

## Potential of Habitual Change on Car Use as the Response to the Fuel Price Policies - Case Study on Bandung Metropolitan Area

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**Abstract:** In Indonesia, the subsidy in fuel price burdens the National Budget every year. Since the price difference between subsidy and non-subsidy fuel in the market become wider every year, the Government need to force more use of non-subsidy fuel to private cars and let the subsidy price only for public transportation. The subsidy policy has been implementing more than forty years and keeping the fuel price stable and cheap. Hence, it seems that people might not put fuel price as the key of consideration in buying and using their car. This research attempts to evaluate the potential of habitual change on car use as the response to the fuel price increases. As expected, it was revealed that somehow the habit of using car could be influenced by the fuel price. In this case, The willingness to change the habit in car use, such as mode shifting, do more efficiency in car use, and reducing frequency of using car was appeared as the research findings. It was revealed as well that motorcycle ownership became one of key factors to mode shift.

*Keywords:* subsidy of fuel price, habitual change on car use, mode shifting.

### 1. INTRODUCTION

Every year, Indonesia faces a dilemma of their National Budget regarding to the subsidy on the energy, especially on the fuel and electricity prices. Since 1970s, the price of gasoline (car fuel) has been subsidized to keep fuel price steady and low in order to push economic and social development. However, since more price escalating on the world's crude oil price, the amount of energy subsidy increase and weigh down the budget every year. Almost all Government's plan in reducing the subsidy (in order words are to increase the fuel price) must look toward a social and political pressure that might be damaged to their office. Coady *et al.* (2006) reported that in some developing countries, in 2005 data, the subsidies on the gasoline or fuel price was projected to more than 2% of the GDP, e.g. Azerbaijan with 12.7%; Bolivia 3.1%, Ecuador 3.6%; Egypt 4.1%, Indonesia 3.2%, Jordan 5.8%, and Yemen 9.2%. In Indonesia, the amount of subsidy of energy could be even higher than the total public spending on education and health.

Various price of gasoline fuel in Indonesia can be seen in the following table. The price of Premium and 'Solar' were subsidized while the price was unchanged since 2009. The non-subsidies price ('Pertamax' and 'Pertamax Plus') was adjusted based on the crude oil price in the world market and the new price is announced every date of 1 and 15 every month.

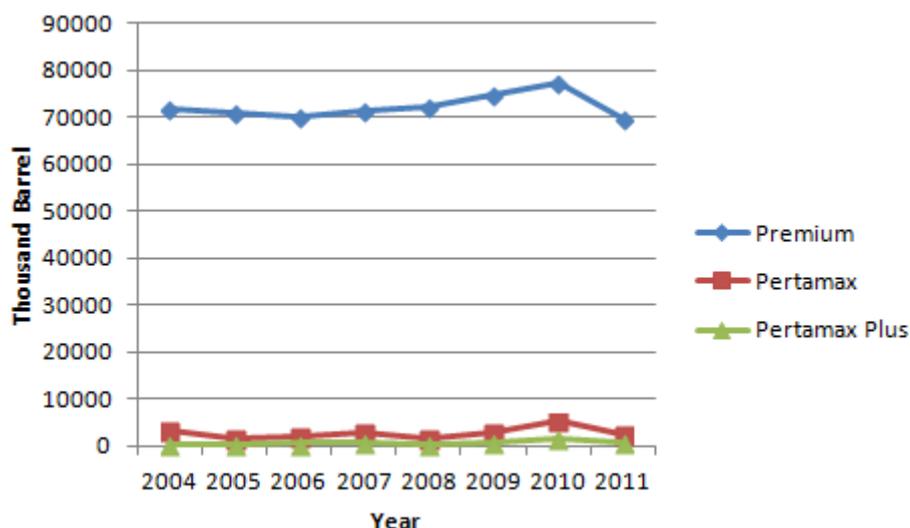
Table 1. Various Fuel Type in Indonesia

Product Name	Research Octane Number (RON)	Price per Liter IDR (USD)*	Remarks
Pertamax Plus	95	9,550 (0.995)	as March 2012
Pertamax	92	9,200 (0.958)	as March 2012
Premium	88	4,500 (0.469) <sup>ξ</sup>	last changed 2009
Solar (Diesel Fuel)	-	4,500 (0.469) <sup>ξ</sup>	last changed 2009

<sup>ξ</sup> subsidized price

\* USD 1 = IDR 9,600

Since the fuel price subsidy burdens the National Budget, Government forces the private car users to shift the fuel from Premium to Pertamax. The subsidy fuel is given to public transport vehicle or commerce truck. However, in fact, it is not easy to shift the habit of car user in using subsidy fuel. Note that, comparing to the non-subsidy fuel, the consumption of Premium is still very high year by year, as can be seen in the figure below.

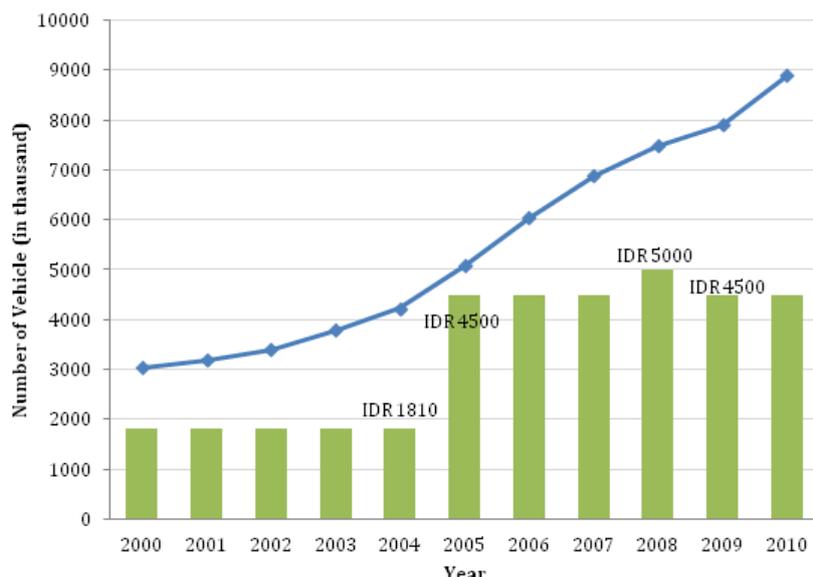


Source: Ministry of Energy And Mineral Resources (<http://www.migas.esdm.go.id/>, access date: March 2012)

Figure 1. Fuel Consumption

Facing this situation, the Government considered several options to have more shifting from Premium to Pertamax (or to any other non-subsidy fuel). Some options are reducing the subsidy or in other words increasing the price of Premium and employing some penalties for private car that still use Premium. Within ten years, the Government has reduced the subsidy several times by increasing the fuel price. On the contrary, data from National Statistic Bureau shows that number car ownership is still increasing even though the price of Premium increases. The figure below gives an illustration of the relationship between number of car ownership and fuel price.

As seen in the figure above, from the year of 2000 to 2010, the price of Premium changed three times, i.e. from IDR 1810 to IDR 4500 in 2004, from 4500 to IDR 5000 in 2008, and decreasing from IDR 5000 to IDR 4500 in 2009. At the years when the price increase, number of car ownership still has positive trend to the years.



Source: Ministry of Energy and Mineral Resources (<http://www.migas.esdm.go.id/>, access date: March 2012)

Figure 2. Increasing Number of Car Ownership and Fuel Price (Subsidy)

Comparing with other countries, the fuel price in Indonesia is relative cheaper. It is still cheaper comparing with other developing countries in the region. The figure below gives an illustration of the fuel price in several countries in the world.

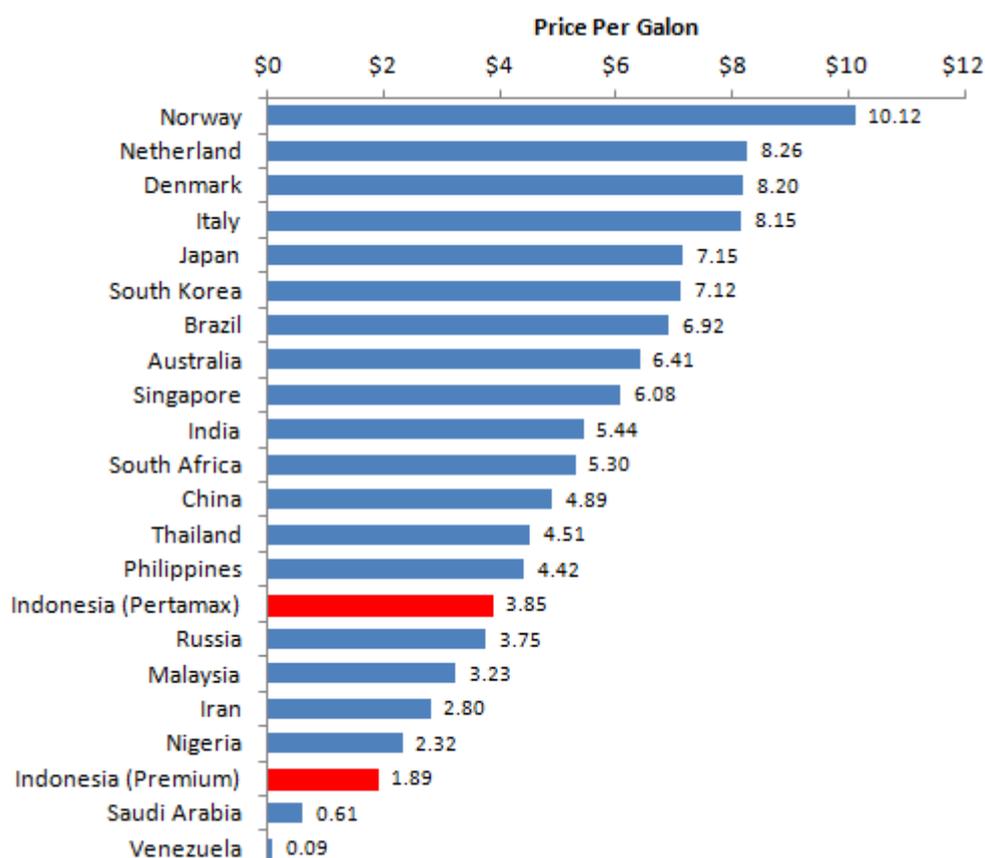


Figure 3. Fuel Price in Some Countries in the World

Source: IISD, 2013 (modified)

Despite to the subsidy scheme, the car ownership and car usage should be decreased while the price of fuel increased. Research from Goodwin *et al* (2004), for the case of UK, the fuel price increases by 10% followed by the decreases car ownership by 1% in short run and 2.5% in the long run. In the case of Canada, Litman (2012) states that fuel increasing can persuade more mode shifting, change trip pattern and type of vehicle. Fujisaki *et al* (2011) concluded that fuel increasing gave positive impact for public transport use and negative impact to private car use. Based on statistic data and other research findings, if the Government increases the fuel price (or reduce the subsidy for fuel price), should it influence the car use? If so, how it can be influenced?

According to the research question, the research objective is to evaluate the potential of habitual change on car use as the response to the fuel price. As the policy to keep fuel price stable has been implemented more than forty years, car users might not never put fuel price as the key factor to have and to use a car. However, this research attempts to illustrate that somehow the car users might be influenced by the variability of fuel subsidy price.

## 2. DATA COLLECTION

Survey interview was carried out to collect research data. The respondents were those who had car and use their car for their daily trip (e.g. working trip in this research). They were also assumed had and can use other alternative mode to go to their office, such as using public transport or using motorcycle. The respondents were classified as middle class and not a car user captive. The pilot survey was conducted to gain brief information on what the respondent do if the price of fuel increases. In the pilot survey, respondents could answer anything related to their perspective as the response to fuel price increases. Based on the pilot result, in the main survey, it was developed three scenarios of fuel increase and four type of behavior change. The scenarios of price increase were the price of Premium become IDR 6000 (scenario 1), become IDR 9000 (scenario 2), and implementation of the obligatory to not use Premium for private car (scenario 3). Regarding to the scenarios of the price, there were expected habitual change, i.e. **(1)** keep using car (no change at all); **(2)** do efficiency in using car, such as minimizing air conditioning (change somehow but still using car); **(3)** reduce the frequency of using car (like the second response, change somehow but still using car); and **(4)** shifting to other alternative mode such as public transport or using motorcycle (significant change). Besides capturing the habitual change related to fuel price increases, the interview collect other data such as respondent characteristics, trip characteristic, and so on.

Some main findings from data can be seen in Figure 3 that shows the proportion of respondents that will change their habitual as the response of various fuel prices. It can be seen in the figure, there are various response of car users in order to anticipate fuel increasing. In spite of that finding, more than half of respondents prefer to keep use their car although the fuel price increase double. Mode shifting appears become the next response that facing variability of fuel price. This finding can be examined further since this type of response is important when introducing new transit system. Note that other three responses in the figure are still using car. Therefore, trying to use fuel price to encourage more use public transport, for example, would not be an easy task. Latest policy related to reduce fuel consumption is a compulsory to all Government staff in all level to not use Premium (subsidy fuel) for their vehicle. This policy would be extended to other national companies. As result shown in the figure, this policy, illustrated in the scenario 3, is likely not running well since more than 50%

respondents tend to still use car while other responses such as reducing frequency and mode shifting relatively low.

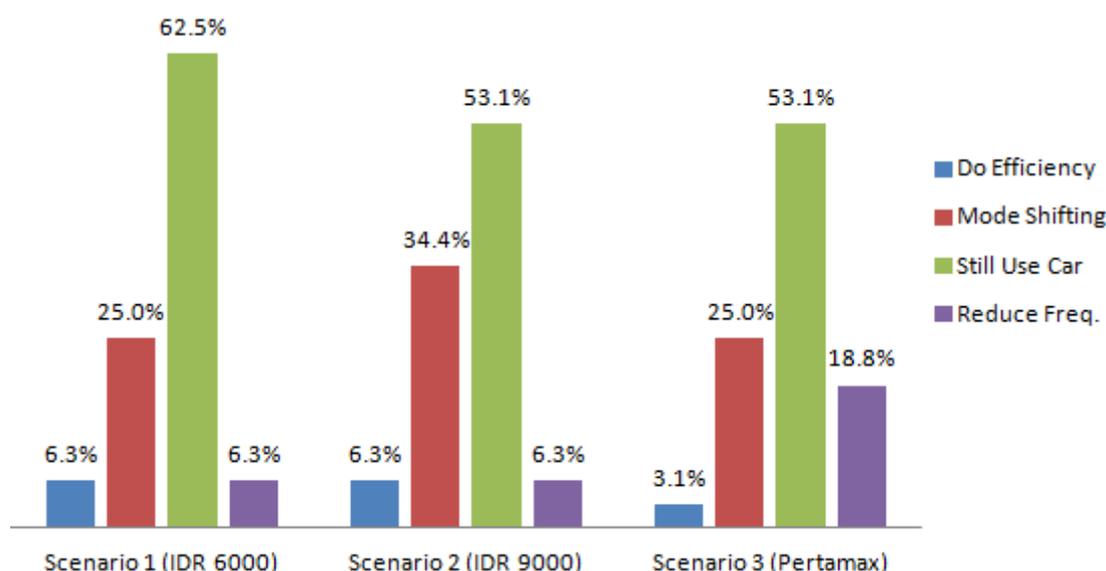


Figure 4. Habitual Change as the Response of Various Fuel Price Policies

### 3. AFFECTED FACTORS

To evaluate affected factors related of the car use habit, a simple multinomial model was developed. In the responses to the fuel price, the data were classified into three groups, i.e. the group that keeping to use car (do nothing); the group that doing something in order to response fuel price but still using car related, such as doing an efficiency (in using car) and reducing the frequency of using car; and the group that do mode shifting. The respondent in the first group was considered that their habit to use car was not influenced by variability of fuel price. On the other hand, the respondents' habit in the third group was considered change extremely, i.e. shifting to other mode. From the survey, the alternative mode was motorcycle for those who have access to use and public transportation. To illustrate, the dependency variable of model is as follow.

$$Y = \begin{cases} 1; & \text{if respondents' habit to use car is unchanged due to fuel price} \\ 2; & \text{if respondents did something but still using car related} \\ 3; & \text{if respondents shift their car to other mode, i.e. motorcycle and public transport} \end{cases}$$

where Y is response of car user due to fuel variability.

After some trial and errors and correlation analysis, there are parameters that considered into the model as shown in the Table 2. Using econometric software, the model was developed and the result is shown in Table 3. The multinomial model was developed with the based alternative was mode shifting (Y=3). Therefore, all coefficient estimated was interpreted relatively to the alternative of mode shifting. Note that the variable of trip length in those tables represents straight distance from respondents' resident to their workplace or school.

Table 2. Data Summary for Model Development

No.	Variable	Cluster	No. of data
1	Trip length	up to 10 km	118
		more than 10 km	91
2	Gender	male (1)	104
		female (0)	105
3	Age (year)	less than 30	52
		31 – 40	78
		41 – 50	40
		> 51	39
4	Total household income	less than 6 million	90
		more than 6 million	119
5	Motorcycle ownership	No have	78
		Have	131

Table 3. Model Development

Variable	Coefficient (t-ratio)
Trip length (0: ≤ 10 km)	-0.173 (-1.7185) **
Gender (0: female)	-0.977 (-2.0563) ***
Age (years), (1: ≤ 30; 2: 31-40; 3: 41-50; 4: >51 = 4)	0.548 (1.4774) *
Total household income (0: ≤ 6 million)	1.177 (2.1663) ***
Motorcycle ownership (0: no have)	-1.089 (-2.5545) ***
Intercept (1-3)	1.987 (1.9271) **
Intercept (2-3)	2.011 (1.6126) *
<b>Statistic Parameters</b>	
%-correct prediction	67.81%
Number of observation	206
Log-likelihood at zero	-148.4721
Log-likelihood at constants	-92.1639
Log-likelihood at convergence	-67.7708
Rho squared w.r.t. zero	0.5435
Rho squared w.r.t. constants	0.2647

note: \*\*\* significance at the level of 5%; \*\* at the level of 10%; \* at the level of 15%

Some interesting research findings can be discussed as follow. According to the table above, those who have longer distance to work or school tend to consider other mode or at least reduce unnecessary car use in short distance. Related to gender, men prefer to use other mode or to do some efficiency in using car when the price of subsidy fuel increases.

Research on mode shifting between private car and public transportation, as discussion in Wibowo and Chalermpong (2009), indicated that in developing countries such as in Thailand and Philippines, car users have higher standard in the term of comfort and convenience. Therefore forcing them to shift their car to public transportation would not be an easy to do. Unlike Bangkok and Manila, Bandung Metropolitan Area does not have mass transit system. Public transportation in Bandung is dominated by small bus called *angkot* (similar operational characteristic with *jeepney* in Manila but smaller capacity). The *angkot* has route for the

service but do not have fixed schedule and headway. It can stop everywhere on the road and having minimum comfort facilities such as no air conditioned inside the vehicle. In this situation the car users who afforded to higher fuel price might not consider using *angkot* as they response to the fuel price variability. Facts from the data that reflected from the model, these users were higher income group (as defined as household income more than 6 million).

Other work in Wibowo and Qiranawangsih (2010) showed that for the security reasons, female tends to still using car rather than using *angkot*. On the other side, comparison between *angkot* and motorcycle, for the safety reason, female tends to use *angkot* rather than motorcycle. Thus, those facts indicate that female might have willingness to sacrifice for higher cost in order to have better security and safety in travelling. Compilation with this research finding, in the certain level, female traveler will keep using car although the price of fuel increase.

The other important finding in the model development is the role of motorcycle. In many larger cities in Indonesia, there are a lot of motorcycle users. This type of mode is very dominant in every road. Recently, motorcycle becomes alternative mode for congestion area in the city. As shown in the model, those who have motorcycle tend to be not a car dependency. There are most likely to change the mode while the fuel price increases, as illustrated in coefficient estimated for the variable of motorcycle. However, survey data reveal differently from the model. As shown in the Figure 4, the proportion of still using car was quite high (more than 50%).

#### **4. CONCLUSION AND POLICY IMPLICATION**

Over than forty years, fuel price in Indonesia is subsidized to make the price stable and cheaper. The aim of this policy is to encourage economic and social development. However, this strategy has consequence that is a high dependency of car use. Research background showed that variability of fuel price was not change car use significantly. However, from the model development, some gradation of habitual changes in car use was revealed. Car user might consider to do something when the price of subsidy fuel. They might do some efficiency or reduce the frequency of car use or even shifting to other mode that relatively less consume of fuel, such motorcycle.

One recommendation that can be developed from model development is to introduce public transportation service to car user. In Bandung, for example, introducing new bus rapid transit was not running well, especially to the car user (Wibowo, 2011). Fuel price, as well as parking policy, could be seen as a penalty cost to those who does not have willingness to shift from car to public transportation. However, the penalty looks not too effective since service quality of the offered public transportation was not comparable with the service quality of private car, in the term of accessibility, for example.

The policy implication from the research findings is the program to reduce fuel subsidy should be continued, regardless to any political and social implication. Keeping high subsidy on fuel price produces ineffective and inefficiency on transportation cost, for the short and long run. From the research findings, it is revealed that some individual tend to change their habit in car use as the response of fuel price. This group should be maintenance and considered as role of change to better transportation service.

Further research can be carried out by extended the research methodology for finding the 'minimum fuel price' that accepted to reduce significantly total traveled by car, e.g. up to 50%. Similarly, it can be developed to find the minimum accepted fuel price for mode shifting by trading off with offering public transport system.

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