This thesis explores the implications of heteroscedasticity in regression models, where the variance of errors is not constant across observations. Traditional estimators such as Ordinary Least Squares (OLS) rely on the assumption of homoscedasticity, but real-world data often deviate from this ideal. In response, Weighted Least Squares (WLS) estimation is introduced to address known forms of heteroscedasticity, alongside the Feasible Weighted Least Squares (FWLS) estimation method, which only requires partial knowledge of heteroscedasticity's form. The theoretical contribution establishes the efficiency of the WLS over the OLS under known heteroscedasticity, and the introduction of the FWLS as a viable alternative. Simulation studies further illustrate the nuanced behavior of the FWLS estimators, offering a comprehensive comparison of the various candidate FWLS estimators under varying model specifications (including misspecified variance models) and insights into their performance relative to the OLS estimator. Recommendations are provided to guide method selection based on specific model characteristics, highlighting the importance of accounting for heteroscedasticity in empirical research.