The Returns to General Social Ability and Industry-Specific Social Capital

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Abstract

This paper aims to develop a theory of how social skills are utilized in the production of goods and services in order to test whether this type of non-cognitive ability receives significant returns in the labor market. In particular, it focuses on the role that social skills play in allowing individuals to form work-related relationships within industries. The value of having these relationships (or social capital) depends on the organizational network structure of the industry in which a given individual works, as well as his or her relative position within that structure. I estimate a model in which the returns to general social skills and industry-based social capital depend on industrial organizational structure in order to test the key predictions of the closure and structural hole theories of the social network literature. Specifically, I estimate a switching regression model that allows for endogenous switching, in order to account for worker selection into different industries. Based on these estimates, the paper details trends in industrial network structure as well as changes in the returns to general social skills and industry-specific social capital between 1979 and 2000 in the United States.

1 Introduction

The literature has increasingly focused on the importance of non-cognitive characteristics in influencing individual economic outcomes. In particular, recent work has tried to elucidate which particular non-cognitive traits matter and why.[1] Along this vain of research, this paper aims to develop a theory of how social skills are utilized in the production of goods and services in order to test whether this type of non-cognitive ability receives significant returns in the labor market. While investigating the return to social skills, it is important to take into account the mechanisms by which this type of non-cognitive ability influences individual productivity. One such mechanism is the role that social skills play in allowing individuals to form work-related relationships within industries . The value of having these relationships (or social capital) depends on the organizational network structure of the industry in which a given individual

[1] For examples, seeHeckman and Rubinstein (2001), Bowles, Gintis, and Osborne (2001b), and Osborne-Groves (2005).

works, as well as his or her relative position within that structure. The organizational structure of industries has drastically changed over time as industries have responded to rapid improvements in information technology. Therefore, I aim to use time-variation in this industrial characteristic to examine how the interaction between individual social skills and organizational structure affects wages.

There is growing evidence that social skills are becoming an increasingly important skill requirement in the labor market, particularly with the rapid adoption of computer technology. Bresnahan, Brynjolfsson, and Hitt (1998) suggest that advances in information technology are complementary with organizational changes to improve the quality of goods and services. Bresnahan (1999) posits that this has led to an increase in the demand for skilled workers with substantial individual autonomy, greater cognitive skills, and greater "people" or "soft" skills. Looking at the mix of occupations within the United States economy, Autor, Levy, and Murnane (2003) find an increasing shift towards occupations that require more "non-routine" tasks, which involve the use of interactive, communication, and managerial skills as well as analytic reasoning skills. Similarly, Borghans, ter Weel, and Weinberg (2006a) find increased demand for occupations that require higher levels of social skills. In addition, based on evidence from Germany, these authors find a substantially larger increase in the importance of people skills within occupations.[2]

While it would seem that social skills are in increasing demand, few efforts have been made to investigate the market returns to this type of non-cognitive ability. This is primarily due to the scarcity of reliable measures of people skills. As a result a number of studies have focused on the returns to occupational social skill requirements.[3] Borghans, ter Weel, and Weinberg (2006a) improve upon this work by utilizing a measure of youth sociability in the National Longitudinal Survey of Youth 1979 (NLSY79) to estimate the returns of individual people skills within occupations of similar social skill requirements. In subsequent work (2006b), the same authors look at how interpersonal styles (specifically directness versus caring) influence job assignment and wages.

In contrast to the work by Borghans, ter Weel, and Weinberg, this paper highlights the importance of social skills in casual social interactions (which depend on general social skills) as well as the establishment of relationships (which require time investment in a particular context or setting). Both types of interpersonal interactions are likely to be important in the production of goods and services. I posit that individuals with higher levels of general social skills likely acquire higher levels of social capital in their firms and industries. Here social capital captures the importance of work-related relationships for individual productivity, as well as the strength of these bonds. Since social capital investments are context-specific, the returns to this type of investment, as well as to general social skills, are likely to be more sensitive to demand shifts within industry than across industries. Finally, I argue that the organizational

[2] Specifically, they estimate that 95 percent of the increase in the importance of social skills has arisen within occupations.

[3] See Kilbourne et al. (1994) and Bacolod and Blum (2005).

network structure of an industry characterizes its demand for social skills and as such one can use measures of this industrial characteristic to identify the returns to general social skills and individual industry-based social capital.

The remainder of the paper is organized as follows. In the next section, I develop a theory of how variable social skill levels lead to differential investment in industry-based social networks, and of how the returns to general social skills and industry-based social capital depend on industrial organizational structure. Section 3 discusses the empirical strategy while Section 4 describes the datasets used in the subsequent empirical analysis, paying detailed attention to the methodology for constructing measures of industry-based social capital, as well as of industrial organizational structure. Section 5 presents a descriptive analysis of trends in industrial organizational structure. Section 6 analyzes the returns to general social skills, individual industry-based social capital, and industrial organizational structure. The final section concludes.

2 Conceptual Framework

Consider the following problem where an individual (i) maximizes the expected net present value of wages (w) by choosing which industry (J) to work in each period (t).

$$\max_{\{J_{it}\}_0^T} E\left[\sum_{t=0}^{T} \beta^t * w_i(a_i, s_{ijt}, N_{jt}, \overline{s}_{jt}, \sigma_{jt})\right]$$

Within a given industry J, an individual's wages depends on his innate social ability (a_i) and industry-specific social capital (s_{ij}), as well as the organizational structure of that industry. Social skills increase individual productivity by lowering the cost of coordinating productive activities with others, as well as by lowering the cost of information flow within a given organization. In particular, work relationships based on repeated social interaction likely facilitate cooperation by reducing free rider problems, as well as opportunism [4] Therefore holding the organizational structure of industry J fixed, I expect wages to be increasing in ability ($w_a > 0$) and increasing in industry-specific social capital ($w_s > 0$).

An individual's industry-specific social capital depends on his tenure within a given industry as well as his innate social ability. Particularly, the industry-specific social capital of a worker accumulates in the following manner:

$$s_{ijt} = \sum_{k=0}^{t-1} \delta^{t-k} * 1(J_{it} = J_{ik}) * O_{jk}(a_i)$$

[4] See the literature on repeated games (such as Abreu, 1988; and, Fudenberg and Maski, 1986), as well as Glaeser, Laibson, and Sacerdote (2002).

In each period, an individual invests in social ties with others (both coworkers and clients). The size of this investment ($O_j(a_i)$) depends on i's position in the organizational structure of industry J, where those with higher social ability are assumed to hold positions with greater emphasis on the importance of social interaction ($O_a > 0$). Work-related social capital investments depreciate over time (where δ is the depreciation factor) and are industry-specific (e.g. social capital investments made in industry J fully depreciate if i moves to another industry). This last effect is captured by the indicator function in the industry-specific social capital acculation equation.[5]

Finally, the return to social skills (which includes both general sociability and individual industry-specific social capital) depends on the organizational structure of industry. Burt (2000) argues that individuals with more people skills and social capital have an advantage in identifying and developing more rewarding opportunities that arise from a particular network structure. Burt points to three key dimensions of network structure: size, density, and hierarchy. Network size, N_{jt}, is the number of workers employed in industry J at time t. All else equal, I expect that the availability of more contacts means that more socially able individuals are more likely to receive diverse bits of information within the organization. Therefore, I hypothesize that the returns to sociability and individual industry-based social capital is increasing in network size (($w_{aN_j} > 0$, $w_{s_j N_j} > 0$).

In addition, one can characterize organizational structure by the mean ($\overline{s}_j$) and variance (σ_j^2) of the individual social capital stocks held by workers employed in industry J, where:.

$$\begin{aligned} \overline{s}_{jt} &= \frac{1}{N_{jt}} \sum_{i=1}^{N_{jt}} s_{ijt} \\ \sigma_{jt}^2 &= \frac{1}{N_{jt} - 1} \sum_{i=1}^{N_{jt}} (s_{ijt} - \overline{s}_{jt})^2 \end{aligned}$$

The general importance of social interaction in industry J is reflected by $\overline{s}_j$ (e.g. it can be viewed as a measure of network density). Conversely, σ_j can be viewed as a measure of the degree of specialization of social interaction within industry J (e.g. industries with organizational structures that are more centralized or hierarchical are expected to exhibit a higher level of σ_j).

Within the social network literature there is debate with respect to how one should expect the different dimensions of network structure to affect the rewards to people skills and social capital. Coleman (1990) argues that more dense networks give individuals more reliable communication channels and facilitate sanctions that make it less risky for people in the network to trust one another.

[5] Glaeser, Laibson, and Sacerdote (2002) develop a related framework focused on community-specific social capital, though these authors do not consider the role of individual sociability in social capital formation.

Following this argument, for a worker employed in industry J one would expect the returns to social ability and industry-specific social capital to increase with an upward shift in $\overline{s}_j$ ($w_{a\overline{s}_j} > 0$, $w_{s_j\overline{s}_j} > 0$). However a worker's wages should be less responsive to increased demand for sociability in other industries ($-J$) due to the industry-specific nature of individual-level social capital ($w_{a\overline{s_{-j}}} > 0$, $w_{s_j\overline{s_{-j}}} = 0$). Additionally, the network closure argument advocated by Coleman suggests a negative association between network hierarchy and wages ($w_{a\sigma_j} < 0$, $w_{s_j\sigma_j} < 0$).

Conversely, Burt (1992) emphasizes the connection between more hierarchical networks (i.e. networks with more holes in the social structure, or structural holes) and brokerage opportunities within organizations. In particular, structural holes serve as an opportunity to broker the flow of information between people and control the coordination of productive activities that bring together people from opposite sides of the hole. Based on this theory, one would also expect that industries with more hierarchical organizational structures should place a premium on sociability. Therefore, for a worker employed in industry J one would expect the returns to social ability and industry-specific social capital to increase with an upward shift in σ_j ($w_{a\sigma_j} > 0$, $w_{s_j\sigma_j} > 0$). Again, a worker's wages should be less responsive to increased demand for particularly high levels of sociability in other industries ($-J$) due to the industry-specific nature of individual-level social capital ($w_{a\sigma_{-j}} > 0$, $w_{s_j\sigma_{-j}} = 0$). In addition, the structural holes argument predicts a negative association between network density and wages ($w_{a\overline{s_j}} < 0$, $w_{s_j\overline{s_j}} < 0$).

In the empirical analysis that follows, I examine how the interaction between individual social skills and organizational structure affects wages. In doing so, I evaluate how well the competing predictions of the closure and structural hole arguments fair in explain wage variation in the United States labor market

Finally, it is important to note that the decision of an individual to work in a particular industry depends on expectations regarding the evolution of organizational structure of all industries over time. In this model, individuals specifically form expectations about future values of $O_j(a_i)$, $\overline{s}_j$, and σ_j. Therefore, in order to identify the returns to general social skills and individual industry-based social capital, my estimation strategy must address how workers select into industries.

3 Empirical Implementation

Following the theoretical model outlined in the previous section I consider the follow base model specification for estimation:

$$\ln w_{ijt} = a_i'\beta_{1t} + s_{ijt}\beta_{2t} + I_{jt}'\beta_{3t} + (a_i' \otimes I_{jt}')\beta_{4t} + (s_{ijt} \otimes I_{jt}')\beta_{5t} + \xi_{it}'\beta_{6t} + \nu_{jt} + \varepsilon_{it} \quad (1)$$

where a_i is a vector of time-invariant ability measures (including cognitive ability, personality, and social skill indicators), s_{ijt} is a measure of industry-

specific social capital, I_{jt} is a vector of measures of industry network structure, and ξ_{it} is a vector of time-varying and time-invariant personal characteristics (including measures of family background, general industry tenure, firm tenure, and work experience). The measures of personal characteristics are included to control for potential sources of endogeneity such as the mismeasurement of time invariant ability. The inclusion of measures of tenure and work experience are meant to ensure that β_{2t} and β_{5t} reflect returns to social capital instead of other forms of industry-specific human capital. Finally given that the data contain many observations for the same industry, I include industry random effects (ν_{jt}) to allow for the possibility of industry-specific shocks that affect wages.

An obvious concern with estimates based on model (1) is sorting of individuals into industries on the basis of unobserved heterogeneity. To account for fixed individual differences in wages that may be correlated with my measures of industry-specific social capital and industry network structure, I further estimate a modified version of model (1) allowing for individual fixed effects (γ_i):

$$\ln w_{ijt} = s_{ijt}\beta_2 + I'_{jt}\beta_3 + (a'_i \otimes I'_{jt})\beta_4 + (s_{ijt} \otimes I'_{jt})\beta_5 + \xi'_{it}\beta_6 + \gamma_i + \nu_{jt} + \varepsilon_{it} \quad (2)$$

where ξ_{it} is now a vector of only time-varying personal characteristics. An unfortunate consequence of the fixed-effects procedure is that I am unable to identify general returns to time-invariant ability (β_1) and I am unable to identify changes in the returns to ability, social capital, and industry network structure (as well as to interactions between these three characteristics) over time.

If the individual's choice of industry depends on unobserved time-varying characteristics that also determine wages, then the estimates from the fixed-effects will be biased. In order to deal with the selection issue, I can alternatively model the choice of industry jointly with the wage determination equation. Specifically, I envision a process in which individuals first make the decision whether to switch industries based on information available in period $t-1$ and then realize their wage in period t in either the same industry as period $t-1$ or in a new industry. The switching regression model with endogenous switching is defined as follows:

$$\begin{aligned}
\ln w_{ijt} &= X'_{ijt}\beta + \nu_{jt} + \varepsilon_{it}, \forall i \ s.t. \ j_t = j_{t-1} \quad (3.1)\\
\ln w_{ijt} &= X'_{ijt}\widetilde{\beta} + \widetilde{\nu}_{jt} + u_{it}, \forall i \ s.t. \ j_t \neq j_{t-1} \quad (3.2)\\
M^*_{it} &= Z'_{ijt}\lambda + f_{jt} - w_{it} \quad (3.3)\\
M_{it} &= 1 \text{ iff } M^*_{it} > 0 \Longrightarrow j_t \neq j_{t-1}\\
M_{it} &= 0 \text{ iff } M^*_{it} \leq 0 \Longrightarrow j_t = j_{t-1}\\
&\quad (\varepsilon, u, w)' \tilde{} N(0, \Sigma)\\
\text{with } \Sigma &= \begin{bmatrix} \sigma_{\varepsilon\varepsilon} & \sigma_{\varepsilon u} & \sigma_{\varepsilon w} \\ \sigma_{u\varepsilon} & \sigma_{uu} & \sigma_{uw} \\ \sigma_{w\varepsilon} & \sigma_{wu} & 1 \end{bmatrix}
\end{aligned}$$

If $\sigma_{\varepsilon w} = \sigma_{uw} = 0$, we have the switching regression model with exogenous switching. However, in my model estimation I allow for the possibility of endogenous switching. For the model outlined above, equation (3.1) corresponds to model (1) for non-industry movers while equation (3.2) corresponds to model (1) for recent industry movers. Specifically, I allow for the possibility that the estimated coefficients and industry fixed-effects vary between these two groups. Equation (3.3) models the individual's choice whether to switch industries. Particularly, I assume that this decision is information (Z_{ijt}) which includes the network structure characteristics of the industry where the individual worked in period $t-1$, as well as industry fixed-effects (f_{jt}) from the industry worked in period $t-1$. I estimate the coefficients for this system of equations utilizing maximum likelihood estimation.

In the section that follows, I detail the data utilized to estimate the above-mentioned models. In particular, I highlight the procedure by which I construct measures of individual industry-based social capital, as well as of industrial network structure.

4 Data Sources

4.1 Individual Characteristics

My wage and employment data comes from the National Longitudinal Survey of Youth (NLSY79). This dataset contains measures of cognitive ability (e.g. the AFQT score), personality (e.g. the Rotter locus of control score) as well as different measures of sociability. In particular, the 1979 survey includes a measure of how easy it is for respondents to make friends in school. The 1984 survey contains a measure of the number of social clubs respondents participated in during high school. The 1985 survey contains self-assessed reports of contemporaneous sociability (when the respondents were 20-28 years old) and sociability at age six. I plan to utilize all or part of these measures to construct an indicator of individual social skill. Finally, this dataset also contains the occupational and industrial histories of individual workers, which should allow for the construction of a measure of industry-specific social capital (which will also depend on occupational data detailed below).

4.2 Individual Industry-based Social Capital

Based on the conceptual discussion above, I consider individual industry-based social capital to be a function of industry tenure as well as an individual's position within the organizational structure of his or her particular industry over the course of this tenure. In order to measure an individual's position in their industry's social network I utilize occupational social task requirement data provided by the Fourth and Revised Fourth Editions of the Dictionary of Occupational Titles (DOT). In particular I consider DOT measures of occupational requirements for (i) adaptability to accepting responsibility for the direction, control,

or planning of activity, (ii) adaptability to situations involving the interpretation of feelings, ideas, or facts in terms of personal viewpoint, (iii) adaptibility to influencing people in their opinions, attitudes or judgements about ideas or things, and (iv) adaptibility to dealing with people beyond giving and receiving instructions.[6] The DOT provides a binary indicator of the presence or absense of these social task requirements in each occupation that it details. I contend that these measures are reflective of the number of connections or bonds that an individual has with others within the industry network, while they also capture the quality or importance of these bonds within the overall network structure of the individual's given industry. As such, I utilize individual data on industry tenure interacted with a (time-weighted) index of occupational social task requirements during a given tenure period to construct a measure of individual industry-based social capital.

4.3 Organizational Structure of Industry

Similarly to the construct of individual industry-based social capital, I use occupation level data on skill requirements coupled with the occupational composition of a given industry's workforce to characterize the organizational structure of industry. This methodology follows closely Autor, Levy, and Murname (2003). In particular, I use occupational employment by industry (based on the Current Population Survey - CPS) to calculate a weighted average of the social skill requirements (from the DOT) for the average worker of each industry for each year. Similarly I compute the standard deviation of social skill requirements across occupations within each industry for each year These measures of organizational structure are sensitive to within occupational skill requirement changes as well as shifts in occupational composition within industry.[7] They are meant to represent the network density and network hierarchy of individual industries across time. However, in order to construct measures that are more inline with conceptual framework highlighted above I may attempt to weight these measures by the age or the tenure profile of workers by occupation and industry. Finally, I use total employment by industry as a measure of industrial network size.

5 Trends in Industrial Network Structure

To be completed. In this section I will provide a descriptive analysis of trends in industrial network structure. In particular, I aim to investigate whether there have been systematic changes in industrial network structure over time,

[6] These four variables are considered to be occupational temperaments that measure adaptability requirements of workers in specific job-worker situations. Autor, Levy, and Murnane (2003) use the first variable as their measure of interactive skills, while Borghan, ter Weel, and Weinberg (2006a) use the last three variables to construct their measure of social skill requirements.

[7] In particular, the revised Fourth Edition of the DOT (1991) updates task requirement data for 2,453 of the 12,742 occupations detailed in the Fourth Edition (1977).

and if so whether these changes have been concentrated in a select number of industries orif they have occured more generally across the US economy. I then intend to relate this evidence to potential implications for the return to industry-based social capital relative to the return to general social skills. In addition, I will focus on how changes in industrial network structure relate to changes in informational technology prices and to the potential differential responsiveness of industries to the adoption of this type of technology.

6 The Returns to Social Skills and Industry-based Social Capital

To be completed. In this section I aim to discuss the main empirical findings of the paper with respect to the returns to social skills and industry-based social capital, as well as any robustness checks related to these results. In particular, I will relate these findings to the hypothesized outcomes of the closure and structural hole arguments outlined in Section 2.

7 Discussion

To be completed. In addition to discussing the implications of the empirical findings presented in sections 5 and 6, I also intend to discuss the role of schools in developing social skills as well as potential avenues of related future research.

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