Job hopping, earnings dynamics, and industrial agglomeration in the software publishing industry

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ARTICLE INFO

ABSTRACT

This paper investigates the implications of industrial clustering for labor mobility and earnings dynamics in one large and increasingly important high-technology sector. Taking advantage of longitudinal employee-employer matched data, I exploit establishment-level variation in agglomeration to explore how clustering in the software publishing industry affects labor market outcomes. The results show that clustering makes it easier for workers to job hop within the sector. Higher earnings levels in more agglomerated areas are partly attributable to sorting across locations among workers and firms in the industry on the basis of observable and unobservable characteristics. Controlling for this heterogeneity, workers in clusters have relatively steep earnings-tenure profiles, accepting lower wages early in their careers in exchange for stronger earnings growth and higher wages later. These findings are consistent with theoretical models in which agglomeration improves labor market coordination and facilitates greater learning and human capital formation.

1. Introduction

Over a quarter of the nation's workers in the software publishing industry are located in one state, and nearly a third of that state's software publishing workers are employed in a single county.[1] Though one of the most prominent examples of industrial clustering, software is not the only sector in which it occurs; evidence suggests that firms in a number of industries, from automobile manufacturing to biotechnology, concentrate in particular locations to an extent over and above what we would expect given the distribution of economic activity more generally (Porter, 1990; Krugman, 1991; Kim, 1995; Ellison and Glaeser, 1997, 1999; Holmes and Stevens, 2004).

While a large literature addresses the potential sources of agglomeration economies, only a small number of studies investigate how geographic clustering by firms in particular industries interacts with local labor market dynamics. Using longitudinal employee-employer matched data, this paper examines the nature and extent of industrial clustering and explores the relationship between agglomeration among establishments and labor mobility,

earnings levels, and earnings growth rates in one large and dynamic high-technology sector.

The empirical analysis reveals that clustering among establishments in the software publishing industry is associated with shorter job durations and greater job-hopping among individuals within the sector. Starting and average wages are higher in clusters, but this is due in part to sorting among workers and firms across locations. After addressing biases arising from self-selection, the results indicate that, relative to those employed by more isolated firms, workers in more clustered firms have steeper earnings-tenure profiles, accepting lower salaries at the start of their careers in exchange for stronger earnings growth and higher salaries later.

These findings suggest that, in understanding the relationship between clustering and labor market outcomes, we must look beyond traditional models of agglomeration that predict that clustering should affect wage levels, but not necessarily wage growth rates or labor mobility. To the extent that workers exhibit more job mobility in clusters and that a fraction of the wage premium that arises in clusters is the result of a wage growth effect as opposed to a level effect, the results are consistent with theoretical models in which clustering improves labor market coordination and fosters greater learning and human capital formation.

The paper proceeds as follows. The next section reviews the literature on agglomeration and its implications for labor market outcomes. Section 3 describes the data, discusses the methodology I employ to measure clustering, and presents basic descriptive statistics. Section 4 turns to the empirical analysis and discusses

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[1] Author's calculations based on publicly available County Business Patterns data for 2005.

the results in light of theoretical models with predictions for the impact of industrial clustering on local labor market dynamics. Section 5 concludes.

2. Literature

A substantial body of evidence suggests there is a large and persistent urban wage premium (Glaeser and Maré, 2001; Rosenthal and Strange, in press). For many of the same reasons we might expect wage levels to be higher in cities, we might also expect wage levels to be higher in industrial clusters (Duranton and Puga, 2004; Rosenthal and Strange, 2004). Firms that cluster with others in the same industry may enjoy higher worker productivity due to greater local demand or input-output linkages (Krugman, 1991; Ciccone and Hall, 1996). Alternatively, information externalities or knowledge spillovers that increase the productivity of firms could contribute to higher wages within clusters, as Lucas (1988) and Rauch (1993) have argued might occur more generally in cities. It could also simply be that industrial clusters attract relatively high-quality firms or high-ability workers, the former perhaps more capable of capitalizing on agglomeration's benefits and the latter possibly deriving more utility from other local amenities (Combes et al., 2008). In any of these cases, we would expect wage levels, but not necessarily wage growth rates or job mobility, to be higher in industrial clusters.

On the other hand, if clustering improves labor market coordination or promotes greater human capital accumulation among workers, wage growth rates as well as job mobility could be higher within clusters. For example, if agglomeration reduces job search frictions, not only could working in an industry cluster induce more job hopping as workers and firms seek out better matches, but it also might reduce risks associated with industry-specific human capital investment. These lower risks to investment might motivate workers to specialize, which in turn could lead to stronger wage growth (Becker and Murphy, 1992; Rotemberg and Saloner, 2000). Also, if workers in clusters more readily exchange information regarding production techniques, investment in human capital might be less expensive, which could give rise to a relatively greater amount of human capital accumulation and steeper wage-tenure profiles. Just as Glaeser (1999) and Glaeser and Maré (2001) suggest occurs in cities, industrial clustering could speed the rate of interactions and thus facilitate more rapid learning.

Hence, while some theories suggest that wages among workers in clusters should be uniformly higher than wages among those outside clusters, others imply that higher wages may only come with time. Initial wage levels among workers starting their careers in clusters might even be lower than those among workers starting outside clusters if clustering is conducive to on-the-job search and promotes more aggressive bidding among firms over skilled labor. In this case, agglomeration could induce greater job mobility as well as steepen wage-tenure profiles, with workers in clusters accepting lower wages initially in anticipation of higher wages later in their careers owing to their ability to claim a greater share of the economic rents from competing firms (Burdett and Mortensen, 1998; Postel-Vinay and Robin, 2002a, 2002b). Together with differences in the production processes and organizational structures of individual firms as well as variation in the costs of doing business across locations (such as congestion and rents), balancing the downside of heightened competition over skilled labor against any benefits from agglomeration could help to explain why some firms might choose to locate inside and outside clusters in equilibrium (Holmes, 1999; Combes and Duranton, 2006).

Thus, studying patterns of job and income mobility across different locations over time can shed light on the nature of any interaction between clustering and labor market dynamics. Al-

though a few studies have investigated job mobility patterns in high-technology industries in the context of possible knowledge spillovers (Saxenian, 1994; Almeida and Kogut, 1999; Fallick et al., 2006), the broad ramifications of clustering in particular industries for earnings dynamics are not well explored, in large part due to a lack of appropriate data. Using a large, longitudinal employee-employer matched dataset, this paper documents job mobility and earnings dynamics among workers at clustered and dispersed software firms and considers these patterns in light of models with different implications for clustering and labor market outcomes.

3. Data

3.1. Sources

To capture job and income mobility of individuals as they move within and between firms over time, I require a data set that combines information about workers and their employers and that permits me to track each over a long period. Due to incomplete information about individuals' employment and earnings histories, small sample sizes, and reporting problems, traditional survey data render it difficult to measure job mobility or to evaluate the temporal pattern of earnings changes among workers (Bound et al., 2001). I study the relationship between industrial agglomeration and local labor market dynamics using an employee-employer matched data set constructed and maintained by the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) Program. LEHD integrates quarterly administrative earnings information for workers derived from U.S. state unemployment insurance records with internal Census Bureau censuses and surveys.[2] The result is a database that is particularly well suited to examining job mobility and earnings dynamics and that provides an opportunity to explore how clustering interacts with local labor markets more extensively than have past studies.

LEHD data boast several advantages over household and business based survey data. The data are current and relatively accurate because businesses face financial penalties for misreporting their workers' employment and earnings information. Since the scope of the quarterly longitudinal data is nearly the full universe of firms and workers, I can follow individuals over time as they move across the earnings distribution and across employers. Additionally, the integrated records contain information on workers' demographic characteristics, including date of birth, race, sex, and education. Though sparse relative to the information on individuals in surveys such as the Current Population Survey and Panel Study of Income Dynamics, the worker characteristics on the LEHD data permit some flexibility in investigating variation across demographic groups and serve as important controls in the empirical analysis. Critically for this study, LEHD data also contain a detailed industry classification code (six-digit NAICS) and a unique address, including latitude/longitude coordinates, for nearly all establishments.

The LEHD data have several limitations. First, the data are not available for all U.S. states, and the amount of historical data varies by state.[3] Second, coverage is limited for workers and firms in some sectors, including agriculture, non-profits, and public administration.[4] Third, LEHD data lack information on hours worked,

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[2] More extensive descriptions of LEHD data appear in Abowd et al. (2006) and Haltiwanger et al. (2007).

[3] As of early 2008, 48 states (including the District of Columbia) are participating in the LEHD Program. This is an ongoing project, and additional states are expected to join.

[4] See Stevens (2002) for a more detailed description of the LEHD database coverage issues.