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# Inference on Non-Stationary Longitudinal Exponential Data with Missing Values

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**Abstract**

In manufacturing studies, non-stationary longitudinal or repeated exponential data may comprise repeated time dependent exponential responses and a set of multi-dimensional covariates for a large number of objects. In practice it is likely to have some missing observations due to the fact that data is collected repeatedly over time. In this paper, we address estimation methodology under missing completely at random (MCAR) for non-stationary repeated exponential responses. As responses are collected repeatedly over time from the same object, it is likely that these responses will be correlated and one needs to take the appropriate correlation structure into account to get consistent and efficient estimates of the regression parameters. In this paper, we will exploit the suitable time series type auto-correlation such as exponential auto-regressive of order 1 (EAR(1)), exponential moving average of order 1 (EMA(1)) and exponential exchangeable or equi-correlation (EEQ) structures and estimate regression parameters consistently and efficiently by using a modified generalized quasi-likelihood (GQL) estimating equation approach under MCAR. As in practice the number of repeated responses for different objects can appear in random manner, the modified GQL has also been extended to account the random repetition problems in this paper. The finite sample estimation performance of the GQL approach under MCAR is examined through a simulation study.

**Keywords:** Repeated exponential failure times, exponential auto-regressive, moving average and equi-correlation processes, method of moments, generalized quasi-likelihood estimating equations, missing completely at random.

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