Assessing the Effects of the Vehicle Restriction Policy: U-do Island in Jeju-Do, Korea

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Abstract: This study aims at assessing the effects of Udo's vehicle restriction policy enforced by Jeju Special Self-Governing Province in July 2008. Authority initiated the policy to enhance the traffic safety and protecting its nature and environment. The effects are assessed by conducting before and after study. Using monthly data for visitors and vehicles entering the Island, regression analysis model is used to identify the changes in travel patterns by comparing the data for before and after of policy enforcement. To identify the opinions of local residents and relevant personnel about the policy, an interview method with a set of questionnaires is employed. It shows that the policy has been successful so far, enhancing the traffic conditions and reducing the traffic accidents in the Island. It also shows that the volume of tourists and vehicles entering the Island has been increased, despite of the restricted vehicle volume, resulting in subsequent increase in tourism revenues in the Island. In other words, one may conclude the vehicle restriction policy would have no negative impact on the tourist business. Based on the analyzed results, some of policy recommendations are suggested.

Key Words: Vehicle restriction policy, traffic safety, Regression analysis model, protecting traffic nature and environment, interview method
1. INTRODUCTION

The objective of this study is to assess the effects resulted from the vehicle restriction policy implemented at Udo Island, Jeju Special Self-Governing Province. In July 2008, Udo Island, one of the most famous tourist attraction places in Jeju-Do, initiated the policy which aims at restricting the number of vehicles entering the Island. It was expected that the policy would help maintaining Udo's fame as a tourist place by enhancing the traffic safety and protecting its nature and environment. Yet there were also concerns about the potential negative effects on the tourist business, such as increasing complaints from tourists, resulting reduced number of tourists, and ultimately reduced revenues.

The main theme of this paper is to evaluate the effects of the policy in this context. The process of the policy implementation is first described and discussed, and then the effects are analyzed by identifying the changes in volumes of tourists and vehicles entering the Island. A regression model is developed to compare the monthly volume data generated before and the after of the policy enforcement. A interview method was applied to identify qualitative attributes of the effects. A set of questions were prepared for the interviews with local residents and relevant personnel. Finally, some of policy recommendations are suggested based on the analyzed results.

2. UDO'S VEHICLE RESTRICTION POLICY

Udo Island, located at east side of Jeju Island, is one of well-known tourist attraction sites. Despite its small size, Udo boasts full of amenities as well as tourist attractions and activities: fertile soils, abundant schools of fish, and scenic sights; local heritage (female divers, stone walls, and stone tombs) as well as natural attractions abound all over the area. It is also full of tourism outlets: fishing, bike trails, sand massaging, tour submarines and cruises. Udo recently gains its reputation as a place of filming location of the famous TV soap opera.

Due to its fame, the number of tourists visiting Udo-Island has been constantly increased, and so did the number of vehicles entering the Island. This resulted in chronic traffic congestion and increasing traffic accidents and at same time demolished the nature and environment. Transportation facilities, including roads and parking, in Udo are in general insufficient and in bad shape. Hence, the increasing vehicle flow driving around the Island has caused serious concerns about the pedestrian safety and the environment.

On 1st of July, Jeju Special Self-Governing Province announced the vehicle restriction policy in order to protect the exquisite nature and mitigate traffic problems as well as enhance the traffic safety. The contents of the policy is very simple:

- Max. number of entering vehicles: 605 vehicles/day
- Period: July & August (2 months)

The number of vehicles on the ferryboat is counted by personnel at the Sungsan Port. When the number exceeds the maximum, no more vehicles are allowed on board with any exception.

For the preparation of the policy implementation, the authority established the policy agenda setting process and conducted a study which estimated the optimal number of entering vehicles, considering the safety issue and the preservation of nature. There were also a number of community meetings with the interested parties, including local residents and tourist agencies.
3. COMPARISON: BEFORE AND AFTER VEHICLE RESTRICTION POLICY

Comparison between before and after the policy enforcement has focused on the changes in the number of tourists as well as the number of entering vehicles.

Table 1 lists the number of tourists visiting Udo by months from year 2005 to 2010. As seen, in spite of implementation of the restriction policy, the tourists have been constantly increased at an annual average rate of 14.2%.

<table>
<thead>
<tr>
<th>Month</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Avg. % Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>414,461</td>
<td>462,748</td>
<td>450,016</td>
<td>543,775</td>
<td>732,222</td>
<td>803,463</td>
<td>14.2%</td>
</tr>
<tr>
<td>Jan.</td>
<td>23,387</td>
<td>20,885</td>
<td>27,680</td>
<td>22,404</td>
<td>27,231</td>
<td>45,498</td>
<td>14.2%</td>
</tr>
<tr>
<td>Feb.</td>
<td>16,093</td>
<td>24,449</td>
<td>21,462</td>
<td>17,680</td>
<td>31,151</td>
<td>38,626</td>
<td>19.1%</td>
</tr>
<tr>
<td>Mar.</td>
<td>13,699</td>
<td>26,076</td>
<td>28,908</td>
<td>27,089</td>
<td>38,540</td>
<td>44,987</td>
<td>26.8%</td>
</tr>
<tr>
<td>Apr.</td>
<td>40,117</td>
<td>29,762</td>
<td>42,106</td>
<td>41,123</td>
<td>67,643</td>
<td>74,189</td>
<td>13.1%</td>
</tr>
<tr>
<td>May</td>
<td>41,722</td>
<td>53,086</td>
<td>57,082</td>
<td>61,448</td>
<td>81,603</td>
<td>86,226</td>
<td>15.6%</td>
</tr>
<tr>
<td>Jun.</td>
<td>37,400</td>
<td>36,528</td>
<td>37,563</td>
<td>54,964</td>
<td>62,404</td>
<td>63,542</td>
<td>11.2%</td>
</tr>
<tr>
<td>Jul.</td>
<td>48,795</td>
<td>47,811</td>
<td>50,653</td>
<td>63,524</td>
<td>77,159</td>
<td>86,773</td>
<td>12.2%</td>
</tr>
<tr>
<td>Aug</td>
<td>82,410</td>
<td>88,126</td>
<td>74,425</td>
<td>94,199</td>
<td>115,662</td>
<td>119,570</td>
<td>11.2%</td>
</tr>
<tr>
<td>Sep.</td>
<td>25,421</td>
<td>34,885</td>
<td>26,687</td>
<td>38,478</td>
<td>71,751</td>
<td>69,637</td>
<td>22.3%</td>
</tr>
<tr>
<td>Oct.</td>
<td>42,665</td>
<td>46,465</td>
<td>36,258</td>
<td>58,650</td>
<td>70,313</td>
<td>83,575</td>
<td>14.4%</td>
</tr>
<tr>
<td>Nov.</td>
<td>29,335</td>
<td>31,020</td>
<td>29,341</td>
<td>37,307</td>
<td>49,446</td>
<td>60,324</td>
<td>15.5%</td>
</tr>
<tr>
<td>Dec.</td>
<td>13,417</td>
<td>23,655</td>
<td>17,851</td>
<td>26,909</td>
<td>39,319</td>
<td>30,516</td>
<td>17.9%</td>
</tr>
</tbody>
</table>

Note: Units are persons and %
Source: Gov't internal documents(2005~2010)

Table 2 shows the changes in the number of vehicles entering the island. It shows constantly increasing total volumes of entering vehicles despite the restriction policy over the periods of July and August starting from year 2008. Between 2005 and 2010, the number increased at an annual average rate of 10.9%, while during months of July and August, the increasing rate reached at 11.3% and 3.3% respectively.

Consequently, one may conclude that the restriction policy did not have any negative impacts on the tourist business in Udo Island. On the contrary, the policy appears to have some positive impacts by changing travel patterns of tourists. It seems that many tourists alter their itinerary by entering Udo during other seasons or days when no restriction is enforced.
Table 2 Number of vehicles entering Udo island

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Avg. % Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>50,088</td>
<td>52,883</td>
<td>53,009</td>
<td>62,374</td>
<td>83,917</td>
<td>84,029</td>
<td>10.9</td>
</tr>
<tr>
<td>Jan.</td>
<td>1,901</td>
<td>1,758</td>
<td>2,191</td>
<td>1,842</td>
<td>2,088</td>
<td>3,906</td>
<td>15.5</td>
</tr>
<tr>
<td>Feb.</td>
<td>1,757</td>
<td>2,031</td>
<td>1,952</td>
<td>1,668</td>
<td>2,722</td>
<td>3,721</td>
<td>16.2</td>
</tr>
<tr>
<td>Mar.</td>
<td>1,260</td>
<td>2,154</td>
<td>2,326</td>
<td>2,357</td>
<td>3,298</td>
<td>3,525</td>
<td>22.8</td>
</tr>
<tr>
<td>Apr.</td>
<td>3,609</td>
<td>3,686</td>
<td>3,366</td>
<td>4,425</td>
<td>5,989</td>
<td>5,922</td>
<td>10.4</td>
</tr>
<tr>
<td>May</td>
<td>4,021</td>
<td>4,400</td>
<td>5,239</td>
<td>5,828</td>
<td>8,229</td>
<td>8,160</td>
<td>15.2</td>
</tr>
<tr>
<td>Jun.</td>
<td>4,366</td>
<td>4,061</td>
<td>4,206</td>
<td>4,948</td>
<td>7,634</td>
<td>7,208</td>
<td>10.5</td>
</tr>
<tr>
<td>Jul.</td>
<td>7,529</td>
<td>7,120</td>
<td>7,920</td>
<td>9,939</td>
<td>12,469</td>
<td>12,801</td>
<td>11.2</td>
</tr>
<tr>
<td>Aug.</td>
<td>13,876</td>
<td>14,806</td>
<td>13,983</td>
<td>15,956</td>
<td>15,772</td>
<td>16,292</td>
<td>3.3</td>
</tr>
<tr>
<td>Sep.</td>
<td>3,343</td>
<td>4,060</td>
<td>3,722</td>
<td>4,675</td>
<td>9,653</td>
<td>8,916</td>
<td>21.7</td>
</tr>
<tr>
<td>Oct.</td>
<td>4,276</td>
<td>4,777</td>
<td>3,569</td>
<td>5,416</td>
<td>7,568</td>
<td>6,482</td>
<td>8.7</td>
</tr>
<tr>
<td>Nov.</td>
<td>2,910</td>
<td>2,097</td>
<td>2,726</td>
<td>2,968</td>
<td>4,847</td>
<td>4,804</td>
<td>10.5</td>
</tr>
<tr>
<td>Dec.</td>
<td>1,240</td>
<td>1,933</td>
<td>1,809</td>
<td>2,352</td>
<td>3,648</td>
<td>2,292</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Note: Units are persons and %
Source: Gov't internal documents (2005~2010)

4. ANA LYSIS OF THE EFFECTS

4.1 Regression Analysis
Regression analysis was performed to assess the effects of the vehicle restriction policy. This study assumes that the effects can be identified by a following operational relationship:

\[ \text{Effect} = \text{number of entering vehicles without the policy} - \text{maximum allowed number of entering vehicles}(605 \text{ veh/day}) \]

Consequently, assuming the policy be not implemented, the number of entering vehicles should be estimated at onset. In general the number of entering vehicles can be considered as a function of the number of entering tourists. For the estimation, the regression analysis model is employed with the number of tourists being an independent variable and with the number of vehicles being a dependent variable. The equation is thus,

\[ Y_i = \beta_0 + \beta_1 \text{TOUR}_i + \epsilon_i \]  

Where,  
\[ Y_i = \text{Number of entering vehicles} \]  
\[ \text{TOUR}_i = \text{Number of entering tourists} \]  
\[ \epsilon_i = \text{Errors} \]
The data listed in Tables 1 and 2 are utilized. The number of entering tourists on the months of July and August in 3 years from 2008 to 2010 are used as input data for the independent variable, while the number of entering vehicles over the same periods for the dependent variable. Missing data due to the cancellation of sailing resulted from bad weather conditions are intentionally eliminated for the analysis. The resulting regression equation is:

\[ Y_t = -14.184 + 0.174 \times TOUR \]

\[ t-value = (-1.921)(62.011) \]

\[ R^2 = 0.987 \]

Using the above equation, we can conclude that the number of vehicles that could not enter the Island because of the policy implementation are estimated from 208 vehicles in 2008 to 4,131 vehicles in 2010.

The yearly-based results are summarized in Table 3. As seen, in 2008 the policy was enforced for eleven days and total number of vehicles that were not allowed on board were 208 vehicles (11 vehicles daily). In 2010, the number increased to 4,143 vehicles (148 vehicles daily) over 28 days.

<table>
<thead>
<tr>
<th>Period</th>
<th>Days Enforced</th>
<th>Number of Restricted Vehicles</th>
<th>Average Daily Restricted Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008. 7–8</td>
<td>11</td>
<td>208</td>
<td>19</td>
</tr>
<tr>
<td>2009. 7–8</td>
<td>18</td>
<td>3,053</td>
<td>170</td>
</tr>
<tr>
<td>2010. 7–8</td>
<td>28</td>
<td>4,143</td>
<td>148</td>
</tr>
</tbody>
</table>

### 4.2 Perceptions and Opinions of Udo Residents

To assess the perceptions and opinions of residents in Udo Island, a set of questionnaires were prepared. Interviews with the residents were performed at the offices in Sungsan Port and on ferryboat as well as at residential places in Udo on 20th of March, 2011. The results can be summarized as follows.

- **Traffic Accident**
  Since there were no reliable data or documents on traffic accidents within Udo Island, interviews with Udo police department personnel were conducted. They answered that traffic accidents appears to be reduced substantially. Especially, accidents involved with ATV (small motorcar rented by tourists) and Scooter were greatly decreased after the enforcement of the policy.

- **Traffic Condition**
  Before the enforcement, there were a great number of complaints about congestions and resulting noise and pollution. However, after the enforcement, Udo residents feels that traffic conditions during the summer seasons were vastly improved.
Ferryboat Revenue
There was a concern about the possible reduction in ferryboat revenue. While ferryboat personnel suggested the problem of over-flowed parking vehicles around the port, they did not complain or mention the problem of reduced revenue due to the policy enforcement. It can be explained by the fact that the total annual number of entering vehicles had been increased, so had been the revenue.

4.3 Discussions
As assessed above, the vehicle restriction policy has various effects on the tourists, Udo residents and other related parties. The effect of the policy enforcement is first identified through the regression analysis. It shows that the policy has been successfully implemented such that it actually reduces the number of entering vehicles to the Island. As seen, the number of vehicles that were not allowed to enter the Island were 11 veh/day in 2008, 170 veh/day in 2009, and 148 veh/day in 2010.

The resulting effects are numerous: reduced traffic accidents and congestions. All in all traffic conditions in the Island has been evidently improved. There was concern about the possible reduction in ferryboat revenue. But that turned out to be wrong. Overall number of tourists has been constantly increasing, so has been the number of entering vehicles on yearly basis. All in all the policy enforcement has been a success not just in traffic point of a view but also it helps the protection of the Udo's nature and fame.

5. SUGGESTIONS AND RECOMMENDATIONS
While the policy has a number of positive aspects, there are still rooms for improvement as well as the problems to be resolved.

- Parking problem at Sungsan Port should be resolved. Due to the policy, vehicles that are allowed on ferryboat should find a place for parking. In addition to the maximum number enforcement (605 vehicles per day), no other vehicles are allowed after 1 p.m. At present, the capacity of parking facilities at Sungsan Port cannot accommodate the present parking demand. Some of vehicles penetrate the working areas of Port, creating the chaotic problem around boarding areas of the Port.

- There are also parking problem within Udo Island. Despite of the policy, Udo itself does not have adequate parking facilities. Especially, a lack of parkings near the beach areas causes the traffic problem on the adjacent roads. Hence, parking problem within the Island should be assessed and resolved.

- Hourly operation of the policy should be adjusted. Currently, after 1 p.m. no vehicles are allowed to enter the Island. Yet observation of in and out travel patterns and resulting traffic condition within the Island indicates that operation hours can be adjusted, allowing the vehicle entering after 3 p.m, since most of entering vehicles start exiting after 3 p.m.

- Udo residents are not happy with excessive noises coming from the operation of ATVs' and scooters. In near future, the number of ATVs' and scooters for tourists are expected to increase. There is thus a need to deal with the noise problem caused by
ATV and Scooter.

- The traffic situation has been enhanced since the policy enforcement. Yet there are new traffic problem due to the expected uses of ATV, scooter and chartered buses. In some areas, the traffic congestion becomes worsening. There are thus a need to evaluate the traffic situation in those areas.

- Traffic codes necessary for regulating overall traffic condition and operation are needed to be established. For example, possible introduction of traffic codes suited for traffic flow in park areas, such as regulating farm operating vehicles, speed limits, electric vehicles only, etc, should be examined.

- Road traffic signs are needed to be enhanced. their locations must be evaluated and uses of seawater-proof materials should be considered.

- Currently there is no night-owl ferry services, creating inconveniences for Udo residents as well as tourists. To promote tourist business and to mitigate inconveniences of the residents, possibility of providing proper night-owl ferry services should be examined.

- Entrance fee (annual revenue around 1 billion won) collected by Jeju Government should be invested in developing Udo Island, such as resolving transportation problem and new sightseeing places.

- Road conditions in Udo in general are in very bad shape. In addition to renovating existing roads, more facilities for pedestrian and increased traffic should be provided under the condition that the new facilities do not demolish the natural condition of Udo Island.

6. CONCLUSION

This study assessed the effects of Udo's vehicle restriction policy enforced by Jeju Special Self-Governing Province in July 2008 and suggested the policy recommendations. The objective of this policy was two-tired: enhancing the traffic condition/safety and protecting its nature and environment in Udo Island. The main theme of this study was to determine whether enforcement of this policy has been a success or not.

To achieve this, regression analysis model was developed to identify the changes in the volumes of tourists and vehicles entering the Island. Comparing the monthly volume data of before and after, it was found that total volumes of tourists and vehicles has been increased, despite of the strict enforcement of the policy. Interview method was applied to identify qualitative attributes of the effects. A set of questions were prepared for the interviews with local residents and relevant personnel. The results showed that traffic conditions and safety has been in general enhanced, and the revenues from tourist business has been increased. Hence, one can conclude the policy has been successfully implemented so far.

This study also suggested a number of policy recommendations for further refinement of the policy: resolving parking problems in Sungsan Port as well as in Udo Island, improving and reforming the local streets and roads, adjusting the hours of policy operation, refining traffic signs, providing night-owl ferry services, and investing revenues collected from entrance fees in Udo development project.
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