A panel data analysis of timber harvesting operations and its impact on the cost of water treatment

ABSTRACT

It is noted that several activities conducted near water stream such as timber harvesting operations, agriculture-based plantation, road construction, housing development and particularly conversion of forest land to other land uses will lead to diminishing in water quality. As water stream contaminated, cost of treating the water will be raised accordingly. Hence, this could take up a significant component of the cost of water supplies. In a case of Malaysia, the companies that operate the water treatment plants have to bear the additional cost on their own. This scenario has brought unfairness to those companies as they not the one who contaminates the water stream. Therefore, an attempt is made to estimate the cost of water treatment with its potential determinants and carry out the simulation analysis. For this study, we examine the impact of timber harvesting activities on the cost of water treatment. The timber harvesting is divided into two practices namely conventional and sustainable timber harvesting practices. In this respect, the assessment of cost of water treatment is also to be known as external costs of timber harvesting activities towards water treatment. In other word, this could be considered as implicit cost for timber companies. The cost of treating water is expressed as a function of the production of water produced (measured in gallons treated), turbidity of the raw water intake [as measured in Nephelometric Turbidity Unit (NTU) and pH] and a dummy variable to represent the influence of the rainy seasons. Based on reports from water treatment plants, every two weeks averages for each item have been calculated. The final set of data consists of 24 weeks which is for every two weeks observations from January 2009 to December 2009 and 6 water treatment plants in Kelantan, Malaysia. All variables used in this study are in natural logarithmic form. We have employed panel data analysis in estimating the cost of treating water function. The result shows that the NTU and cubic meter treated (CT) were significant at the level of 1-percent. Whereas, other factors such as the dummy (DM) variable that measures the rainy season was insignificant. In addition, based on goodness of fit of the Ordinary Least Square (OLS) model, it is clearly indicated that the model is well fitted as it passes the diagnostic test. Simulation analysis reveals that the average increase in sedimentation rates associated with NTU level from 198 to 580 increased the average cost per cubic meter of water treatment to RM1.88 [with Conventional Logging (CL) practices] from RM0.65 (without timber harvesting activities). On the other hand, as sedimentation rates reduced to 388 in Reduced Impact Logging (RIL) practices, the average cost per cubic meter increased to RM1.26. Simulation analysis indicated that the external cost of CL bear the highest cost of water treatment activities. Hence, the cost per cubic meter of water treatment will reduce by RM0.62 or 49-percent when RIL practices were adopted. These findings demonstrated that the implementation of RIL is preferable in reducing the contamination in water stream from rising erosion and sedimentation rates resulted from timber harvesting.

Keyword: Cost of water treatment; Water quality; Nephelometric Turbidity Unit (NTU); pH; Impact analysis