Lock Efficiencies

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The purpose of this study was to develop and estimate a model of lock performances of lock flotilla based on historical LPMS data. A flotilla is defined as a power vessel and a set of barges. Information gathered from this study would help understand factors that lead to variation in lock transit times and could be used to estimate lock processing times for different types of flotilla. Two types of locks were considered: single lockage and double lockage. In the single lockage, a flotilla approaches the lock, enters the lock chamber, gates are closed, the lock is filled then emptied, the gates open, and the flotilla exits the lock chamber. Extra steps are required for a double lockage. Furthermore, there are two lockage types established: consecutive and straight locks. LPMS data analyzed for this study reflected data for the Upper Mississippi River where there is a total of 29 locks and where approximately 50 percent of the locks are double cuts.

The econometric model used for this study regressed processing times as a function of lock and flotilla characteristics among many other factors. The factors included observable or directly measurable phenomena, such as lock width, length, lift and age and generally non-observable or harder to measure factors such as river conditions and lock master rules. At the time of the symposium, models generated were preliminary and the signs of the coefficients were not all obvious or logical. There would be a need to further understand the lockage technologies and processes before really understanding the LPMS data. Further analysis would look at vessel effects, firm effects and equilibrium changes over the geo space.

Questions and Issues:

- Participants asked for an explanation clarifying the meaning of "firm effects" and wondered whether each lock can be considered a firm. The presenter explained that firm effects could be the result of locks processing different tow companies hauling commodities down the river. Presenter was also in agreement with a suggested notion of considering the different locks as separate firms.

- After the clarification on the meaning of firm effects, one participant suggested that one possible way of capturing firm effects was to include all locks in the model and then determine whether each lock is significant. Significant locks could then be further investigated. The presenter was in agreement with this approach. The presenter elaborated by indicating that when group-lock type dimension dummy variables were removed from the equation and replaced with individual locks dummies, the model showed a very small but positive increase that is statistical significant. However, the presenter indicated that the problem with separating the lock effects is that it becomes very difficult to return back to the dimensionality question. The presenter explained that he would like to maintain the grouping effects and then explain away the other differences in locks with observed data.

- An issue was raised on why the study needed to incorporate dimensions. The presenter explained that there was a need to be able to answer policy questions such as, "We have 600′ locks, what happens if we have 1200′ locks?"

- One participant noted that a variable that was not addressed is depth over sill. This varies from lock to lock and determines the speed of the approach. In addition, instead of using LPMS exclusively to look at the WCSC data, it was recommended that locks be inspected for sill depth to determine the sill depth that will allow vessels to maneuver faster. The policy decision would then become - if you have a deeper sill, can move more tonnage per lockage.

- Participants wondered whether there were recreational vessels at locks and whether mixed a lockage would produce a slower processing time for exit/entry times assigned to commercial vessels. It was agreed that recreational component may affect lockage times. A member of the audience suggested that there were all kinds of externalities other than single and double cuts that affect processing times. It was also noted that these were very seasonal.

- One participant suggested that the study team also look at commercial vessels that have no recreational components as opposed to mixed lockages that could embrace both commercial/recreational.

- The presenter mentioned that the study team had calculated the variables to identify rules from the data but had not been able to determine any systematic application of the rules. One participant suggested that looking at each of the steps would reveal systematic patterns.

- As a caution one participant warned that that the system is set up with defaults and that people who work on the locks sometimes tend to enter default entries due to work overload.

- In one participant's belief, the data on lock approach times is the most important determinant of lock cycle time followed by filling and emptying times in estimating and explaining variability in locking time. The inclusion of upstream/down stream dummy variables was also suggested.

- It was also suggested that some discussions be initiated with Upper Mississippi and Ohio River Corps analysts since they have been through this analysis before. They could provide some valuable insights.