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Neighborhood, race and educational inequality☆

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ABSTRACT

Education is critical to poverty reduction and upward mobility, and rising education inequality has drawn broad concern in the United States. However, the role of neighborhood context in education remains under-studied. This paper integrates the ordinary least squares (OLS) regression, spatial filtering regression and geographically weighted regression (GWR) to explore determinants of student performance in Salt Lake County, and better understand the underlying causes. Path analysis is used to examine the interactions among school performance, student background, and neighborhood environments. We find that over 60% of the variation in student performance can be explained by school resource, student background and neighborhood environments using OLS and spatial filtering regressions. The GWR model further reveals that student performance in the eastern region with a higher percentage of whites, higher household income and higher education levels, is more sensitive to the neighborhood environment than in poorer and more diversified northwestern regions. Finally, path analysis finds that household income and population density influence student performance indirectly by attracting more whites to the neighborhoods. These findings confirm the significance of neighborhood context in students' academic performance, and the importance of integrating GIS spatial analysis tools into studying education inequality.

1. Introduction

Education is fundamental to economic growth, equity and social justice, and is an important factor in community development, public health and urban safety (Lochner & Moretti, 2001; Rehme, 2007). The United States has experienced significant improvement in all levels of education, and a large portion of high-school graduates are admitted to college (Goldin & Katz, 2008a). However, education inequality remains large, and significant gaps exist by race and ethnicity. The increasing diversity in the United States even complicates the issues about the gap in academic performance among different races.

Test scores and dropout rates among schools or among different student groups are widely accepted as quantitative measures of student performance (Rumberger & Palardy, 2005), and are also major indicators of education inequality (Hanushek, 1997; Lovasi et al., 2014). Disparities in students' test scores have been mainly attributed to student-level attributes such as students' personal characteristics and family backgrounds, and school-level factors such as school climate and teacher quality. While spatial inequality has been a major concern of human society and government (Wei, 2015), less attention is paid to the spatial dimension of education including the role of neighborhood context or environments (Gulson & Symes, 2007; Lipman, 2004; Zhang & Kanbur, 2005), although student performance varies greatly across neighborhoods in urban areas.

This paper employs spatial and non-spatial models to investigate spatial inequality and the determinants of student performance across schools, with an explicit emphasis on neighborhood contexts in Salt Lake County—a historically White community that has rapidly become racially and ethnically diverse. We map and analyze cluster patterns using local indicators of spatial autocorrelation (LISA) to reveal student's achievement across schools to see whether school performance gaps across neighborhoods are emerging. We use geographical weighted regression (GWR) to reveal how different factors influence school performance in different regions. Path analysis is employed to better understand interactions among school performance, student enrollment, and socio-economic status. Path analysis can also uncover the indirect influences of neighborhood diversity and household income on school performance.

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2. Literature review

The recent global financial crisis has renewed scholarly and societal attention on inequality (Ewing, Hamidi, Grace, & Wei, 2016; Wei, 2015). Education inequality is understood as an important dimension of global inequality (Sahn & Younger, 2007). Although, equal access to education resources is a basic human right, educational gaps still exist in many dimensions—race, gender, family backgrounds, and neighborhood conditions (Caballero, Haynes, & Tikly, 2007; Dougherty et al., 2009; Duncan & Magnuson, 2005; Goldin & Katz, 2008b; Goldsmith, 2004; Keller et al., 2015; Lipman, 2004; Thomas, Wang, & Fan, 2001). These factors usually lead to the differences in students' test scores (Thomas et al., 2001), and are often employed as determining factors of educational outcome. To examine the relationship between these factors and educational outcome, education production function is proposed as a comprehensive analytical framework to study educational inequality from the perspectives of production and efficiency (Hanushek, 1986; Levin, Jamison, & Radner, 1976; Rice & Schwartz, 2008).

2.1. Education production function

Education production function is widely accepted as an analytical framework to measure the relationship between school output and school input. School output or school performance includes both short-time learning outcomes such as test scores and long-term outcomes like employment and earnings (Betts, 1996; Bishop, 1991). School inputs typically include school resources, students' backgrounds, and school neighborhoods. This education production function has been used to analyze the determinants of school performance multi-dimensionally. However, this framework does not contain much geographical context or interaction among schools.

Scholars' attention mainly focuses on school inputs which help improve students' academic performance. The quality of school resources is considered to be a critical factor in students' academic performance. It is suggested that school size and teacher qualifications play important roles in determining how well students learn (Darling-Hammond, 2000). School climate (Koth, Bradshaw, & Leaf, 2008), teacher expectations of students (Rubie-Davies, Hattie, & Hamilton, 2006) and the student-teacher relationship (Konishi, Hymel, Zumbo, & Li, 2010) also influence students' performance. Scholars also compare the differences between private and public schools, and find that school practices and policy affect the performance gaps between them (Coleman & Hoffer, 1987; Goldhaber, 1996; Jensen, 1986). Arsen and Ni (2012) and Ni (2012) suggest that the presence of charter schools in close proximity to traditional public schools may produce a “creaming effect” and lead to a concentration of disadvantaged students in public schools.

Student background is another significant factor which is often categorized into two distinctive categories, personal characteristics and students' family background (Duncan & Magnuson, 2005; Keller et al., 2015). Student personal characteristics include such factors as age, gender and race (Caballero et al., 2007; Dougherty et al., 2009; Goldin & Katz, 2008b; Goldsmith, 2004). Students' academic performance varies greatly among different races (Ferguson, 2003; Fryer & Levitt, 2004; Goldsmith, 2004; Riha, Slate, & Martinez-Garcia, 2013), especially between whites and blacks. With the rapid increase of Latino population in recent decades, scholars have also found that many Latino students struggle in academic tests (Bean & Tienda, 1988; Hemphill & Vanneman, 2011; Lee, 2002).

When considering family background, it seems that parents' involvement in educational activities affects student achievement (Izzo, Weissberg, Kasprow, & Fendrich, 1999). Parents' expectations and behavior are closely related to educational outcomes (Davis-Kean, 2005). Furthermore, family income, race and size create different living and studying environments and provide unequal education resources for children (Downey, 1995). Children born to wealthy parents tend to have a higher level of school-based competence than individuals born in low-income families (Patterson, Kupersmidt, & Vaden, 1990).

2.2. Neighborhood effects on education

Education production function provides a comprehensive framework to analyze the relationship between school income and outcomes with the consideration of internal and external factors. Although external influences beyond school resources or family draw much scholars' attention (Rice & Schwartz, 2008), geographical contexts such as neighborhood environments are often missing in education production function,

With increasing attention to the spatial dimension of inequality in social sciences (Wei, 2016), spatial effects, especially neighborhood effects, have also been considered in education research (Gulson & Symes, 2007), and geographical information system (GIS) has become a powerful tool to study educational inequality, and should be increasingly used in education research (Chaney & Rojas-Guyler, 2016; Gulson & Symes, 2007).

Neighborhood environment has been increasingly studied in health and behavior research, and it has been well established that health outcomes and the ability to recover from stress are related to neighborhood environment (Ellen & Turner, 1997; Li, Wei, Yu, & Tian, 2016; Saelens, Sallis, Black, & Chen, 2003; Ulrich et al., 1991). The evidence suggests that neighborhood environment (e.g. racial composition, facility services and social networks) shapes individuals' outcomes. Neighborhood factors such as perceived safety and social connections influence students' behavior and achievement (Barber & Olsen, 1997; Ennett, Flewelling, Lindrooth, & Norton, 1997). Other location related issues in education research have also been studied, such as school accessibility and student performance (Williams & Wang, 2014), travel-to-school mode choice (Wilson, Wilson, & Krizek, 2007) and student movement (Parsons, Chalkley, & Jones, 2000). School is also an important element of neighborhood, and access to better schools increases residents' satisfaction with their neighborhoods (Lotfi & Koohsari, 2009).

Neighborhood environment also includes pollution exposure, another important neighborhood factor, which has drawn increasing attention in research on student performance. Scholars have examined different kinds of exposure to see how the environment exposures influences the cognitive development of children (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). Student test scores are sensitive to student exposure to polycyclic aromatic hydrocarbon (Lovasi et al., 2014). Also, the concentration of air pollutants like O_3 leads to student health problems and school absenteeism (Gilliland et al., 2001; Mohai, Kweon, Lee, & Ard, 2011), which directly affect student achievement.

Spatial effects also include spatial autocorrelation generated from clustering of human activities. In research on education, scholars notice the positive effects on students' academic achievement of cluster grouping programs (Gentry & Owen, 1999). School cluster grouping is a strategy that high-achieving students are placed in one classroom, or one school, to achieve better academic performance (Hoffer, 1992) due to competition and inspiration among students. The competition between schools in the same school district also can help improve school performance and create better performing school clusters (Hanushek & Rivkin, 2003; Woessmann, 2007).

Closely related to spatial clustering is residential segregation, which also contributes to school segregation (Frankenberg, 2013; Omi & Winant, 2014). White school students' achievements in white neighborhoods are usually better than black school students' achievements in black neighborhoods. Scholars find that if the study area is highly segregated, students in different regions are sensitive to different factors and the spatial heterogeneity is then created (Parker, Segovia, & Tap, 2016; Riha et al., 2013). Other factors contributing to spatial heterogeneity include the division of urban, suburban and rural