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Social Interactions and Labor Market Outcomes of  
War Veterans: Dissertation Summary

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# Social Interactions and Labor Market Outcomes of War Veterans

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Social networks play an important role in the labor market. Various surveys document that from 30 to 60 percent of jobs are found through friends or relatives. To better understand how networks operate in the labor market, I examine how networks that were formed involuntarily as a result of military drafts in the American Civil War and the First World War affect the postwar labor market outcomes of veterans in 1880, 1900, and 1930.

My study uses two data sets. The first contains new data on 1,295 drafted American infantrymen who served together overseas during World War I, and was formed by matching military service records, prewar draft records, and postwar information from the 1930 census, as well as information on up to 60 of a veteran's nearest neighbors in 1930. The second, collected by Fogel et al. (2000), matches 35,570 Civil War veterans to postwar censuses. I exploit the time-series feature of the Union army sample and eliminate all unobserved individual and group-level fixed effects.

For both samples, the military unit's overall unemployment rate has a negative and statistically significant effect on a veteran's own likelihood of employment. The findings are consistent with a model in which information about job vacancies is communicated through the network. Both samples are fairly representative of the white working-age male population, therefore contributing to the external validity of the results.

I introduce a new framework which allows one to further decompose the social effect into its two components, the endogenous ("the effect of others' outcomes"), and the contextual ("the effect of others' characteristics"). I show that the two effects are separately identified, provided that some people belong to more than one group. I apply the framework using two types of reference groups for each veteran: 1) those who had served in his unit and 2) his neighbors. I find the endogenous effect to be much stronger than the contextual effect, indicating the presence of a large social multiplier: a change in an individual's employment propagates through the network and affects the employment of others. The framework is also applicable in other settings, since in many cases individuals are potentially affected by multiple types of reference groups.

## I. Overview

During the past few decades, there has been a growing interest in social networks among economists. Economists have examined the effect of social interactions in a wide variety of areas. In the labor market, various surveys have

documented the importance of the informal channel—that is, finding jobs through friends and relatives. Ioannides and Loury (2004) summarize a number of surveys which find that 30–60 percent of jobs (in various industries and of various statuses) are gotten through the informal channel.

This dissertation has twin goals. The first is to study the role social networks play in the labor market. This work seeks to empirically investigate how social networks affect labor market outcomes by examining groups that were formed involuntarily because of a quasi-random event. I examine the postwar outcomes of two groups of veterans, Civil War veterans and World War I veterans. I also make use of a new panel data set I constructed of American war veterans who were drafted and served together during World War I. The second goal is to introduce and illustrate an application of a new methodology for decomposing the social effect into its two components, the *endogenous* and the *contextual* effects.

In Chapter 2, I introduce a new framework, Multiple Reference Groups, which allows one to separately identify the two components of the social effect. The components are commonly referred to in the literature as the contextual (or exogenous) and endogenous effects. The endogenous effect measures the effect of a statistic of the group outcomes (say, the average unemployment rate of a group), and the contextual effect is the effect of the group characteristics (say, the race and average age of group members). Manski (1993) was the first to introduce the reflection problem. Informally, one type of this problem refers to the inability to separately identify these two types of effects. In other words, one cannot identify whether some group characteristics have a direct effect on an individual (the contextual effect) or are reflected and mistakenly attributed to the effect of the group members' outcomes (the endogenous effect). My methodological contribution can be used to separately identify the two effects if some people are influenced by more than one reference group. I further show how to estimate the two effects by explicitly solving for the two effects. This allows for a comparison of the relative importance of the two effects. The magnitudes of the two types of social effects determine the extent to which a change in one's outcome affects others in the group. Finally, I show that the identification result holds even if one of the groups has perfectly correlated unobservables.

In the empirical part of my dissertation (Chapters 3 and 4) I focus on the effect of social interactions on the labor market outcomes of war veterans. The settings I consider allow me to address some of the critical issues faced by many empirical studies of social influence and peer effects. The three primary advantages of the settings I consider are that I observe all members of the groups (and these groups are well defined), that groups were formed because of an exogenous shock, and that I observe labor market outcomes of interest, such as employment.

The data sets contain information on actual ties between agents. I observe the actual group memberships, and all members of the group. Furthermore, the groups I examine had all experienced battle and were likely to forge meaningful ties. While the standard economic data sets include a wealth of information on labor market outcomes, they lack information on group membership. Surveys that include additional information on the channel through which a job was obtained (for example, a neighbor as opposed to an employment agency) can only be used to test various predictions or highlight the importance of a certain channel. Without additional information on the actual group members who caused the outcome, one cannot hope to further uncover the mechanisms through which social interactions operate.

I examine groups that were formed involuntarily because of an exogenous shock—the American Civil War or America’s decision to enter World War I and its need to quickly raise a large army. This allows me to use far less restrictive assumptions. In contrast, in most instances, groups or social networks are formed endogenously. This can lead to many potential problems in inference, an issue that is recognized by almost every empirical study. For example, consider a case in which individuals with a higher unobserved ability (unobserved by the researcher) choose to become members of groups with higher observed group characteristics (such as average level of education). A straightforward estimation of the effect of the group characteristic will lead to biased results. As emphasized by Moffitt (2001), in the case of group interactions, correcting for this selection is even more challenging than the usual selection bias in the nongroup case.

Realizing the importance of having randomly assigned groups, researchers in recent years examined social interactions in various settings in which groups were randomly assigned (for example, Sacerdote [2001] and Zimmerman [2003]). However, many of these studies focus on populations or outcomes that are somewhat specialized. The samples I examine represent an important segment of the labor market, namely, working-age white males. Because the samples I study are fairly representative of the entire working-age male population, one may be more inclined to use the findings to address policy issues that affect the general population.

In Chapter 3, I focus on a sample of World War I veterans. I construct a new data set of American men who were drafted and served together in World War I during the years 1917–1919 and use it to examine the effect of networks formed during the war on postwar (1930) likelihood of employment. In the 1930 census, I find that a group’s unemployment rate has an economically and statistically significant effect on a veteran’s own likelihood of being employed. The magnitude of the effect can be summarized as follows: all else being equal, a 1-percentage-point increase in his peers’ unemployment rate decreases a veteran’s likelihood of employment by 0.3–0.4 percentage points. I then provide robustness checks

to address various concerns. For example, I examine alternative specifications of the correct reference group and find that larger groups, such as battalions (which consist of four military companies) have no statistically significant effect. I also find the employment outcomes of other military companies within the same regiment to have no statistically significant effect. I show that the company’s group effect persists after controlling for the prewar place of residence of the group’s members by exploiting the variation in the group’s composition of prewar locations. I also provide a discussion of some of the mechanisms through which social effects may operate in the labor market, as well as present a simple model of networks and employment.

I conclude Chapter 3 with an empirical application of the Multiple Reference Groups method. The method is illustrated by considering my sample of World War I veterans. For each of the veterans, the two groups of reference are 1) the men who had served with that veteran during World War I, and 2) a group of his closest (in terms of distance) neighbors. I find that the endogenous effect is much larger than the contextual effect. For various characteristics, the results suggest that at most, 20 percent of the total social effect on employment is due to the contextual effect.

The final chapter of the dissertation, Chapter 4, examines the labor market experiences of Civil War veterans of the Union Army. The contribution of this chapter is twofold. First, as in the World War I case discussed above, the Union Army sample provides an unusual circumstance under which networks were formed, namely a large-scale war, coupled with a rich data set which provides information on all members of a reference group, as well as labor market outcomes over time. Second, the time-series nature of the sample—that is, the fact that I observe the employment outcomes of the men during several periods after the war—allows me to remove any effect that is due to an individual or group-level unobserved effect, provided that these unobserved effects are constant over time.

I find evidence of a statistically and economically significant peer effect among the Union army veterans. For example, in the 1900 census, the marginal effect of a 1-percentage-point increase in one’s peers’ long-term unemployment rate (defined as six or more months of unemployment in the past year), all else being equal, increases one’s probability of being unemployed over the long term by an additional 0.2 percentage points. The statistically significant effect persists after correcting for the simultaneity generated by the peer effects and controlling for personal characteristics such as age, marital status, occupation, and macroeconomic conditions. Using the time-series nature of the sample to remove any individual and unobserved-group-level fixed effect, I illustrate the advantage a time-series data set provides, as it allows one to estimate the social interaction regardless of the source or nature of the unobserved group- and individual-level charac-

teristics (under the assumption that this unobserved effect is constant across the periods used).

## II. Policy Implications

This dissertation makes several contributions to the study of social interactions from a policy standpoint. Social networks formed during war allow for a rare opportunity to examine the results of what would otherwise be a difficult social experiment to carry out. The empirical findings suggest that social interactions play an important role in the labor market even when groups are involuntarily formed. Two features of the samples examined make the results more likely to extend to other settings of interest. First, in both cases (Civil War and World War I), the sample is representative of the white working-age male population. Second, the groups I examine are fairly heterogeneous in their makeup. This could be of special importance if one is trying to understand the effect of forming heterogeneous groups, such as the busing of school children.

My findings highlight the importance of taking social interactions into consideration when evaluating policies that target participants in the labor market. I find a sizable social effect on employment, and that a large part of the total effect on employment is attributed to the endogenous component. My findings suggest that it is the actual employment of others which matters, not the characteristics of others. This is consistent with the existence of a large multiplier effect, or spillover effect. Though there is an extensive literature evaluating the effect of various programs on employment, there has been little attention paid to the spillover these programs generate as the effects propagate through one's social network. Targeting the employment of certain individuals within a group will also affect the employment of those not directly targeted. Policies or programs that target employment should therefore consider the additional benefit that would propagate through social networks.

Though it would be hard to imagine an incentive scheme or government intervention that would radically change people's choice of association, government intervention could help to strengthen and encourage the formation of contacts among those already likely to associate. This could be the motivation for strengthening associations for minorities, women in business, etc. For example, Moffit (2001) notes that in Europe there have been programs to support networking among people of low socioeconomic background. By better understanding how networks operate, we can better design such programs.

The main methodological contribution of this dissertation is providing a framework that allows one to separately identify the contextual and endogenous effects. The magnitudes of the two types of social effects determine the extent to which a change in one's outcome affects others in the group. This has important policy implications for determining the

benefit of virtually any program, be it welfare, job training, or schooling. Since individuals are often affected by multiple circles of influence (such as neighborhood, family, friends from high school, friends from college, etc.), the framework can be applied in many settings.

To give an example of the importance of the decomposition, consider a principal of a school who must decide how to assign children to classrooms. Assume he or she observes the characteristics of the children. For a given pool of children, an assignment to groups could lead to different results, depending on the magnitude of the two effects. If the principal knew the relative importance of the two effects, he or she could optimally assign the children to classes in order to maximize some objective, such as helping the weaker students, or maximizing the average test score, or any other goal.

This dissertation also illustrates the advantage a time-series data set can provide. For instance, consider a case in which policymakers are collecting data to study the effect of social interactions for the purpose of program evaluation. It is important to give serious consideration to collecting data over several time periods (a time-series approach). While the collection of time-series data will be more costly, the results of the evaluation are likely to be more credible.

## III. Data

The dissertation uses two data sets, Civil War veterans and World War I veterans. The military group used as the reference group in most of the specifications is the military company (a company consisted of 100–200 men) in which each veteran served during World War I or the Civil War. There are several advantages that groups formed during military service provide. These include the exogenous circumstance under which the groups were formed, scope and size of reference group, and strength of ties.

From a methodological point of view, the major advantage of examining a military setting is the way in which companies were formed. Unlike most other settings, formation of networks in this case was involuntarily and due to an exogenous shock. Further, the nature of the experience was likely to create strong bonds. All of the men examined participated in battle. The men not only spent all of their time with each other but also depended on one another and had to develop the ability to work as a team. At times their lives depended on the actions of their comrades. Unit spirit and pride were also encouraged by the military, as a way of building unit cohesion.

Because the nature of the assignment is crucial, I further investigate its properties. For the World War I sample, I show that assignment is consistent with random assignment, as well as provide more detail on the mechanisms of the draft. In the case of the Union Army sample, the geographic component has strong predictive power in determining as-

signment to groups. I exploit the time-series nature of the available sample to overcome the concern that an unobserved group characteristic is, in fact, behind the findings that some observed group characteristics have a statistically significant effect. For both samples, I also show that the sample is quite representative of the working-white-male population.

**World War I Sample (Chapter 3).** I constructed a new data set of World War I veterans from various sources. It consists of United States infantrymen who had served together during World War I in the 313th Infantry Regiment, Seventy-Ninth Division. The core sample of men ( $n = 1,295$ ) were all drafted and had fought overseas. I focus on the military company as the individual's reference group and examine *all* those in his unit. All of the units I examine consist of men who trained together, were deployed to Europe, and fought together overseas.

In addition to their military service records, the men were linked to two additional data sources, the 1930 United States census of population and their prewar draft registration card. Finally, for each of the men linked to the census of 1930, information about up to 60 of their nearest neighbors was collected.

The linked data set allows one to observe those who had served together in the same military company, and to observe theirs and their neighbors' postwar outcomes in the 1930 census, while controlling for their prewar place of residence and occupation. The 1930 census includes information on labor market outcomes (such as employment, occupation, and industry), housing market information (such as ownership and housing values), and various demographics (such as age, race, parents' place of birth, and immigration information). The military service records provide information on place of residence prior to enlistment, place and date of birth, ranks and promotions, citations and court martials, whether wounded, and the (military) company affiliation within the regiment. The draft registration records were used to obtain information on the men's occupation prior to enlistment.

**Union Army Sample (Chapter 4).** The data in this chapter are primarily based on the Union Army Study, a monumental data collection effort led by Fogel et al. (2000). It contains the members of 303 companies in the American Civil War Union Army. They were randomly drawn from a sample of over 20,000 companies, whose records are stored at the National Archives in Washington, D.C. The 303 companies chosen were all part of volunteer white infantry regiments and represent all of the participating states except for Rhode Island. The base sample consists of the military records of the 35,570 individuals in those companies. The sample was then linked to the censuses of 1860, 1870, 1880, 1900, and 1910, as well as pension records.

I make use of the linked files of the 1880 and 1900 censuses as well as information from the pension files. I do

not use the other census years, since the 1870 census does not contain employment status (just occupation), and by the 1910 census the majority of the sample belongs to an age group that is highly likely to be retired or deceased. In addition, I have used the 1880 and 1900 census Integrated Public Use Microdata Series (Ruggles et al. 2004) to calculate various local labor-market conditions.

## IV. Methods and Findings

Broadly defined, the empirical part of the dissertation uses three types of specifications: reduced-form, instrumental variables, and separating the social effect using the Multiple Reference Groups framework.

To give a brief illustration, assume there are  $g = 1 \dots G$  groups, each with  $n_g$  members  $i = 1, 2 \dots n_g$ . One of the econometric specifications can be written as

$$y_{i,g} = h[\alpha + x'_{i,g}\beta + Z'_g\gamma + \rho \cdot m(\bar{y}_{-i,g}) + \varepsilon_{i,g}],$$

where each individual, indexed by  $i,g$ , has an outcome of interest  $y$ , say the binary outcome of being employed or unemployed, a vector of covariates  $x$ , which affect the likelihood of employment, such as age, occupation, and local labor-market conditions, and an error term  $\varepsilon_i$ , a scalar capturing the individual unobservable characteristics and shocks to his or her employment prospects. In addition, each individual's job prospects might depend on the group's characteristics, summarized by the vector  $Z_g$  and the outcomes of all other members in the group  $\bar{y}_{-i,g}$ .  $\gamma$  is often referred to in the literature as the contextual (or exogenous) effect, and  $\rho$  as the endogenous effect.

The reduced-form specifications test whether the characteristics of others (but not the actual outcomes of others) are consistent with the existence of peer effects. I find that the characteristics of the military unit, such as the average age of unit members, and the neighborhood-block characteristics, such as marriage rate and the average age of those in the labor force, have a statistically significant effect on employment. I interpret the fact that I find a statistically significant effect as consistent with the existence of a peer effect in determining unemployment. The reduced-form specification can be written as

$$y_{i,g} = h[\alpha + x'_{i,g}\beta + \bar{X}'_{-i,g}\gamma_{1r} + Z'_{-i,g}\gamma_{2r} + \varepsilon_{i,g}],$$

where  $\bar{X}_{-i,g} = \frac{1}{n_g-1} \sum_{j \in g, j \neq i} x_j$ . The reduced-form coefficients  $\gamma_r$  are a measure of whether a social influence exists. However, it is difficult to attach any meaningful economic interpretation to the magnitude of the estimates.

For both samples, I implement an instrumental variable specification. For example, for the World War I sample, I use as an instrument for the unit's unemployment rate the compounded unit-neighborhood measure, such as the average

of the average labor-force age across all blocks in which the company members reside. The statistically significant results suggest a sizable peer effect. In regard to the validity of the instrument, while it is possible that an individual chooses to live in a block based on the average age of its members, the instruments I use are based on the average across all blocks in which the members of each military company reside. These instruments are based on the characteristics of hundreds of others, and are likely to be uncorrelated with one's individual unobserved characteristics. The more crucial assumption is that the average age of the neighborhood does not have a direct contextual effect but only operates through the endogenous effect, the group's average unemployment rate. This assumption cannot be tested. Therefore, I make use of the Multiple Reference Groups framework, which allows for estimation of both the endogenous and contextual effects.

For the Multiple Reference Groups specification, I examine two groups to which each World War I veteran belongs: 1) the veterans that served with him, and 2) those residing in his neighborhood block. I find a large and statistically significant social effect on employment. When considering the decomposition ( $\rho$  and  $\gamma$  above), the results suggest that the endogenous effect is more important than the contextual effect in the case of employment. The results imply that it is the employment status of others that matters for finding jobs, not the characteristics of others (such as whether they are professionals).

For the Union Army sample, the time-series nature of the sample provides an opportunity to purge any fixed (over time) unobserved group effect. In addition, any individual-level fixed (over time) unobserved characteristic would also be differenced out. My findings suggest that one's peer group unemployment rate has a statistically significant and negative effect on one's own likelihood of employment.

## V. Conclusion

This dissertation provides evidence on the effect of one's peer group on one's own likelihood of employment using two samples, one of Civil War veterans and one of World War I veterans. The effect is substantial in size and is statistically significant, controlling for various local labor-market conditions and owner characteristics.

I also examined the case in which some members belong to multiple reference groups and proved that the endogenous and contextual effects are separately identified in the linear-in-means case. This result is in contrast to Manski (1993), who shows that in the single group case in the linear-in-means setting the two effects are not separately identified. Moreover, the result holds true even if one of the groups has perfectly correlated unobservables. Hence, this framework can potentially be used in other settings to study other questions. I illustrated how to separate the two types of social effect using the sample of veterans and their neighbors. I

found that a large part of the total effect on employment is attributed to the endogenous component. My finding suggests that it is the actual employment of others that matters, not the characteristics of others. This finding is consistent with the informational channel being an important one. This finding also suggests a large multiplier effect, or spillover effect.

In order for the findings to be extended to networks formed in other circumstances, ties formed during military service cannot differ substantially from those formed in other types of settings. This depends on what the underlying mechanism is that networks formed during military service operate through. Is it strong bonds formed among a small group of men? The importance of weak ties (Granovetter 1975) might suggest otherwise. Is there an extra emotional value, such as unit pride, that increases the strength of ties beyond what would otherwise be the tie between two people who met? If so, would this type of affiliation be all that different from that experienced by the alumni of a college? Answers to such questions will help in determining the external validity of the results.

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