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Cities, immigrant diversity, and complex problem solving

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ABSTRACT

Recent evidence suggests that greater immigrant diversity in cities and workplaces makes workers more productive. However, even the most careful extant empirical work remains at some remove from the main mechanisms that theory says underlie this relationship: interpersonal interaction in the service of complex problem solving. This paper aims to 'stress-test' these theoretical foundations, by observing how the relationship between diversity and productivity varies across workers differently engaged in complex problem solving and interaction. Using a uniquely comprehensive matched employer–employee dataset for the United States starting as early as 1991 and continuing to 2008, this paper shows that growing immigrant diversity in cities and workplaces is related to higher wages for workers intensively engaged in various forms of complex problem solving, including tasks involving high levels of innovation, creativity, and STEM. Mixed evidence is found for the theory that benefits are concentrated among those whose work require problem solving as well as high levels of interpersonal interaction.

1. Introduction

Are diverse populations better at problem solving than those that are homogeneous? Researchers in a wide range of disciplines contend that people with different demographic characteristics carry with them different perspectives, and that the combination of these perspectives can confer either economic advantages or drawbacks. Advantages are said to arise because diverse populations are collectively able to map out a wider range of approaches and solutions to complex problems. Drawbacks are caused by the difficulties that individuals from different backgrounds experience in establishing trust and common ground. To the extent that such mechanisms operate in the economy, we can think of diversity as a public good, generating costs or benefits that are not fully captured by individuals. Scholars have explored these ideas for at least half a century (e.g. Hoffman and Maier, 1961; Dawson, 2012), mostly studying gender, education, and other forms of demographic heterogeneity manifested within work teams and organizations.

Over the past decade, social scientists have begun exploring a distinct type of diversity at a different scale: immigrant (or birthplace) diversity in metropolitan areas. Several factors can explain interest in this topic. One is that global flows of migrants have doubled since 1960 (Özden et al., 2011), with populations in prime receiving countries like the U.S. becoming dramatically more heterogeneous.[1] This heterogeneity is not spread evenly across receiving economies; it is concentrated in metropolitan areas (Wilson and Svajlenka, 2014). Meanwhile, researchers studying the economics of immigration increasingly contend that immigrants and natives are best understood as complements in the labor market (e.g. Peri and Yasenov, 2015); an immigrant-derived plurality of heuristics represents one channel for such complementarity. Cities are also sensible containers for such externalities, since we recognize that many of the most important factors explaining economic performance are external to firms but internal to regional economies (Moretti, 2012; Storper, 2013).

Most empirical studies find a positive correlation between urban immigrant diversity and productivity, suggestive of the idea that the benefits of immigrant diversity outweigh the costs (Ottaviano and Peri, 2006; Nathan, 2011; Kemeny, 2012; Bellini et al., 2013; Suedekum et al., 2014; Trax et al., 2015; Kemeny and Cooke, 2015, 2017a; Elias and Paradies, 2016). However, these studies lie at some remove from the behavioral foundations that underlie the hypothesized mechanisms. One can observe a robust association between urban immigrant diversity and various measures of productivity, but one cannot observe actual interactions among members of a diverse populace, at least not at scale. This paper aims to more closely connect available evidence to these foundations. It extends knowledge by exploring the idea that the productivity benefits from urban and workplace-specific immigrant

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[1] In the US, this sea change has been enabled by the 1965 Hart Celler Act: a piece of legislation that eliminated quotas that privileged Western European migrants.

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diversity will vary according to the kind of activities in which workers are engaged.

Theory offers two potential axes of differentiation. First, according to Hong and Page (2001), Weber and Fujita (2004), and others, benefits from diversity ought to be amplified in activities that are challenging, knowledge-intensive, innovation-oriented, and lacking in pre-established routines, activities that we will henceforth describe using the shorthand 'complex problem solving.' Second, given that spillovers are generated through interpersonal interaction, workers in activities that require high levels of both complex problem solving and social engagement should benefit more strongly from the diversity that surrounds them. To take an extreme example, contrast a sculptor's job, which requires a great deal of a certain kind of complex problem solving – creativity – but does not necessarily require a great deal of interpersonal interaction, with that of a director of a Hollywood film, whose success depends on both. If the mechanisms shaping diversity's relationship to productivity are in fact rooted in the interaction of heuristics and the concomitant benefits to problem solving, then diversity effects ought to matter more for the movie director than the sculptor.

Data on U.S. workers, employers, industries, and occupations are used to test these ideas. Our primary data source is the U.S. Census Bureau's confidential Longitudinal Employer-Household Dynamics (LEHD). LEHD provides uniquely comprehensive matched employer–-employee data describing workers and their work establishments, available between 1991 and 2008. LEHD describes workers' place of birth, and permits description of their productivity as measured by their earnings. Using these data we are able to measure diversity in one's city as well as one's establishment, allowing clearer identification of the specific contexts where any productivity-enhancing or -inhibiting effects may reside. We capture variation in complex problem solving and interaction by combining occupation-specific task characteristics from the U.S. Department of Labor's O*NET database with detailed information on the occupational structure of industries from the Bureau of Labor Statistics' Occupational Employment Statistics (OES).

Grouping workers according to the task characteristics of their industry, we predict how their wages respond to changes in the diversity found in their city and workplace. Models are estimated over multi-year job 'spells', within which workers remain in a single establishment and city, permitting the inclusion of *worker* × *workplace* × *city* fixed effects. The primary strength of this strategy is that it accounts for bias from unobserved but pertinent durable features of individuals, their workplaces, and their metropolitan areas. We additionally implement the generalized method of moments (GMM) instrumental variables estimator in order to help address potential bias from unobserved shocks. Though our approach cannot fully eliminate the potential effects of such bias, it represents a strong empirical strategy that ought to build confidence about the nature of the relationships between diversity and productivity.

Our findings largely offer support for the theory underlying this growing body of scholarship. We observe a robustly positive, statistically significant and substantial relationship between urban immigrant diversity and wages among workers in industries that intensively demand complex problem solving. The wages of a typical worker in an industry requiring high levels of complex problem solving rise by an average of nearly 7 percent in response to a one standard deviation increase in urban immigrant diversity. By contrast, for workers where complex problem solving is unimportant, we find no significant association between city diversity and wages. Estimates of the links between wages and diversity in the workplace are also differentiated. As workplace diversity rises by one standard deviation, the wages of workers in industries featuring high levels of complex problem solving rise by approximately 2%, as compared with only 0.7% for workers in activities where complex problem solving is unimportant. Considering the intersection of problem solving and social interaction, we find mixed evidence. While at the establishment scale we find evidence that the benefits of diversity are concentrated among workers engaged in high levels of both complex problem solving and social interaction, at the urban scale we do not detect such a differentiated relationship.

2. Literature

The idea that a population containing a diverse group of immigrants might outperform one in which individuals are more homogeneous finds its chief motivation at the intersection of two bodies of work: one exploring the consequences of heterogeneity in organizations; the other examining subnational regions as sites of external economies.

From the longstanding scholarship on the impacts of heterogeneity in organizations comes the main theoretical logic for an economic impact of immigrant diversity. The initial premise is that observable demographic characteristics are related to underlying cognitive regularities (Nisbett et al., 1980; Clearwater et al., 1991; Thomas and Ely, 1996; Hong and Page, 2001). Hong and Page (2004), for example consider that individuals with 'identity diversity,' defined as those with particular demographic, geographic, ethnic, or cultural backgrounds, are also likely to be distinctive in terms of their 'functional diversity,' meaning the ways they perceive and solve problems. Some hold that this functional diversity can improve economic performance, while others contend it ought to reduce it. On the positive side, it is argued that more functionally-diverse organizations ought to be more productive for two reasons. First, when faced with a problem or challenge, they will be able to access a larger range of potential solutions, and should thereby be able to select the one that will be most effective. Second, they ought to be able to cross-pollinate to generate new solutions that cannot be reduced to any one perspective (Aiken and Hage, 1971). Computational models of this idea provide support, by showing that groups composed of diverse problem solvers can outperform teams made up of agents with superior but more homogeneous abilities (Huberman, 1990; Hong and Page, 2004).

Arguments suggesting that diversity will negatively impact performance flow from psychology's 'social identity theory.' According to this view, diverse organizations will tend toward internal fragmentation, with rent-seeking behavior and raised costs of cooperation across the fragments (Tajfel, 1974; Turner et al., 1987; Van Knippenberg and Schippers, 2007; Harrison and Klein, 2007). It is worth noting that, while these streams of organizational research make different predictions, they posit fundamentally compatible visions of the mechanisms by which diversity influences economic outcomes. Whether diversity helps or hurts, its economic effects flow from interpersonal interactions among individuals who are demographically, and therefore cognitively different. One side emphasizes the costs associated with such interactions when problem solving is needed, while the other side stresses the benefits.

Urban-focused researchers have built upon this foundation, suggesting that the public-good (or bad) qualities ascribed to diversity in the workplace may operate at higher spatial scales. The logic for this emerges from a larger body of theory and empirics making the point that regional economies are an important site of positive externalities – economic benefits that are a function of scale but that cannot be fully captured by individual agents (Moretti, 2012; Fujita and Thisse, 2013; Storper, 2013). Chief among these are gains to worker productivity that flow from concentrations of workers with high levels of human capital. Workers are made more productive when their fellow city residents are better-educated (Rauch, 1993; Moretti, 2004a,b). Such localized externalities have also been modeled in relation to research and development activity: inputs into innovation relate more closely to outputs at the metropolitan rather than organizational scale (Audretsch and Feldman, 2004).

The present paper is motivated by an analogous logic. Just as spillovers arise from local concentrations of educated workers and R & D, concentrations of birthplace-diverse workers in cities may augment worker productivity. A growing body of empirical work has