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# Measuring Ethnic Clustering and Exposure with the *Q* Statistic: An Exploratory Analysis of Irish, Germans, and Yankees in 1880 Newark

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## Abstract

The study of population patterns has animated a large body of urban social research over the years. An important part of this literature is concerned with the identification and measurement of segregation patterns. Recently, emphatic calls have been made to develop measures that are better able to capture the geography of population patterns. The objective of this article is to demonstrate the application of the Q statistic, developed for the analysis of spatial association of qualitative variables, to the detection of ethnic clustering and exposure patterns. The application is to historical data from 1880 Newark in the United States, with individuals classified by ethnicity and geocoded by place of residence. Three ethnic groups, termed Irish, Germans, and Yankees, are considered. Exploratory analysis with the Q statistic identifies significant

differences in the tendency of individuals and building occupancy to cluster by ethnicity. In particular, there is evidence of a strong affinity within ethnic clusters and some intermingling between Yankee and Irish residents. In contrast, the exposure of Germans to individuals of other groups is found to be more limited.

对人口模式的研究多年来已经掀起了城市社会研究的热潮。这些研究文献的一个重要组成部分是有关隔离模式的识别和测量。近期已产生有力的呼吁，以制定能够更好地捕捉人口模式地理的措施。这篇文章的目的是展示为分析定性变量的空间关联而开发的 $Q$ 统计对于监测民族聚类和曝光模式的应用。该应用分析美国纽瓦克从 1880 年以来的历史数据，个人按种族分类和由居住地编码。考虑到三个民族，即爱尔兰，德国，和洋基人。用 $Q$ 统计的探索分析，确定了在个人的倾向和建设居住种族集群上的显著性差异。特别是有证据显示，在民族集群内和在一些洋基人和爱尔兰的居民之间，有一个很强的亲和力。相比之下，德国人与其他群体的个人接触较为有限。

A través del tiempo, el estudio de los patrones de población ha construido un abultado cuerpo de investigación social urbana. Buena parte de esta literatura se ocupa de la identificación y medida de los patrones de segregación. Recientemente, son notables los llamados enfáticos que propenden por medidas más efectivas que capten la geografía de los patrones de población. El propósito de este artículo es demostrar la aplicación de la estadística Q, desarrollada para analizar la asociación espacial de variables cualitativas, con la cual detectar la agrupación étnica y patrones de exposición. La aplicación se hace a datos históricos de la Newark de 1880 en los Estados Unidos, clasificando los individuos por etnicidad y geocodificados por lugar de residencia. Se tomaron en cuenta tres grupos étnicos, denominados irlandeses, alemanes yanquis. El análisis exploratorio con la estadística $Q$ identifica diferencias significativas en la tendencia de los individuos y ocupación de edificaciones a agruparse por etnicidad. En particular, existe evidencia de una fuerte afinidad al interior de los agrupamientos étnicos, lo mismo que de cierta mezcla de residentes yanquis e irlandeses. Por contraste, se ha encontrado que la exposición de los alemanes ante individuos de otros grupos es más limitada.

Key Words:

clustering exposure Q statistic segregation spatial association

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Palabras clave:

agrupamiento exposición estadística Q segregación asociación espacial

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# Notes

1. MATLAB code to calculate and test Q is available as supplementary material that accompanies Ruiz, López, and Páez (2010). The code can also be downloaded at http://www.science.mcmaster.ca/geo/faculty/paez/publications.html#journals

2. As noted earlier, decreasing overlap degree reduces the risk of false positives but also the power of the statistic. The application is therefore very conservative. For thoroughness, we calculated the statistic using r = 2, 3, and 4. The statistic is highly significant and rejects the null hypothesis of randomness in every case. As well, the relative frequency of symbols, and their significance, does not display undue variations. Detailed results for this sensitivity analysis are available from the authors.

3. We also calculated the statistic using r = 2. The results hold.

4. We also calculated the statistic using r = 2 and 3. The results hold.

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