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Identification of the Age-Period-Cohort Model for Incomplete Development Triangles

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We consider the identification problem for age-period-cohort models for a class of non-trapezoidal index sets: actuarial development triangles with missing data points. To this end we study the connectivity properties of the index set. This allows for formulating regularity conditions for the model to have maximal rank, identifying critical points whose removal from the index set will change the topology of index set, and, where applicable, decompose the index set into subsets that allow for sub-models with maximal rank. While the approach is inspired by a graph theoretical framework, we also employ clustering techniques to fully determine the topology of a given index set. If the age-period-cohort model is used to specify the systematic part of a regression model, the identification of critical points and sub-models of maximal rank allows for a reduction of the rank of the regression model, potentially leading to enhanced computational efficiency. Examples of different types of critical points are provided, along with a demonstration of the rank reduction of the regression model made possible when such critical points exist.