Analyzing and Forecasting Uncertainties in the Price of Asphalt Cement

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The United States has more than 2.6 million miles of paved roads and highways. 93% of this infrastructure is surfaced with asphalt cement. Maintenance of the paved roads and highways, in addition to new projects, requires a significant amount of asphalt cement. Each year, more than 500 million tons of asphalt mixture are produced in the U.S. and the demand is forecasted to increase 3.3% annually. However, significant volatility and unprecedented uncertainty in the price of asphalt cement is a serious challenge for Federal, State, and local Departments of Transportation (DOTs) with regards to proper cost estimation and budgeting for transportation projects. In a volatile and unstable market, transportation agencies face price speculation, inflated bids, very short-term price guarantees, and too few bidders for a project. Currently, DOTs apply various risk management strategies such as offering price adjustment clauses in contracts, utilizing owner buying power, or providing flexible project start time to control the consequences of the uncertainty in the price of materials. However, before employing any risk management strategy, they need to measure, analyze, and forecast the level of uncertainty in the price of materials to ensure whether it is a proper time to utilize the strategy. This issue is more critical for asphalt cement since the level of volatility in its price is not constant over time and may change significantly even over a short period of time. DOTs need to track the level of uncertainty in the price of asphalt cement to update their decisions about implementing their risk management strategies. However, there is little knowledge about measuring, analyzing, and forecasting volatility in the price of asphalt cement. This gap in knowledge makes it difficult for DOTs to recognize the proper time to implement their risk management strategies to control the consequences of the volatility in the price of asphalt cement. The research objective of this study is to measure, model, and forecast asphalt cement price volatility. Auto Regressive Conditional Heteroscedasticity (ARCH) and Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) time series models are used to analyze, quantify, model, and forecast the uncertainties and volatility in asphalt cement price index. The asphalt cement price index of the Georgia Department of Transport (GDOT) is used in this study. Similar to many other state DOTs, GDOT determines its asphalt cement price index based on the average of prices from the department's monthly survey of approved local asphalt cement suppliers. To achieve the research objective of this study, the poster is structured as follows. After a brief review of the ARCH/GARCH volatility models and an introduction to the dataset that is used in this study, the research methodology and the steps conducted during this study are presented. Next, the multiple steps involved in the modeling process such as creating the primary conditional mean function, Heteroscedasticity test to check if the volatility is statistically significant, creating ARCH/GARCH models and estimating its parameters are described. Finally, the performance of the model is evaluated, the results of the models are interpreted, and the findings of this research and future works are summarized. The results of this study can help DOTs quantify and predict the volatility in the price of asphalt cement, and subsequently wisely implement their risk management strategies on a proper time to address the risk of asphalt cement price uncertainty in highway construction projects. The proposed research approach can be repeated for other states using their own price indexes.

Key Words: Uncertainty, Volatility, Asphalt Cement, Time Series, ARCH/GARCH, Forecasting,