

8 Using Quantile Regression for Duration Analysis *

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Summary: Quantile regression methods are emerging as a popular technique in econometrics and biometrics for exploring the distribution of duration data. This paper discusses quantile regression for duration analysis allowing for a flexible specification of the functional relationship and of the error distribution. Censored quantile regression addresses the issue of right censoring of the response variable which is common in duration analysis. We compare quantile regression to standard duration models. Quantile regression does not impose a proportional effect of the covariates on the hazard over the duration time. However, the method cannot take account of time-varying covariates and it has not been extended so far to allow for unobserved heterogeneity and competing risks. We also discuss how hazard rates can be estimated using quantile regression methods.

8.1 Introduction

Duration data are commonly used in applied econometrics and biometrics. There is a variety of readily available estimators for popular models such as the accelerated failure time model and the proportional hazard model, see e. g. Kiefer (1988) and van den Berg (2001) for surveys. Quantile regression is recently emerging as an attractive alternative to these popular models (Koenker and Biliias, 2001; Koenker and Geling, 2001; Portnoy, 2003). By modelling the distribution of the duration in a

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flexible semiparametric way, quantile regression does not impose modelling assumptions that may not be empirically valid, e. g. the proportional hazard assumption. Quantile regression models are more flexible than accelerated failure time models or the Cox proportional hazard model because they do not restrict the variation of estimated coefficients over the quantiles. Estimating censored quantile regression allows to take account of right censoring which is present in typical applications of duration analysis (Powell, 1984; Fitzenberger, 1997). However, quantile regression involves three major disadvantages. First, the method is by definition restricted to the case of time-invariant covariates. Second, there is no competing risks framework yet and third, so far quantile regression does not account for unobserved heterogeneity, which is a major ingredient of the mixed proportional hazard rate model.

Quantile regression models the changes of quantiles of the conditional distribution of the duration in response to changes of the covariates. In actual applications of duration analysis, researchers are often interested in the effects on the hazard rate after a certain elapsed duration and how the hazard rate changes with the elapsed duration (duration dependence). Machado and Portugal (2002) and Guimarães *et al.* (2004) have introduced a simple simulation method to obtain the conditional hazard rates implied by the quantile regression estimates. In this paper, we present a slightly modified version of their estimator. The modifications are necessary to overcome difficulties in the case of censored data and to fix a general smoothing problem. Using this method, it is straightforward to analyze duration dependence without having to assume that the pattern estimated for the so-called baseline hazard in proportional hazard rate models applies uniformly to all observations with different covariates.

Section 2 discusses important aspects of quantile regression methods for duration analysis and shows how conditional hazard rates can be obtained from estimated quantile regression coefficients. Section 3 summarizes.

8.2 Quantile Regression and Duration Analysis

This section discusses quantile regression as an econometric tool to estimate duration models and addresses various issues involved. Quantile regression models are contrasted with the popular proportional hazard rate model. Our discussion includes selected results from an empirical application taken from the long version of this paper, Fitzenberger and Wilke (2005).