

CHAPTER 3 RESEARCH FRAMEWORK

3.1 Research Design for Duration Variables

The research design for collecting duration variables was developed through combining the motorcycles sampled in 2000 from the MOTC with the corresponding registration information for these sampled motorcycles from the VRS. The samples in the MOTC survey were randomly collected from the registered motorcycles in the VRS on December, 1999 (MOTC, 2000). Via linking the plate number of these sampled data to the registration records, the duration variables for motorcycle age and ownership duration can be observed. The VRS's motorcycle records, such as the date of manufacture, the original issue date of a licensing plate, the name of the owner, and the "transfer" or "disposal" record and its date (if any¹), offered a basis for observing the time-to-event history of motorcycle disposal age or ownership duration.

To specify the duration of a motorcycle being owned, it is essential to first identify a new or used motorcycle at the time of purchase and the initial holding time via the VRS records. Provided that no transfer records were revealed before the MOTC's sampling time, this demonstrated that the present owner had bought a brand new motorcycle at the moment of purchase and the registration plate's original issue time initiated the holding time for that motorcycle. In contrast, if at least one transfer record existed, the "latest transfer" record, before the MOTC's sampling time, revealed when a holder began to hold his/her motorcycle, which meant that he/she owned a second-hand motorcycle. Also, the age of a used motorcycle at the time of purchase can be observed.

Furthermore, in order to determine the complete ownership duration of the sampled motorcycles by the specific owners, a follow-up observation of the event (either a transfer or disposal record) from the VRS was also undertaken. The end of the observation period was set as February 15, 2004. As a result, the complete holding duration of a sampled motorcycle could be obtained if the duration termination, identified as either a transfer or disposal, occurred during the more than four-year

³ "Transfer" means when a motorcycle owner transfers his/her motorcycle to another owner and changes the registration record in the VRS ; while "disposal" means a motorcycle owner ends his/her motorcycle registration in the VRS and, hence, the motorcycle can no longer be used on the roads.

observation period (from December 15, 1999 to February 15, 2004). On the other hand, if no events were revealed for a sampled motorcycle during the observation period, this was regarded as censored data. Therefore, the holding duration was computed as the time between the initial holding and the terminating holding (either a disposal or transfer record occurred) of a motorcycle. On the contrary, the time between the initial holding and the end of the observation, if no event occurred, was defined as censoring time.

As for the observation of motorcycle age, it is comparatively easy to be collected and defined as the duration between the date of initial registration and the disposal date (if any). If no disposal event occurred, the time between the initial registration date and the end of the observation period was computed as censoring time. Owing to the scrappage age or active age of a motorcycle connected closely with the emissions production and energy consumption, it seems more appropriate to count the real usage time of a motorcycle. Hence, we chose the initial registration date but not the manufacture date of a motorcycle as a starting point.

The observation for duration variables, linking the MOTC's sampling data to the VRS records is illustrated in Figure 1.

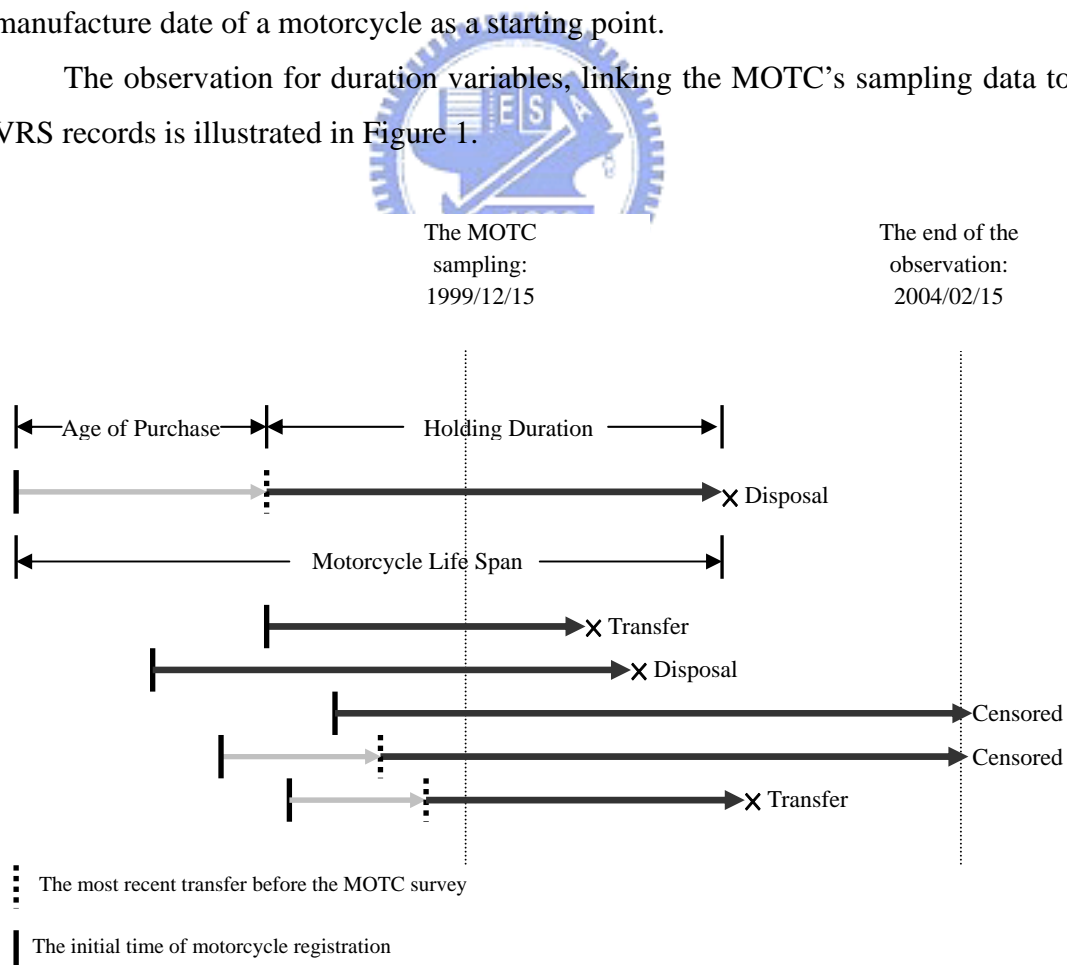


Figure 1 Research Design for Observing the Duration Variables

3.2 Association Framework for Duration Variables and Determinants

Factors affecting the motorcycle age and holding duration may reveal the implications for traffic management and policy making. The associations between these duration variables and their determinants are of importance at not only the disaggregate level but the aggregate level. The research framework about the association between duration variables (or events) and their determinants is shown in Figure 2.

For the disaggregate predictors part, many vehicle and usage attributes have been proved to be highly associated with the holding duration or disposal age of a vehicle. Motorcycles with a poorer status for the initial holding (e.g. a used one or old aged) would reduce the holding duration of the motorcycle, and also a lower replacement cost (e.g. lower selling price, engine capacity, or residual value) will shorten the holding duration or disposal age of a motorcycle. In addition, socio-demographic attributes and motorcycle use conditions such as holder's characteristics, usage frequency, maintenance cost, and even other alternative modes available may affect the duration being owned or the age of scrapping a motorcycle.

For the aggregate predictors part, using the regional perspective is especially useful in understanding the motorcycle ownership and scrappage behavior differences among regions. Two kinds of aggregate variables—socioeconomic levels and emissions inspection performance were applied according to the holding duration or motorcycle age being studied. The socioeconomic variables were examined both in the analysis of holding duration and motorcycle age, while the variables for illustrating emissions inspection performance were used only in exploring motorcycle scrappage age.

A relatively poorer district's economic level such as a higher unemployment rate, higher Engel's coefficient, and lower consumption propensity may on average result in a more conservative consumption behavior, thus raising the likelihood of extending the holding duration or disposal age. In addition, district's vehicle ownership density may reflect the different compositions in the regional vehicle fleet. A higher motorcycle density might show that motorcycles were a principal mode in the district resulting in a higher likelihood of being heavily used and accelerated their disposals, while a higher passenger car density, however, might reveal that a greater possibility for a passenger car being used alternatively, thereby reduced a motorcycle use frequency and extended the time of motorcycles being transferred or disposed of in a district.

The association between emissions inspection performance and motorcycle scrappage age (or motorcycle age in-service and age of second-hand motorcycle purchased) from the regional perspective is important because local I/M programs may have adopted different strategies to deal with older motorcycles. In particular, regions with poorly implemented programs may allow older motorcycles to remain in service, thus aggravating the emissions problem. Therefore, this study applied regional I/M performance measures such as inspection rate, ineligibility rate, and CO and HC emission levels to explore this association.

In addition to the two main duration variables concerned (holding duration and disposal age), the age of a second-hand motorcycle at the initial purchase is an additional duration variable worthy of consideration for it can increase the knowledge about how old a used motorcycle is likely to be owned. Hence, age of a second-hand motorcycle being initially held is applied not only as an independent variable but also a dependent variable as well. While as a dependent variable, the association with vehicle, usage, and aggregate predictors as previously mentioned were similarly applied.

In Figure 2, the association was established by examining duration models and logistic regression models. Beside the concerns about duration variables, the choice probability between a used and new motorcycle and as well between a transfer and disposal event are worthy of exploration. Hence, we also employed a logistic regression model to estimate the relative odds between the two binary outcomes respectively.

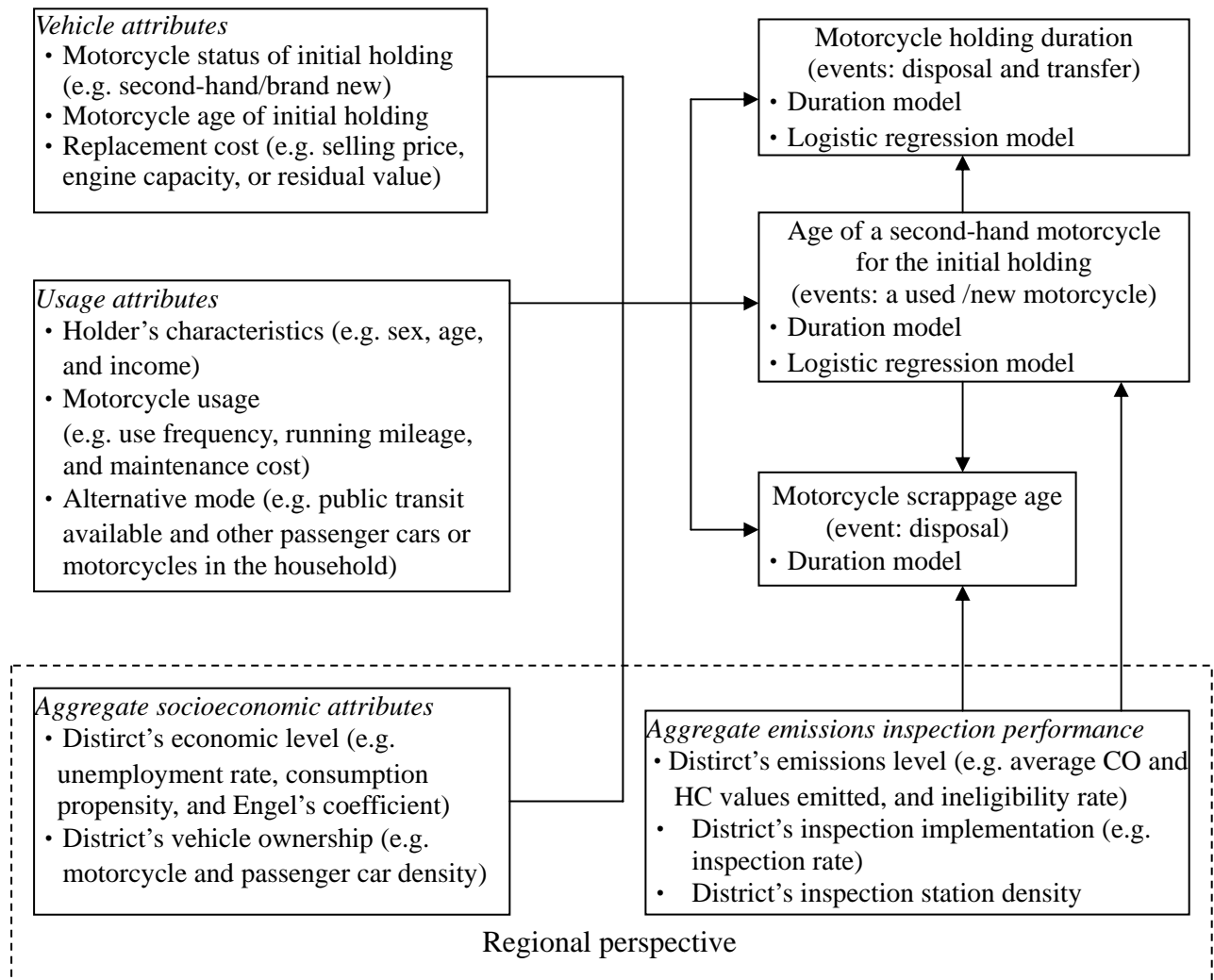


Figure 2 Association Framework between Duration Variables and Determinants

