176 | 4.860286 | -1.121115 | -5.221232 |
| Minimum | -8.019458 | 4.787895 | -1.331169 | -5.698374 |
| Standard deviation | 0.145194 | 0.012395 | 0.029613 | 0.131462 |
| Skewness | -1.634987 | 1.434235 | -1.732267 | -1.817434 |
| Kurtosis | 4.158298 | 6.671089 | 10.29298 | 5.117848 |
| Jarque-Bera | 29.08311 | 52.45378 | 157.5437 | 42.76906 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| Sum | -441.9782 | 279.3848 | -69.74014 | -307.6145 |
| Sum Sq. Dev. | 1.201641 | 0.008758 | 0.049986 | 0.985083 |
| Observations | 58 | 58 | 58 | 58 |

Source: Data proceed

Table 2: Result for cointegration lags 1 1

| Variable | LN_CAR_N | LN_GAS_CAR | LN_PMG | LN_Y_N |
|------------------|------------|------------|----------------|---------|
| Hypothesized | Trace | | 0.05 | |
| Number of CE (s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None* | 0.932419 | 287.7323 | 47.85613 | 0.0001 |
| At most 1* | 0.719874 | 136.8445 | 29.79707 | 0.0001 |
| At most 2* | 0.533674 | 65.58362 | 15.49471 | 0.0000 |
| At most 3* | 0.335197 | 22.86286 | 3.841466 | 0.0000 |

Trace test indicates 4 cointegrating eqn (s) at the 0.05 level. *denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) P values. Source: Proceed author with EViews

Table 3: Result for cointegration lags 1 2

| Variable | LN_CAR_N | LN_GAS_CAR | LN_PMG_PGDP | LN_Y_N |
|------------------|------------|------------|----------------|---------|
| Hypothesized | | Trace | 0.05 | |
| Number of CE (s) | Eigenvalue | Statistic | Critical value | Prob.** |
| None* | 0.927008 | 316.6388 | 47.85613 | 0.0001 |
| At most 1* | 0.785091 | 172.6816 | 29.79707 | 0.0001 |
| At most 2* | 0.628318 | 88.11682 | 15.49471 | 0.0000 |
| At most 3* | 0.457956 | 33.68241 | 3.841466 | 0.0000 |

Trace test indicates 4 cointegrating eqn (s) at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) P values. Source: proceed author with EVIEWS

causes the consumption of gasoline continues to increase and reduce per capita society for other consumption process.

In addition to the analysis, it is also clear that the increase in vehicles per each household, as per-capita income increases. There is a tendency to switch to more fuel-efficient vehicles, because the price of gasoline goes up causing price elasticity to become non-permanent.

4. CONCLUSION

From the studies that have been done, using the average data per capita, the consumption of gasoline, the price of gasoline and the number of car stocks, make the relationship between variables in the intention of mutual cointegration in the long term. But there is no possibility in the short run, there is a process of elasticity, especially regarding price.

In general, the result of this study consistently and significantly supports several empirical models in other studies. With the advent of this study, the calculation framework for cointegration relationships between consuming gasoline, gasoline prices, car stocks and per capita income using series time over the period 1960–2017, becomes valid.

It should be noted that the authors in this study did not see and use the data stationary function before the research data was analyzed, because the authors argue that the data will be met if the assumption for cointegration test of the data.

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