Monopsony Power and Factor-Biased Technology Adoption

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There is ample evidence for the exertion of labor market power by firms, both in the United States and across the globe. When examining the welfare costs of such 'oligopsony' power, economists tend to focus mainly on income redistribution between firm owners and workers, and to a lesser extent on allocative efficiency. The potential effects of oligopsony power on the incentives of firms to innovate and adopt new production technologies are, in contrast, not well understood. The economic literature has intensively studied the relationship between competition and innovation on goods markets, but not on factor markets.

This project aims to fill this gap by examining how oligopsony power affects the incentives of firms to adopt new production technologies. The focus lies on the automation of the Illinois coal mining industry between 1884 and 1902. This provides a fascinating episode to study the above questions for three reasons. First, coal mining underwent continuous labor-saving technological change during this period due to the invention of mechanized cutting machines and new underground locomotive types. Second, coal mining towns are a textbook example of oligopsonistic labor markets due to high local labor market concentration and the absence of outside employment opportunities. Moreover, labor markets were unregulated and firms powerful during the gilded age. Third, coal is a nearly homogeneous product, and coal markets were unconcentrated at the time, which facilitates identifying the effects of oligopsony power on innovation.

Data

I assembled a novel panel data set on 895 mines in Illinois between 1884 and 1902, using state inspector reports. It contains unusually rich information on output and input quantities and prices, technology usage, technical characteristics, and ownership information at the mine-year level. Wages and employment data by occupation are at the quarter-year level.

Methodology

The central counterfactual question of the paper is how the adoption of labor-saving new technologies would differ if the market for miners would be perfectly competitive, rather than oligopsonistic. The analysis proceeds in three steps. I start by modeling the labor supply side using a differentiated firms model with oligopsony power in the spirit of Card et al. (2018) and Berry et al. (2019). The key identification challenge is to find labor demand shocks that are excluded from the workers' utility function. I use high-frequency information on energy demand shocks from neighboring industries to identify the slope of the labor supply functions. Using the quarterly wage and employment data, I estimate the pass-through from these energy demand shocks to skilled and unskilled worker wages.

Next, the factor demand model relies on a standard CES production function in skilled workers, unskilled workers, and capital (cutting machines). There are two key identification challenges. First, one has to know the effects of the cutting and hauling technologies on skilled and unskilled-augmenting productivity levels. This is complicated by the fact that these latent productivity levels enter the capital demand function, and are hence endogenous to capital usage. Second, the elasticity of substitution between both labor types needs to be estimated. These two primitives jointly determine whether cutting and hauling machines were skill- or

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unskill-biased. I rely on the production function identification literature by imposing structural assumptions on the timing of input choices and the information set under which these decisions are made. Using the estimated production function, the demand functions for skilled labor, unskilled labor, and capital can be derived under the behavioral assumption that firms minimize their costs.

Finally, I bring the estimated supply and demand models together to compute how the optimal technology adoption rates would change when moving from the oligopsonistic to the competitive equilibrium. As a result, I can calculate the effects of labor market power on (i) productivity growth of both high- and low-skilled workers, (ii) wage growth and wage inequality between different types of workers, and (iii) employment levels and growth for each worker type.

Related Literature

This project contributes to two main sets of literature. First, it builds on a large literature that studies the relationship between competition and innovation (Schumpeter, 1942; Aghion, Bloom, Blundell, Griffith, and Howitt, 2005). In contrast to this literature, I focus on labor markets rather than goods markets. Second, it builds on the seminal papers on factor-biased technological change, such as Autor et al. (2003) and Acemoglu (2003), and on the literature on technological change during the second industrial revolution (Goldin and Katz, 1998; Atack et al., 2004). In contrast to these papers, I allow for oligopsonistic labor markets.

Conflicts of interest

I do not have any financial ties to the energy industry, and have no financial or other interests to disclose that might bear on the proposed work.

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