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**Working Paper**

## Social interactions and unemployment

Working Paper, No. 2003:15

**Provided in Cooperation with:**

IFAU - Institute for Evaluation of Labour Market and Education Policy, Uppsala

*Suggested Citation:* Hedström, Peter; Kolm, Ann-Sofie; Åberg, Yvonne (2003) : Social interactions and unemployment, Working Paper, No. 2003:15, Institute for Labour Market Policy Evaluation (IFAU), Uppsala

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IFAU – INSTITUTE FOR  
LABOUR MARKET POLICY  
EVALUATION

# **Social interactions and unemployment**

Peter Hedström  
Ann-Sofie Kolm  
Yvonne Åberg

WORKING PAPER 2003:15

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# Social interactions and unemployment<sup>#</sup>

by

Peter Hedström\*, Ann-Sofie Kolm\*\* and Yvonne Åberg\*\*\*

10 November 2003

## Abstract

This paper is concerned with social interactions and their importance for unemployment. A theoretical model is specified in which the psychological costs of unemployment depend upon the unemployment level. The analysis reveals social multiplier effects, and shows that multiple unemployment equilibria may emerge. Data on all 20- to 24-year-olds living in Stockholm during the 1990s are used to test hypotheses from the model. The results show that individuals' transition rates out of unemployment is strongly influenced by the unemployment level within their neighborhoods.

Jel-codes: J64, Z13

Keywords: Social interactions, social norms, social multipliers, unemployment

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<sup>#</sup> Earlier versions of this paper have been presented at the Swedish Collegium for Advanced Studies in the Social Sciences, the annual meeting of the American Sociological Association, the Department of Sociology at Stockholm University, the Institute for Labour Market Policy Evaluation in Uppsala, the Department of Sociology at Oxford University, and the Department of Economics at Uppsala University. We wish to thank the seminar participants for their valuable comments. In addition we wish to thank Magnus Bygren, Christofer Edling, John Goldthorpe, Carl le Grand, Bertil Holmlund, Mia Hultin, Tomas Korpi, Charles Manski, Oskar Nordström-Skans, Sten Nyberg, Michael Sobel, and Michael Tåhlin for their valuable written comments on previous versions of the paper. The research reported on here has been made possible by grants from the Institute for Labour Market Policy Evaluation and the Swedish Council for Working Life and Social Research.

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# 1 Introduction

During the last several years, social scientists and policy makers have paid increasing attention to the importance of neighborhood-based social interactions. Although part of the neighborhood effects reported in the literature are undoubtedly due to unobserved differences among the individuals residing in different neighborhoods,<sup>1</sup> the weight of evidence seems to suggest that neighborhood-based interactions are important for explaining the emergence and persistence of various kinds of social problems. Some of the best empirical work to date (e.g., Katz et al. 2001; Ludwig et al. 2001) strongly suggests this to be the case, and given what we know about individual behavior in other realms of society, it would be most surprising if neighborhood-based interactions were of negligible importance.

In this paper we focus on the role of social interactions in explaining unemployment. We will try to be fairly precise as to why we believe that social interactions are likely to influence unemployment, and we will use a large-scale dataset to try to assess their importance. In the next section, we will define more precisely what we mean by a social-interaction effect, and we will distinguish between different types of social-interaction effects on the basis of how the action of one individual influences that of another. Thereafter we develop a theoretical model that allows us to consider how unemployment levels and transition rates out of unemployment are likely to be affected if social-interaction processes are at work. We start off within a partial equilibrium framework (section 3) and then we consider the implications of social interactions within a general equilibrium framework (section 4). In section 5 we use empirical data to test some of the key predictions of the model. We examine differences in unemployment levels between different neighborhood-based reference groups, and analyze whether they appear to systematically influence individuals' transition rates out of unemployment. Finally, in section 6, we summarize our results and discuss some implications of them.

We believe that this paper contributes to the existing literature both theoretically and empirically. Economic theoretical modeling of social processes has made substantial progress since the highly influential work by Akerlof

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<sup>1</sup> See Jencks & Mayer (1989), Evans et al. (1992), Manski (2000), Ginther et al. (2000), Moffitt (2001), and Sampson et al. (2002) for surveys and critical discussions of the literature on neighborhood effects.

(1980). For example, social norms and social customs have now been incorporated into models of criminal behavior (Glaeser et al. 1996), savings and growth (Cole et al. 1992), and tax evasion (Gordon 1989). The modeling in the present paper is most closely related to the analyses of welfare stigma and welfare use by Besley & Coate (1992) and Lindbeck et al. (1999). These studies focus on the individual's voluntary choice between living off of social welfare benefits or earning one's own living. The modeling in the present paper differs from these in that we focus on the social and psychological costs of involuntary unemployment, and we use a model in which wages and unemployment are endogenously determined.

Considering that it is rather well recognized in the public debate that social interactions can reduce the social and psychological costs of being unemployed and thereby lead to the establishment of unemployment 'cultures', one would have expected there to be a significant number of relevant models featuring unemployment as an endogenous outcome. However, to the best of our knowledge, this is the first model of equilibrium unemployment that shows how social and psychological costs of involuntary unemployment can influence unemployment levels.

Our theoretical model extends the basic search model of Pissarides (2000) and takes into account the interaction-based costs of being unemployed. More precisely, our model assumes that the social and psychological costs of being unemployed fall when the unemployment level among others increases. We start off in a partial equilibrium framework with exogenous wages. Thereafter we endogenize wages and consider the implications of social interactions for general equilibrium. In equilibrium, the unemployment level is affected by social interactions because the social and psychological costs they give rise to influence the search intensity of the unemployed and the wage bargains being struck. We show that multiple unemployment equilibria may emerge.

Our paper is also related to a growing body of empirical work on the importance of social interactions for various social and economic processes. Crane (1991) analyzed the importance of social interactions for teenage child-bearing and school dropout in the United States. Hedström (1994) studied the diffusion of trade unions in Sweden at the turn of the 19th century from a social-interaction perspective. Ichino & Maggi (2000) analyzed the role of social interactions in explaining differences in absenteeism from work between northern and southern Italy. Åberg (2003) analyzed the role of external social interactions for couples' decisions about marriages and divorces.

Our paper differs from the above mentioned studies not only in terms of its substantive focus but also in its research design.<sup>2</sup> We have access to a rather unique dataset that reduces some of the problems encountered in previous analyses of social-interaction processes.<sup>3</sup> First of all, our dataset has sufficiently many data points that we can confine the analysis to individuals residing within the same local labor market. We thereby reduce the risk of mistaking spatial variations in vacancy rates and other environmental conditions for social-interaction effects. Second, and to anticipate one of the empirical findings reported later in this paper, there appears to be a great deal of individual heterogeneity in the susceptibility to social influence from others. In order to control for such heterogeneity, it appears essential to use micro-level data. Our dataset is a nine-year panel with information on the exact length of all unemployment spells and detailed information on a range of relevant covariates for approximately 95,000 20- to 24-year-olds who resided in the Stockholm metropolitan area during the 1990s. In combination with fixed-effect specifications this type of data gives precision to the analysis and is likely to reduce omitted-variable bias. Finally, we have data on all individuals residing in this geographical area, including information on their residential addresses. This gives us more flexibility in defining and measuring the behavior of potentially important reference groups than has typically been possible in previous studies. Our research design most closely resembles that of Bertrand et al. (2000) in that we focus on how individuals' behavior is related to the typical behavior in tightly defined reference groups after controlling for time-invariant omitted variables using fixed-effect specifications. An important design difference between our study and that of Bertrand et al. is that we have access to detailed panel data, while they based their analyses on cross-sectional data.

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<sup>2</sup> See Topa (2001) and Topa & Conley (2002) for two studies with a substantive focus similar to ours. Their research design is rather different, however, in that they base their analyses on aggregate data.

<sup>3</sup> Broadly speaking, three general types of problems are at the core of empirical analyses of social interactions: (1) Selection effects and omitted-variable bias can easily be mistaken for social-interaction effects. (2) It is difficult to identify social interaction effects because of the 'reflection problem', particularly when using cross-sectional data. (3) Existing datasets do not typically allow the behavior of relevant peer groups to be properly measured. See Manski (1995), Durlauf (2001), and Moffitt (2001) for more details.

## 2 Social-interaction effects

As mentioned above, this study is motivated by a prior belief in the importance of social interactions. Before analyzing how social interactions are likely to influence unemployment, we will try to define more precisely what we mean by a social-interaction effect, and how such effects differ from other related types of behavioral patterns.

One can distinguish between at least three types of effects that can result in individuals in a group acting in a similar manner, and only one of these has anything to do with social interactions. We can use the following example from Max Weber to clarify the differences between these types of effects:

Social action is not identical with the similar actions of many persons.... Thus, if at the beginning of a shower a number of people on the street put up their umbrellas at the same time, this would not ordinarily be a case of action mutually oriented to that of each other, but rather of all reacting in the same way to the like need of protection from the rain. (Weber, [1921-22] 1978:23)

This piece of everyday behavior is not ‘social action’ explained by some form of interaction between the people on the street, but is due to an *environmental effect*, in this case a rainfall that made all actors adjust their action in a similar manner. Such environmental effects can easily be mistaken for interaction effects. Assume that Weber’s rainfall started at one end and gradually spread along the street. The pattern of umbrella use would then ‘diffuse’ in a way that could easily give the impression of being a genuine social-interaction effect, where one individual’s umbrella use increased the likelihood that adjacent persons would use one as well (Hedström et al. 2001).

Even if during said rainfall we observed that the frequency of umbrella use was higher among those walking on one street than on another, this would not necessarily mean that we were observing the outcome of some sort of interaction process. It could simply be due to a *selection effect*, in this case that individuals with a preference for using umbrellas for some reason ended up walking on one of the streets rather than on the other. For example, if the stores on one street catered to young people, the observed pattern simply could be due to an age-based selection effect since young people are less likely to use umbrel-

las. If we do not take such differences into account we may easily mistake selection effects for social-interaction effects.

Environmental effects and selection effects differ from social-interaction effects in that the correlated behavior they give rise to has nothing to do with individuals influencing one another. A *social-interaction effect* exists if -- and only if -- it was the umbrella use of others that influenced the focal individual's use of the umbrella. A bit of introspection on our part suggests that we sometimes hesitate to use an umbrella for reasons of vanity; being the only person using an umbrella could indicate to others that we were excessively concerned with our appearances. Although we would have liked to use an umbrella, we decided against it in order not to send such signals. But once others started to use their umbrellas we quickly followed suit. This would then be an example of a social-interaction effect, because it is the actions of others that influence our decision whether to use an umbrella or not.

The distinctions introduced so far may be summarized as follows: An environmental effect is operative if we do what we do because we are where we are. A selection effect is operative if we do what we do because we are who we are. And finally, a social-interaction effect is operative if we do what we do because others do what they do.

Social-interaction effects can arise for rather different reasons, and in order to better understand why we observe what we observe it is useful to try to distinguish between them. As suggested by Hedström & Swedberg (1996), one can distinguish between at least three broad types of social interactions, opportunity-based, belief-based, and desire-based interactions (see also Manski 2000 for similar distinctions). Consider the case of an unemployed individual and an action that influences the likelihood that the individual will remain unemployed. How can the unemployment level among others influence this action? The general answer is that this can occur in three different ways, which are exemplified below: (1) the unemployment level among others can influence the focal individual's opportunities, and thereby his or her choice of action; (2) it can influence the focal individual's beliefs, and thereby his or her choice of action; and/or (3) it can influence the focal individual's desires, and thereby his or her choice of action.

In the theoretical model to be developed in the next section we focus on desire-based interactions, i.e., on how the unemployment level among others influences the social and psychological costs of being unemployed and thereby subsequent unemployment levels and unemployment spells. Our focus on

desire-based interactions does not mean that we consider the other two types of mechanisms to be of lesser importance. Opportunity-based interactions are prominent as unemployed individuals often find jobs via employed friends or acquaintances (Granovetter 1995, Topa 2001, Calvo-Armengol & Zenou 2001). As the unemployment levels among others often influences unemployed individuals' beliefs about the prospect of finding a job and thereby their search intensity (Sweitzer & Smith 1974), belief-based interactions are likely to be important as well. At least as far as the unemployed individuals' likelihood of leaving unemployment is concerned, these opportunity- and belief-based interactions are likely to operate in the same direction as the desire-based interactions. Therefore, they are likely to amplify rather than counteract the desire-based social-interaction effects focused upon in the theoretical analysis. The empirical analysis is likewise concerned with social interactions in general and not only with desire-based interactions.

One reason for expecting desire-based interactions to be important in the context of unemployment is the existence of strong normative pressures to earn one's living. Being unemployed usually means that one cannot live up to this norm, and this may bring about feelings of shame or embarrassment (Elster 1983). In Zawadski & Lazarsfeld's classical study of the psychological effects of unemployment in Poland in the 1930s one can find the following autobiographical note of an unemployed mason:

How hard and humiliating it is to bear the name of an unemployed man. When I go out, I cast down my eyes because I feel myself wholly inferior. When I go along the street, it seems to me that I can't be compared with an average citizen, that everybody is pointing at me with his finger. I instinctively avoid meeting anyone. Former acquaintances and friends of better times are no longer so cordial. They greet me indifferently when we meet. They no longer offer me a cigarette and their eyes seem to say, "You are not worth it, you don't work."  
(Zawadski & Lazarsfeld 1935:239)

Although the details of the Polish mason's experiences may seem a bit dated, they highlight an important aspect of the unemployment experience that is as present today as it was in Poland in the 1930s: being unemployed is often associated with strong feelings of shame and embarrassment.

An important reason why the unemployed often experience emotions such as these is that their situation deviates from what is considered normal or typical in their own reference group (Sherif & Sherif 1964). Since reference groups vary from individual to individual, however, the normative pressure is not likely to be felt equally intensely by everyone. In particular, the more common it is to be unemployed in a group, the weaker the normative pressure is likely to be, and the less likely it is that an unemployed individual will experience such emotions. As Lindbeck has expressed it: "Habits and social norms among individuals may often be more connected with subgroups in society than with the values of the population as a whole. This means that 'unemployment cultures' may develop within groups of interacting individuals who share similar unemployment experiences" (1996:18).

Desire-based interactions are also likely to be important for reasons that are unrelated to social norms. Being the only unemployed individual, for example, is likely to be a rather lonely and dull existence compared to one in which many of one's friends and acquaintances also are unemployed. When one's friends are unemployed and available for company, daily activities are probably more stimulating than when none of one's friends have the time to socialize during daytime.<sup>4</sup> Thus, an increase in unemployment among an individual's friends and acquaintances is likely to reduce the social and psychological costs of being unemployed through several different types of mechanisms.

There is a paucity of research on how the unemployment level among others influences the social and psychological costs of being unemployed. One important exception is Clark (2003). Using data from the British Panel Household Study, he reported results suggesting that the unemployment of others indeed influences an individual's unemployment experience. He found that it was easier for individuals to cope with unemployment (as measured with an index of subjective well-being) if they lived in places where many other people were unemployed, or if others in the household were unemployed.

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<sup>4</sup> As part of this study we conducted a series of in-depth interviews with unemployed individuals in the Stockholm region (see Wallander 2002). In these interviews the importance of the unemployment of friends and acquaintances is a recurrent theme. One person expressed himself in the following way: "Now with this beautiful weather it is wonderful to be unemployed. I have many friends who are unemployed, so I can meet them during the days. Instead of being locked up inside an office all the day one can be outside and play soccer. [...] But if all my friends were working I would want to do so as well. Otherwise I would just sit at home without anything to do."

The ‘others’ who influence a focal individual’s social and psychological costs can either be specific individuals with whom the individual interacts, or be some form of ‘generalized other’ representing a typical individual or a typical standpoint. In the latter case we no longer have an example of direct interaction between individuals, but an interaction between an individual and a social aggregate. The difference is well described in the following everyday example from Schelling: “I interact with an individual if I change lanes when his front bumper approaches within five feet of my rear bumper; I interact with a social aggregate when I adjust my speed to the average speed on the highway” (1998:33). In the model to be developed in the next section we assume that the interaction is mediated via a social aggregate, i.e., via the overall unemployment level.

### **3 A partial equilibrium search model with social interactions**

In this section we present a theoretical model that in a straightforward way captures some core features of social interactions. More specifically, we extend the basic search and matching model of Pissarides (2000) to take into account desire-based social interactions. We start off in a partial equilibrium framework where wages are assumed to be exogenous. This allows for a clear focus on how the search behavior of the unemployed is likely to be affected by social interactions. As will become clear, due to social interactions, individual search behavior will be altered in such a way that it reinforces the effects on unemployment of exogenous shocks. The mechanisms behind these social-multiplier effects will later be the focus of our empirical analysis. In section 4 we take the theoretical analysis one step further and ask what the implications of social interactions are likely to be for unemployment in general equilibrium. As then will become clear, the multiplier effects due to adjustments in search behavior will be reinforced by wage adjustments, and we show that multiple unemployment equilibria may emerge.

### 3.1 Matching

Consider an economy with a fixed labor force, the size of which, for simplicity, is normalized to unity. Workers are either employed or unemployed. The economy is characterized by trading frictions due to the costly and time-consuming matching of workers and firms. The matching process is captured by a concave and constant-returns-to-scale matching function,  $H=h(v,su)$ , which relates new hires,  $H$ , to the number of vacancies supplied by firms,  $v$ , and to the number of effective job searchers,  $su$ .  $s$  denotes average search intensity and  $u$  the number of unemployed workers. As the labor force is normalized to unity, we interpret  $u$  as the unemployment rate and  $v$  as the vacancy rate. Firms fill vacancies at the rate  $H/v = h(1,1/\theta) = q(\theta)$ , where  $\theta = v/su$  is labor market tightness. The rate at which an average unemployed worker finds a job is given by  $H/u = sh(\theta,1) = s\lambda(\theta)$ . Clearly we have  $\lambda'(\theta) > 0$  and  $q'(\theta) < 0$ .

In equilibrium the flow into unemployment equals the flow out of unemployment, i.e.,  $\phi(1-u) = s\lambda(\theta)u$ , where  $\phi$  is the exogenous separation rate. Unemployment is then given by:

$$u = \frac{\phi}{\phi + s\lambda(\theta)}, \quad (1)$$

which depends positively on the exogenous separation rate,  $\phi$ , and negatively on tightness,  $\theta$ , and search intensity,  $s$ . It turns out that exogenous shocks will induce additional adjustments in search intensity due to social interactions. As is clear from (1), this will also induce additional adjustments in unemployment. This mechanism will now be explored in more detail.

### 3.2 Workers and firms

Let  $U$  and  $E$  denote the expected present value of unemployed and employed workers, respectively. The flow values for an unemployed worker with search intensity  $s_i$  and for an employed worker are then:

$$rU_i = z - \sigma(s_i) - c(u) + s_i\lambda(\theta)(E - U_i), \quad (2)$$

$$rE = \bar{w} - \phi(E - U), \quad (3)$$

where  $z$  is positive returns to unemployment, which may include unemployment benefits, home production, or some pure value of leisure;  $\sigma(s_i)$  is the cost

of search, where  $\sigma'(\cdot) > 0$ ,  $\sigma''(\cdot) < 0$ ;  $\bar{w}$  is the exogenously given wage; and  $r$  is the discount rate. The term  $c(u)$  captures that the worker experiences a social and psychological cost of being unemployed. This cost is lower the higher the unemployment level is, i.e.,  $c'(u) < 0$ . By introducing a cost function that depends negatively on unemployment, we capture that the wellbeing of an unemployed worker is greater when he or she interacts with many other unemployed workers, and vice versa when the unemployment level is low. Recall from the previous discussion that this is in line with what Clark (2003) found in his analysis of British survey data.

We assume that the unemployed worker chose search intensity,  $s_i$ , so as to maximize the present discounted value of income during search,  $U_i$ , taking macro variables as given. This yields:

$$\sigma'(s_i) = \lambda(\theta)(E - U_i), \quad (4)$$

where the left-hand side is the marginal cost of search, and the right-hand side is the expected return from increased search. Search effort will be greater the tighter the market is, and the greater the utility gain of getting a job is.

Let us now turn to the firm's decision problem. We let  $J$  and  $V$  represent the expected present values of an occupied job and a vacant job, respectively. The marginal product of a worker is constant and denoted  $y$ . The cost of holding a vacancy open is equal to  $ky$ .<sup>5</sup> The arbitrage equations for a firm with an occupied job paying wage  $\bar{w}$ , and for a firm holding a vacancy, are then given by:

$$rJ = y - \bar{w} + \phi(V - J), \quad (5)$$

$$rV = q(\theta)(J - V) - ky. \quad (6)$$

In equilibrium, firms will open vacancies as long as it yields positive rents. This drives rents from vacant jobs to zero, i.e.,  $V=0$ . If we impose this free entry condition,  $V=0$ , on equations (5) and (6), we derive the following expression, which we will refer to as the job creation curve ( $JC$ ):

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<sup>5</sup> We assume that the cost of holding a vacancy is indexed to productivity. This is, however, not important for anything we show in this paper.

$$\bar{w} = y \left[ 1 - \frac{k(r + \phi)}{q(\theta)} \right]. \quad (7)$$

As the wage is exogenously given by  $\bar{w}$ , we have:  $\theta = \theta\left(\frac{-}{\bar{w}}, \frac{-}{k}, \frac{-}{r}, \frac{+}{y}, \frac{-}{\phi}\right)$ .

With tightness given by (7) and search intensity,  $s_i$ , given by (4), we can use (2) and (3) to find the equation determining  $s$ . If we impose the symmetry assumption  $s_i = s$  and use (1) to express the social and psychological cost function in terms of  $s$  in equilibrium, we arrive at the following expression:

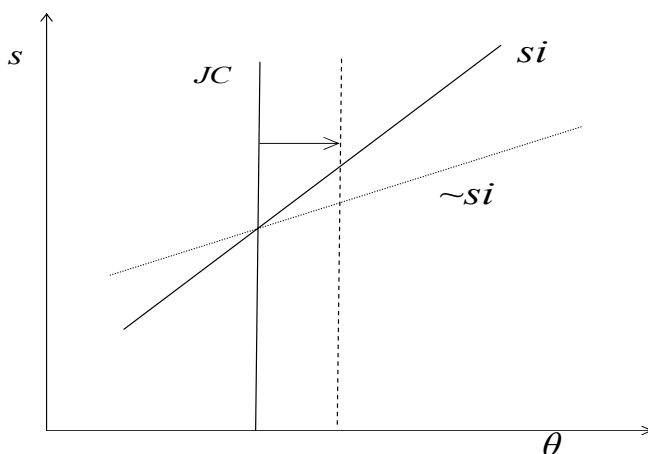
$$\sigma'(s) = \lambda(\theta) \frac{(\bar{w} - z + \sigma(s) + c(\theta, s))}{(r + \phi + s\lambda(\theta))}. \quad (8)$$

We are now in a position to substantiate our previous claim that social interactions are likely to reinforce the effects on unemployment of exogenous shocks, such as a productivity shock (see *figure 1*). The vertical line denoted *JC* follows from (7), and shows that tightness is unaffected by search intensity. The steep positively sloped line denoted *si* follows from (8).<sup>6</sup> The same is true for the less steeply sloped line denoted  $\sim si$ , but  $\sim si$  describes the situation when social interactions are absent.<sup>7</sup> An exogenous shock, such as an increase in productivity  $y$ , will shift the vertical line to the right, i.e., it will lead to an increase in tightness as firms then will find it optimal to open up more vacancies relative to the number of effective job searchers. More vacancies will, in turn, increase search. Therefore unemployment will fall both because of the increase in vacancies and the increase in search. As can be seen in *figure 1*, these effects will

<sup>6</sup> Figure 1 illustrates how a productivity increase raises search intensity by relatively more in the presence of social interactions when the initial equilibrium is stable. In the case of an exogenous in an unstable equilibrium, the economy will converge to a stable equilibrium. Using equation (8) to derive the slope of *si* in  $S - \theta$  space, we can show that it has a positive slope, whenever there is a stable equilibrium. Whether we have multiple equilibria or not is unimportant for the reinforcing mechanism focused upon here. In the next section we will deal more explicitly with multiple equilibria.

<sup>7</sup> Figure 1 shows how search intensity varies with tightness in the presence and absence of social interactions. In order for the lines  $s$  and  $\sim s$  to jointly intersect with the job creation curve at a particular search intensity, the value of leisure net of search costs and social and psychological costs of unemployment is chosen to be identical at that point.

be reinforced by social interactions. When unemployment falls, the social and psychological costs of unemployment increase. This gives the unemployed an additional incentive to increase their search, as this will increase their chances of leaving unemployment. We note from (1) that this reinforcing effect on search intensity also reinforces the reduction in unemployment.



**Figure 1.** Changes in search behavior due to an exogenous tightness-increasing shock.

The mechanism producing these effects is thus one that makes the social and psychological costs of being unemployed a negative function of the unemployment level. If this mechanism is at work, an important empirical implication seems to follow. When the unemployment level falls, it becomes more psychologically and socially costly to be unemployed, and this will motivate the unemployed to search more intensively for a job. This, in turn, is likely to increase the rate at which unemployed individuals leave unemployment. If social interactions are important for labor market behavior, we should expect to find that transition rates out of unemployment are systematically related to the unemployment levels in the relevant reference groups.

Moreover, if this mechanism is at work, yet another important empirical implication seems to follow. If an unemployed individual's relevant reference

group is within a close geographic proximity (neighborhood), unemployment would appear to be ‘contagious’. If, just by chance, one unemployed individual increases his search effort and this results in him getting a job, this would also increase the search effort and hence the transition rates out of unemployment for other unemployed individuals within this area. We should thus expect to find differences in the average search effort and transition rates out of unemployment across neighborhoods. This, in turn, implies that we should find differences in unemployment levels across neighborhoods even if the individuals in the neighborhoods are identical to one another in all relevant respects.

## 4 A general equilibrium search model with social interactions

In the previous section we showed that social interactions are likely to reinforce the effects that exogenous shocks have on search effort. In this section we carry the analysis one step further by analyzing the implications of social interactions within a general equilibrium framework.

We endogenize wages by assuming match-specific wage bargains between workers and firms. With endogenous wages, it follows from (7) that the job creation curve ( $JC$ ) is negatively sloped in the wage-tightness space (see *figure 2*). This negative relationship can be thought of as a demand side relationship. Next we derive the supply side relationship, which we will refer to as the wage curve ( $WC$ ).

### 4.1 Wage determination

When the matched firm and worker bargain over the wage,  $w_i$ , they take economy-wide variables as given. The Nash bargaining objective for a firm-worker pair is given by  $\Omega_i = [E_i - U]^\beta [J_i - V]^{1-\beta}$ , and the Nash bargaining solution satisfies the following first order condition:<sup>8</sup>

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<sup>8</sup> The value functions in (3) and (5) is now written  $rE_i = w_i - \phi(E_i - U)$  and  $rJ_i = y - w_i + \phi(V - J_i)$ . Using these two equations together with (2) and (4) yields expressions for  $E_i - U$  and  $J_i - V$  that are used in the Nash product.

$$\frac{\beta}{1-\beta}J = E - U, \quad (9)$$

where symmetry across firms and workers have been imposed, i.e.,  $w_i = w$ ,  $s_i = s$ .

By using (2), (3), (5), and (6) in (9), and by assuming free entry,  $V = 0$ , we can derive the wage curve (*WC*) as:

$$w = \beta y(1 + k\theta) + (1 - \beta)(z - \sigma(s) - c(u)), \quad (10)$$

which simply says that the wage is set in such a way that the surplus from the match is split between the parties according to their relative bargaining strength. The equilibrium relationship between search intensity and tightness can be derived from (4), using (9) and the fact that  $J = \frac{ky}{q(\theta)}$  from (6). More

specifically, we then have the following relationship between search and tightness in equilibrium:

$$\sigma'(s) = \frac{\beta\theta ky}{1 - \beta}. \quad (11)$$

With no, or a fixed, social and psychological cost of unemployment, we would have a unique equilibrium of wage, tightness, unemployment, and search intensity (see Pissarides 2000). However, the uniqueness of an equilibrium does not necessarily hold when we take social interactions into account and allow for the fact that the social and psychological costs of being unemployed depend on the number of unemployed workers.

This can be seen if we differentiate the expression for the bargained wage in (10) with respect to the wage,  $w$ , and tightness,  $\theta$ , (recognizing that  $u = \phi/(\phi + s\lambda(\theta))$  and that  $s$  is determined by  $\sigma'(s) = \beta\theta ky/(1 - \beta)$ ). This yields the following expression for the slope of the wage curve:

$$\frac{dw}{d\theta} = \beta y k - (1 - \beta)\sigma'(\cdot)\frac{ds}{d\theta} - (1 - \beta)c'(\cdot)\frac{du}{d\theta}. \quad (12)$$

The first term in (12) is positive because the tighter the market, the more vacancy costs will be saved per unemployed worker when a job is created, and workers reap a fraction of these saved vacancy costs.<sup>9</sup> The second term is negative because an increase in tightness also leads to an increase in search effort. This has a direct negative effect on the value of being unemployed and will induce wage moderation. The third term is also negative because increased tightness leads to lower unemployment, and thereby to an increase in the social and psychological costs of being unemployed. These increasing costs will induce wage moderation as the value of being unemployed falls with higher social and psychological costs of being unemployed.

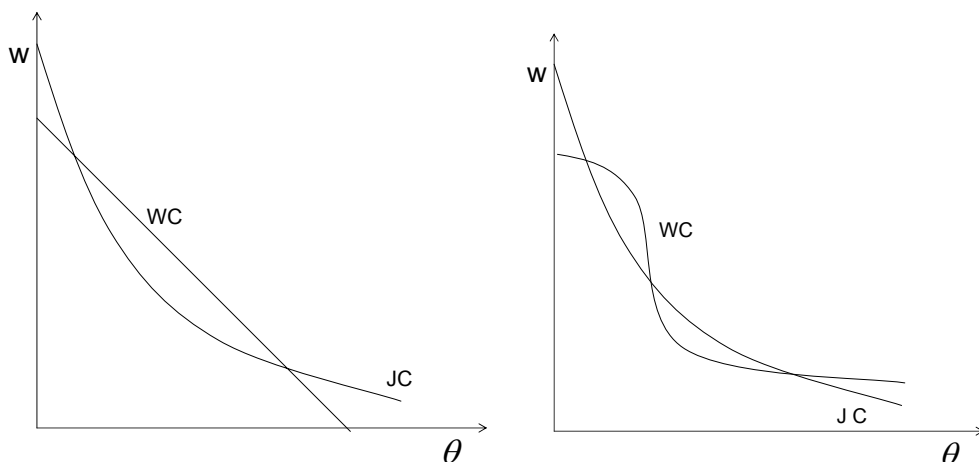
With social interactions, multiple equilibria may emerge. Numerical analyses presented in the appendix reveal that even when search intensity is exogenous, multiple equilibria emerge for fully realistic parameter values.<sup>10</sup> *figure 2* illustrates the situation. The left-hand figure is based on a negative convex relationship between the social and psychological costs of being unemployed and the unemployment level, whereas the right hand figure represents a more realistic case with an inversed S-shaped relationship. In the former case two equilibria exist, while in the latter we observe three equilibria.<sup>11</sup>

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<sup>9</sup> In the absence of social interactions and endogenous search, the wage curve would appear as a positively sloped linear schedule in Figure 2. There would be a unique equilibrium determining tightness and wage. Also, in the absence of social interactions but in the presence of endogenous search, one unique equilibrium would prevail. See Pissarides 2000.

<sup>10</sup> Endogenous search makes multiple equilibria even more likely. This is clear from (12). With exogenous search, the second term on the right hand side vanishes. Moreover, we have  $\frac{\partial u}{\partial \theta} = \frac{\partial u}{\partial \lambda(\cdot)} \frac{\partial \lambda(\cdot)}{\partial \theta} + \frac{\partial u}{\partial s} \frac{\partial s}{\partial \theta}$ , where the second term vanishes when search is exogenous.

<sup>11</sup> As these equilibria refer to steady states, we need to impose some dynamic adjustments in order to say something about stability. By imposing the same adjustment mechanism as in Pissarides (2000), we can show that the equilibria in which the wage curve intersect the job creation curve from below when moving from left to right corresponds to the unique equilibrium in Pissarides, and this can be shown to be stable.



**Figure 2.** Equilibrium wages and tightness in the presence of social interactions.

The inverse S-shaped relationship implies that when the unemployment level is low a given change in unemployment will only have a marginal effect on the social and psychological costs of being unemployed. The situation is similar when the unemployment level is very high. But in between these two extremes there is a region where the effect is rather substantial, i.e., in this region even a small change in the unemployment level can bring about a substantial change in the social and psychological costs of being unemployed.<sup>12</sup>

The intuition behind the multiplicity of equilibria is straightforward. Given that we are located on the job creation curve, workers are satisfied with a low going wage rate if unemployment is low. The social and psychological costs of unemployment then are high, inducing the employed and the unemployed to do

<sup>12</sup> Ideas similar to these were at the heart of Crane's (1991) analysis of neighborhood tipping, and he reported empirical results supporting the hypothesis of non-linear threshold effects. Lindbeck et al. (1999) made an analogous assumption about the disutility of participation in welfare programs in order to generate two stable equilibria. In the appendix an analytical solution corresponding to the left hand figure in *figure 2* can be found.

their utmost to avoid unemployment. Consequently, the unemployed will then search more intensively, and the employed will restrain their wage demands in order to avoid unemployment. An equilibrium with high wages and high unemployment may also emerge. When unemployment is high, the social and psychological costs of being unemployed are low, and hence employed workers will only be content with rather high wages. That is to say, when it is socially more acceptable to be unemployed, wages are not moderated to the same extent as they would have been in a situation where it was socially less acceptable to be unemployed.<sup>13</sup> In addition search effort is rather low as unemployed workers are less prone to escape unemployment relative a situation when it is socially less acceptable to be unemployed.

The reinforcing effects due to social interactions discussed in the partial equilibrium analysis is further strengthened in general equilibrium as wages adjust. An exogenous shock that makes it optimal for firms to post more vacancies will reduce unemployment even absent social interactions. But if social interactions are at work, we should observe both more intensive search and restrained wage demands as the social and psychological costs of being unemployed then increase because of the lower unemployment level. Both the increased search effort and the restrained wage demands tend to increase tightness and reduce unemployment even further.<sup>14</sup>

## **5 Social interactions and unemployment in the Stockholm metropolitan area**

The focus of the preceding two sections has been on the consequences of desire-based social-interactions that make the social and psychological costs of being unemployed inversely related to the unemployment level among others.

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<sup>13</sup> Using data on a random sample of unemployed individuals in Sweden in the early 1990s, Samuelson (2002) reported results in support of this prediction. Controlling for a host of potentially confounding variables she found that those who lived in areas with high unemployment were less willing than those living in low-unemployment areas to accept jobs with lower pay than they previously had.

<sup>14</sup> These reinforcing effects, which are not present if social interactions are absent, hold in stable equilibria irrespective of whether we have one unique equilibrium or multiple equilibria.

As noted above, if this sort of mechanism is at work one should expect to find that the transition rate out of unemployment is lower if an individual is surrounded by many unemployed individuals than if he/she is surrounded by only a few unemployed individuals. Furthermore, these social interaction effects can be expected to bring about variations in unemployment levels between groups of interacting individuals who are similar to one another with respect to relevant observables. These predictions will be the focus of our empirical analyses.

Although our theoretical analysis focused exclusively on desire-based interactions, the predictions are likely to have been more or less the same had we used a more complex model that also allowed for opportunity-based and belief-based interactions. As noted above, opportunity- and belief-based interactions are likely to operate in the same direction as the desire-based interactions. That is to say, changes in relevant beliefs and opportunities that result from other individuals' becoming unemployed are likely to amplify rather than to counteract the desire-based social-interaction effects focused upon in the theoretical analysis. In the empirical analyses we make no distinction between these three types of social-interaction effects.

## **5.1 Data**

The dataset that we used contains information on all 20- to 24-year-olds who lived in the Stockholm metropolitan area during the period from January 1992 to December 1999. We here define the Stockholm metropolitan area as consisting of the entire Stockholm County, except for the following municipalities, which are situated at the outskirts of the county: Norrtälje, Sigtuna, Upplands Bro, Södertälje, Nykvarn, and Nynäshamn. The size of the remaining land area is approximately 1010 square miles and the distance between the centroids of the two most distant municipalities, Vallentuna and Haninge, is approximately 30 miles. Given the excellent public transportation system in this area, it seems reasonable to treat this area as one within which an unemployed individual could, at least in principle, take any job he or she was offered.

The dataset contains information on 180,803 individuals in this age group. We obtained information from various administrative registers on their demographic characteristics, including age, sex, education, income, and country of birth. For those who were ever unemployed we know the dates and exact

lengths of all their unemployment spells measured in number of days.<sup>15</sup> During this time period, 95,775 individuals had at least one spell of unemployment between the ages of 20 and 24.

We also know where these individuals lived at the end of each calendar year, and using this information we can adopt a reference-group definition that appears appropriate for our purposes. The Stockholm metropolitan area is divided into 699 so-called SAMS areas. These geographical areas, which have been constructed so as to contain socially homogeneous residential areas, serve as the basis for our definition of the relevant reference group. The reference group consists of those 20- to 24-year-olds who reside in the same neighborhood as the focal individual. During this period, the median number of 20- to 24-year-olds in such a neighborhood-based reference group was 66.

We focus on neighborhood-based reference groups because individuals' reference groups to a large extent reflect their spatial locations. The closer two individuals are to one another, the more likely they are to interact and to influence each other's behavior (Butt 2002, Wellman 1996, Latané et al. 1995). Because of this, spatial distance and the probability of being part of a focal actor's relevant reference group are likely to be inversely related to one another.

We restrict the analysis to 20- to 24-year-olds for two major reasons. First, by focusing on this narrowly defined age group we are likely to reduce the magnitude of unobserved heterogeneity as compared to what would have been the case had we focused on the entire labor force. Second, we focus on this age group because it is likely that their reference groups are to a large extent located in close geographic proximity. Social-interaction processes are likely to be just as important for other age groups, but then the need for detailed information on the networks linking the individuals to one another would have been more acute than it is in the case of the 20- to 24-year-olds.

As mentioned above, the main reason for restricting the analysis to a single metropolitan area is that we wish to hold constant one of the most important environmental variables: the local labor market situation. Given the fairly short commuting distances within the Stockholm metropolitan area, it can, for all practical purposes, be viewed as one and the same labor market. Thus, by restricting the analysis to a single metropolitan area, we reduce the risk of mis-

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<sup>15</sup> We focus on 'open' unemployment, which means that we do not consider those engaged in labor market training programs and the like to be unemployed.

taking spatial variations in vacancy rates and other labor market conditions for interaction-based reference-group effects.

## 5.2 Variations between neighborhood-based reference groups

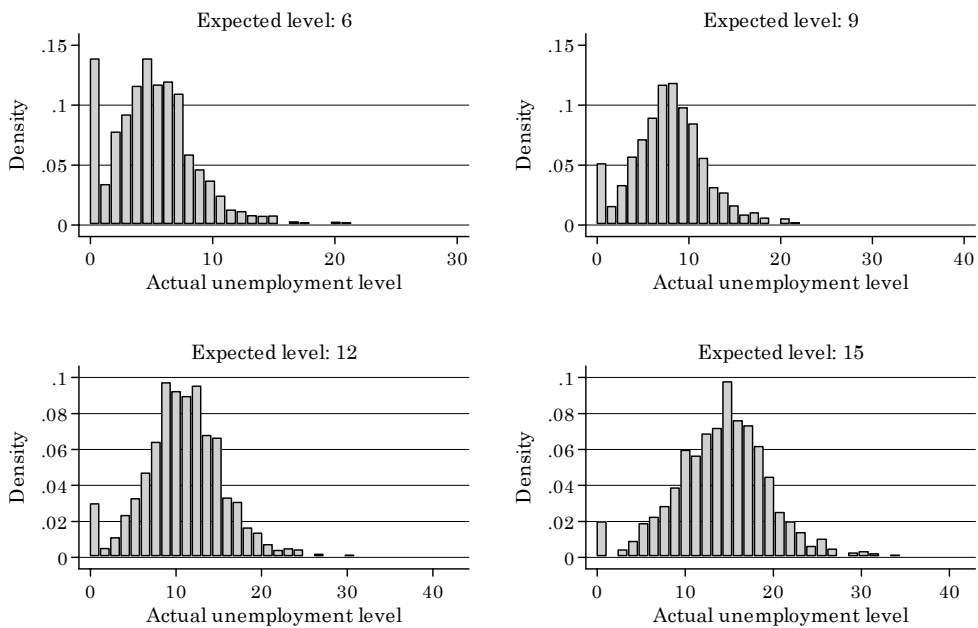
One important implication of the theoretical analysis was that social interactions can bring about different levels of unemployment even in groups of interacting individuals that are identical to one another in all relevant respects. In order to examine whether or not this is the case, we will focus on unemployment levels in the neighborhood-based reference groups defined above. To simplify the presentation, we will often refer to these neighborhood-based reference groups as 'neighborhoods'.

To identify neighborhoods that resemble one another in terms of their unemployment-relevant demographic characteristics, we estimated 96 logistic regression models, one for each month. In the regression models the dependent variable indicated whether an individual was unemployed or not at the 15th of the month, and the independent variables measured the individual's age, sex, education, marital status, number of children, country of birth, whether or not the individual was a student, and whether or not the individual was a recent immigrant.<sup>16</sup> Using these parameter estimates we then calculated each individual's predicted probability of being unemployed, and then we summarized these predicted probabilities for those belonging to each neighborhood. By doing so we arrived at an estimate of the unemployment level one would have expected to observe in each neighborhood-based reference group on the basis of the demographic characteristics of its members. Two neighborhoods are similar to one another in their unemployment-relevant demographic characteristics if these expected unemployment levels are approximately the same.

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<sup>16</sup> We used sets of dummy variables to distinguish between the following educational levels: primary school only, vocational training school, high school degree, and college degree; the following countries/regions of birth: Sweden, Eastern Europe or former Soviet Union, Middle East or Africa, and the rest of the world. (More categories of regions of birth were used in preliminary analyses, but that did not improve the model.) Being a 'recently' arrived immigrant was defined as having arrived to Sweden during the last three years, and being a 'student' was defined on the basis of whether or not the individual had received student allowance (*studiebidrag*) during the year. For the time-varying covariates we used the most recent measurement preceding the month being analyzed. To avoid that the results were unduly influenced by the small number of cases in some of the neighborhoods, we only included a neighborhood when it consisted of at least 10 individuals in this age range.

*Figure 3* shows the unemployment levels within four sets of neighborhoods. In the first set the unemployment-relevant demographics were such that the logistic regression analyses suggested that they all had an unemployment level of 6 (5.5 – 6.5) percent. The second set consists of neighborhoods with an expected unemployment level of 9 (8.5 – 9.5) percent, and in the third and fourth sets the expected level is 12 (11.5 – 12.5) and 15 (14.5 – 15.5) percent respectively. These four sets represent 29 percent of all monthly neighborhood observations, corresponding to 16,217 ‘neighborhood-months’.



**Figure 3.** Variation in unemployment levels between neighborhoods that are similar to one another in terms of unemployment-relevant demographic characteristics.

*Figure 3* clearly shows that unemployment levels vary considerably also between neighborhoods that are highly similar to one another in terms of their unemployment-relevant demographics. In approximately 50 percent of these cases the actual unemployment level deviated by more than 25 percent from the

expected level. Similarly, the ranges in actual employment levels were substantial. Among neighborhood-based reference groups with an expected unemployment level of 6 percent, in some there were no unemployment at all and in others 30 percent were unemployed. The corresponding ranges in the other three neighborhood sets were 0 to 40, 0 to 43, and 0 to 42 percent.

It is likely that some of this variation is due to selection into neighborhoods based on individual characteristics that we have not controlled for. However, the variation in unemployment levels between neighborhood-based reference groups seems to be too large to be explainable in terms of variation in individual characteristics only. We cannot know for sure whether this excess variation is due to social interactions, and particularly not whether it is due to desire-based social interactions. But the pattern is the expected one, and therefore it gives further weight to the social multiplier account of the theoretical analysis.

### 5.3 Transition rates out of unemployment

As noted in previous sections, another important implication of the theoretical analysis is that the transition rates out of unemployment are likely to be inversely related to the unemployment level in the relevant reference group. In order to examine whether or not this is the case we will focus on unemployed individuals' transitions out of unemployment, and whether these appear to be systematically related to the unemployment level in their neighborhood-based reference groups.

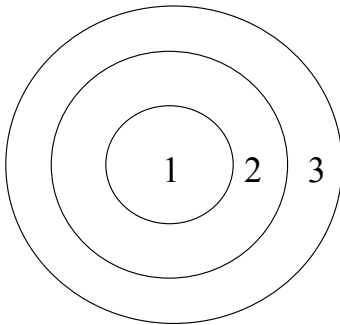
The types of models that we will estimate are Cox proportional hazards models of the following types,

$$h_{it} = h_{0it} e^{\alpha u_{jt-1} + \lambda X_{it-1} + \beta X_{it-1} u_{jt-1} + \delta T_t + \omega N_j}$$

where  $h_{it}$  is the hazard of individual  $i$  leaving unemployment at time  $t$ ,  $u_{jt-1}$  is the unemployment level in neighborhood  $j$  at time  $t-1$ ,  $X_{it}$  is a set of covariates describing individual  $i$  at time  $t$ ,  $T_t$  is a set of dummy variables indicating time measured in calendar years and months, and  $N_j$  is a set of dummy variables indicating neighborhood.

Our main interest is in the  $\alpha$ - and  $\beta$ -coefficients since they indicate whether the unemployment of others systematically influences individuals' transition rates out of unemployment. We will use three different definitions of a neighborhood when measuring  $u_{jt}$ , and we will refer to them as neighborhoods 1, 2,

and 3 respectively (see *figure 4*). Neighborhood 1 is the neighborhood (i.e., the SAMS area) in which the focal individual resides; Neighborhood 2 consists of the neighborhoods that are adjacent to Neighborhood 1; and Neighborhood 3 consists of the neighborhoods that are adjacent to Neighborhood 2 (excluding neighbors of the neighbors that are also neighbors).



**Figure 4.** Neighborhood definitions

Within each of these neighborhoods (and combinations thereof) we have calculated the proportion of unemployed among the 20-24 year olds on the 15th of each month (not including the focal individual). The main purpose of the analysis then is to examine whether these variables are systematically related to the unemployed individuals’ hazard of leaving unemployment during the subsequent month. The parameter estimates are found in *table 1*.

The first model in *table 1* relates the hazard of leaving unemployment to the unemployment level in neighborhoods 1 and 2. The hazard ratio is less than 1.0, which means that the higher the unemployment level in these reference groups, the lower was the focal individual’s hazard of leaving unemployment. The value of .034 suggests a substantial social-interaction ‘effect’. Taken at face value, it suggests that if everyone else in the reference group were unemployed, the individual’s chance of leaving unemployment would only be about 3 percent of what it would have been had no one been unemployed. Obviously, much of this ‘effect’ is due to labor market fluctuations and individual heterogeneity across neighborhoods, and we will gradually introduce various controls for this.

In the second model, we distinguish between the three types of neighborhoods described in *figure 4*. As mentioned above, we expect the composition of individuals' reference groups to be spatially bounded: the closer two individuals are to one another, the more likely they are to be aware of and influence each other's behavior. The results in the second model are in line with these expectations. A given change in the unemployment level in Neighborhood 3 is associated with a much smaller change in the hazard of leaving unemployment than a corresponding change in Neighborhood 1. This is also true when comparing neighborhoods 1 and 2, but the magnitude of the difference is rather small.

An increase in the unemployment level among others may influence the focal individual's transition rate, not only because of the types of social interactions focused upon here. It could also simply reflect the fact that it becomes more difficult to get a vacant job when there are many unemployed individuals competing for it. In the second model we therefore include a control variable measuring the number of unemployed individuals (of all ages) per job vacancy in Stockholm County at the beginning of each month. Not including this variable would likely have produced an upward bias in the effects of the variables measuring the unemployment levels within the individuals' age-specific and neighborhood-based reference groups. As noted in the previous paragraph, however, the effects of these reference-group variables remain highly significant even when controlling for the overall tightness of the labor market.

To simplify the presentation, we will drop the distinction between the three types of neighborhoods and only focus on the combination of neighborhoods 1 and 2. From now on, we will refer to Neighborhood 1 + Neighborhood 2 as the 'neighborhood'. Analyses not reported here showed that this did not have any substantive impact on the results.

**Table 1.** Cox regression, hazard ratios (z statistics in parentheses)  $N = 95,775$  in models 1-6 and 61,845 in model 7.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Proportion unemployed in neighborhood 1+2	0.034 (-66.42)		0.076 (-43.43)	0.103 (-32.14)	0.003 (-5.85)	0.209 (-15.45)	0.260 (-10.27)
Proportion unemployed in neighborhood 1		0.220 (-16.25)					
Proportion unemployed in neighborhood 2		0.226 (-16.25)					
Proportion unemployed in neighborhood 3		0.624 (-4.68)					
Unemployed per vacant job in Stockholm		0.999 (-2.57)	0.996 (-9.41)	1.002 (1.55)	1.000 (1.50)	1.000 (0.26)	0.999 (-0.44)
Woman			1.157 (31.56)	1.144 (29.05)	1.116 (9.80)	1.148 (29.49)	1.166 (26.12)
Age			0.982 (-8.65)	0.981 (-9.02)	0.968 (-6.36)	0.980 (-9.19)	0.982 (-6.35)
Vocational education			0.981 (-3.10)	1.008 (1.35)	0.985 (-0.89)	1.008 (1.23)	0.929 (-0.68)
High school education			1.208 (30.78)	1.118 (17.68)	1.046 (3.07)	1.128 (18.78)	1.044 (0.39)
College education			1.239 (25.51)	1.187 (19.75)	1.024 (1.16)	1.200 (20.59)	1.095 (0.83)
From Eastern Europe or former Soviet Union			0.910 (-6.22)	0.889 (-7.70)	0.929 (-1.99)	0.892 (-7.43)	0.882 (-5.07)
From Middle East or Africa			0.883 (-13.08)	0.845 (-17.36)	0.864 (-6.26)	0.868 (-14.02)	0.875 (-8.28)
From the rest of the world			1.004 (0.53)	0.994 (-0.76)	1.029 (1.43)	1.005 (0.56)	0.999 (-0.08)
Less than 3 years in Sweden			0.674 (-26.27)	0.679 (-25.30)	0.554 (-16.37)	0.688 (-24.26)	1.017 (0.31)
3 - 5 years in Sweden			0.929 (-5.88)	0.957 (-3.54)	0.837 (-5.66)	0.956 (-3.54)	1.090 (2.32)
Married			0.978 (-1.98)	0.967 (-2.93)	0.966 (-3.02)	0.966 (-3.01)	0.927 (-3.72)
No. of children			0.942 (-7.23)	0.948 (-6.49)	0.949 (-6.38)	0.948 (-6.44)	0.975 (-1.57)
Amount of social welfare /10,000				0.982 (-9.29)	0.982 (-9.67)	0.982 (-9.09)	0.970 (-8.66)

**Table 1 (Continued)**

Amount of sick allowance /10,000				0.955 (-17.22)	0.955 (-17.26)	0.954 (-17.76)	0.950 (-13.23)
Days unemployed before current period /30				0.993 (-16.75)	0.993 (-16.63)	0.994 (-15.44)	0.992 (-13.94)
Grade point average from high school							1.001 (13.52)
Prop. unemployed 1+2 × Woman					1.281 (2.55)		
Prop. unemployed 1+2 × Age					1.139 (2.95)		
Prop. unemployed 1+2 × Vocational education					1.259 (1.69)		
Prop. unemployed 1+2 × High school education					1.863 (4.91)		
Prop. unemployed 1+2 × College education					4.177 (8.02)		
Prop. unemployed 1+2 × Eastern Europe or Soviet					0.659 (-1.39)		
Prop. unemployed 1+2 × Middle East or Africa					0.818 (-1.14)		
Prop. unemployed 1+2 × Rest of the world					0.747 (-1.76)		
Prop. unemployed 1+2 × < 3 years in Sweden					5.634 (6.29)		
Prop. unemployed 1+2 × 3 – 5 years in Sweden					3.014 (4.74)		
Dummies for year and calendar month	No	No	No	Yes	Yes	Yes	Yes
Dummies for neighbor- hood ( = fixed effects)	No	No	No	No	No	Yes	Yes
Log Likelihood	-2213820	-2202343	-2202284	-2189504	-2189427	-2188170	-1340550

In the third model we introduce various controls for potentially important individual differences that are likely to influence the transition rates out of unemployment: sex, age, education (highest degree), country of birth, number of years residing in Sweden, marital status, and number of children (see footnote 17 for a description of these variables). From our perspective, the most important result in Model 3 is that the unemployment level in the neighborhood-based reference group has a substantial effect on the hazard even after we control for these variables. Interpreted literally, the hazard ratio of .076 suggests that if everyone in the reference group were unemployed, the focal individual's hazard of leaving unemployment would be only about 7 percent of what it would have been had no one been unemployed.

In the fourth model we introduce yet more control variables. In addition to those included in Model 3 we include variables measuring the amount of social welfare and sick allowance the individuals received during the previous calendar year, and their previous unemployment, measured as the total number of unemployment days before the current unemployment period started (the length of the current unemployment spell is controlled for in the baseline hazard.). In addition, we include eleven monthly and seven annual dummy variables in order to control for seasonal variations and time trends.<sup>17</sup> All these variables have been included exclusively to control for unobserved and otherwise uncontrolled heterogeneity likely to influence the results. Including these variables may lead us to underestimate the effect of the unemployment level among those in the individuals' reference groups. But if we find an effect in spite of controlling for these variables, our case has been strengthened. As can be seen from Model 4, we find an effect, and the effect is rather substantial. The hazard ratio of .103 suggests that if everyone in the reference group were unemployed, the focal individual's hazard of leaving unemployment would be only about 10 percent of what it would have been had no one been unemployed. These comparisons are rather extreme, however. The change in the hazard brought about by a typical variation in the unemployment level is likely to be more informative. The standard deviation of the variable measuring the unemployment level in different neighborhoods is equal to 5 percent units.

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<sup>17</sup> To save space, we have not included these estimates here, but they are available from us upon request. These dummy variables absorbed the effect of the variable measuring the overall tightness of the labor market thereby making this variable appear unrelated to the hazard in models 4 to 7.

If we use this as a measure of a typical variation, these results suggest that a typical increase in the unemployment level among others will tend to reduce the hazard of leaving unemployment by approximately 12 percent.<sup>18</sup>

The fifth model includes (statistical) interaction effects between the unemployment level in the neighborhood-based reference group and various demographic variables in order to examine whether individuals with certain characteristics appear to be more susceptible to influence than others. These (statistical) interaction effects suggest that women, the slightly older, the more educated, and recently arrived immigrants are less influenced by the unemployment level in the neighborhood. These data do not permit us to conclude why we observe these differences. However, a plausible hypothesis seems to be that they reflect how deeply embedded the individuals are in their neighborhoods. The younger cohorts are likely to have lived in their neighborhoods for a longer time than the older cohorts because many of them have not yet left their parental homes. Similarly, Swedish women leave their parental homes at a younger age than do men, and those who recently arrived to Sweden may not yet have built up extensive neighborhood-based networks. The education-based interaction effect may indicate that the networks of the highly educated are neighborhood-based to a somewhat lesser extent.

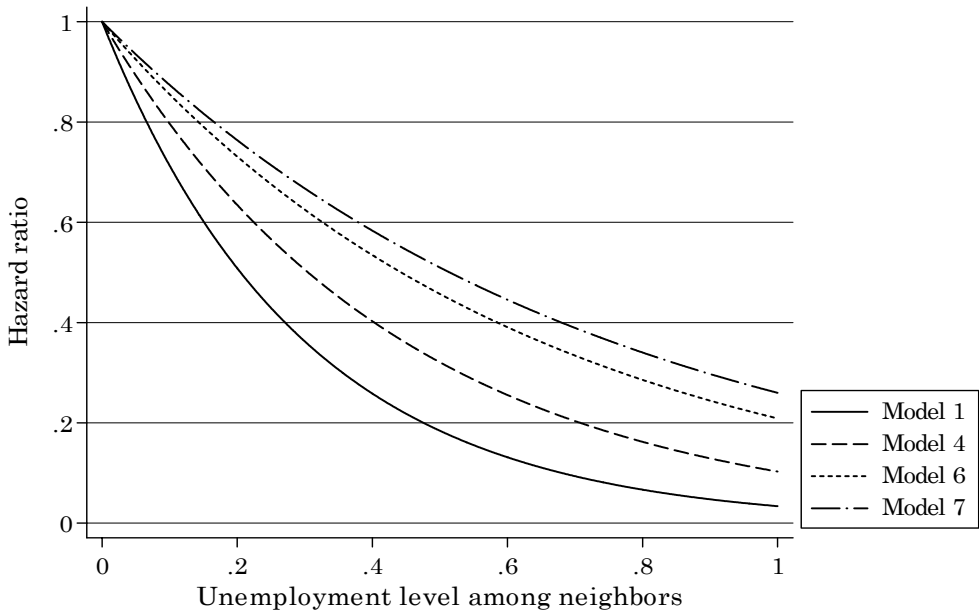
The sixth model is a fixed-effect specification including 698 dummy variables, one for each neighborhood (except one). The reason for including these dummy variables is to control for all time-invariant unobservable characteristics of the neighborhoods. This way of controlling for between-neighborhood differences most likely means that we introduce excessive controls, and therefore underestimate the true effect of the unemployment level among those in the reference groups. In this way we do not capture social-interaction effects that are long-lasting and which influence neighborhoods during the whole time period. But even with these extensive controls, the hazard ratio associated with the neighborhood unemployment variable is 0.209, suggesting a most substantial social-interaction effect.

The seventh model is identical to the sixth model, except for the fact that we only use data on individuals with a high school diploma in order to be able to

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<sup>18</sup> The effects of some of the other covariates are also interesting, but they are not our primary concern in this paper. The results for these variables may be summarized briefly as follows. They suggest that men; the slightly older; those with less education; immigrants from Eastern Europe, from the former Soviet Union, Middle East and Africa; recently arrived immigrants; married persons; and those with children have a more difficult time leaving unemployment.

include their grade point average as a predictor.<sup>19</sup> Controlling for grade point average and restricting the analysis to this sub-population somewhat reduced the effect of the unemployment level among those in the neighborhood-based reference groups. In *figure 5* we compare the effect of the unemployment level in these groups before and after introducing these various controls (the graphs are based on the results in Model 1, Model 4, Model 6, and Model 7).



**Figure 5.** Hazard ratios and neighborhood unemployment before and after controls for confounding variables

As can be seen from *figure 5*, the reduction in the effect brought about by these various controls is rather substantial, but the remaining effect is sizable

<sup>19</sup> During these years, grades in Swedish high schools varied from a low of 1 to a high of 5. The variable used here is equal to the average grade times 100.

nonetheless. Introducing additional control variables is likely to reduce the reference-group effect even more, but it seems highly unlikely that an effect of this magnitude could, either exclusively or even largely, be due to omitted variables (at least we cannot imagine what variables that might be). Although we cannot exclude the possibility that these results in part are due to local time-varying ‘unemployment shocks’, given what we know about the Stockholm labor market in the 1990s, this does not seem to be of first-order importance. We have also checked the robustness of these finding by re-estimating the models using data on smaller geographical areas than the Stockholm metropolitan area as a whole.<sup>20</sup> Qualitatively, these analyses produced very similar results to those reported here. Therefore, we conclude that these results suggest that unemployment is contagious in the sense that the unemployment level among peers seem to influence considerably the rate at which unemployed individuals leave unemployment.

## 6 Conclusion

In this paper we have focused on the role of social interactions in explaining unemployment. We extended the basic search model of Pissarides (2000) to take into account the social and psychological costs of being unemployed, and to show that these costs are likely to be inversely related to the unemployment level among others. We started off in a partial equilibrium framework with exogenous wages, and showed that adjustment in individual search effort reinforced the effect on unemployment following exogenous shocks. The mechanisms behind these social multiplier effects were later the focus of our empirical analysis. We also showed that this straightforward extension of the matching model could have considerable implications for the general equilibrium outcome. In the presence of social interactions, multiple unemployment equilibria may emerge, and this could serve to explain why otherwise similar labor market regions may exhibit vastly different unemployment levels. The reason that a low unemployment equilibrium is sustainable is that the social and psychological costs of unemployment are then high, inducing the employed and the unemployed to do their utmost to avoid unemployment. Con-

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<sup>20</sup> We re-estimated the models for those residing in the municipality of Stockholm, as well as for those in the municipalities of Haninge, Botkyrka, and Huddinge.

sequently the unemployed will then search more intensively, and the employed will restrain their wage demands in order to avoid unemployment. For analogous reasons, a high unemployment equilibrium is also sustainable.

We tested the hypothesis that a higher unemployment level decreases the transition rate out of unemployment by using data on unemployment among 20- to 24-year-olds in the Stockholm metropolitan area during the 1990s. In this age group, more than half experienced at least one period of unemployment during the 1990s. When being unemployed becomes such a common phenomenon, it is likely that the social and psychological costs of being unemployed is much reduced. The empirical analyses revealed that the variation in unemployment levels between neighborhoods seemed to be higher than one would have expected on the basis of the variation in unemployment-relevant observables. We also found that the transition rates out of unemployment seemed to be considerably influenced by the unemployment levels in the neighbourhood-based reference groups; a result to be expected if social interactions are at work. The empirical analyses therefore support the predictions of the theoretical analysis.

The existence of social interactions has important policy implications, as discussed by Wilson (1987), Brooks-Gunn et al. (1997), Moffitt (2001), and others. The magnitude of the effects reported here suggests that policy interventions targeted at these interactions may be highly desirable and effective.

Our paper also deals with issues of considerable theoretical concern to sociologists and economists. The study of social interactions is at the very core of sociology, but, as noted by Coleman (1990), sociologists have typically lacked the analytical tools needed for assessing the aggregate outcomes of such micro-level processes. Coleman's major theoretical agenda was to bring together the sociological tradition with its focus on social interactions and the economic tradition with its rigor and focus on micro-macro links. We would like to see this paper as a contribution to this theoretical agenda. Social interactions are not only important for many processes of concern to economists and sociologists. Social interactions *between* economists and sociologists are also of considerable importance for the development of social-interaction based theories.

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# Appendix 1: Special case with double equilibria

This section considers the case in which it is possible to write (10) as a second order equation in the arrival rate,  $\lambda(\theta)$ . Let the matching function be Cobb-Douglas,  $H=v^{1-\eta}u^\eta$ . Moreover, assume that  $c(u) = (u/(1-u))^{-\alpha}$ , which can be written as:  $c(u(\theta)) = \phi^{-\alpha}\theta^{\alpha(1-\eta)}$  using (1). Now, assume that the matching parameter  $\eta = 0.5$  and  $\alpha = 2$ .<sup>21</sup> This enables us to write equation (10) as a second order equation in  $\lambda(\theta)$ , which yields the following two roots for the arrival rate:

$$\lambda_{low} = \frac{\varepsilon - \sqrt{\varepsilon^2 - 4(1-\beta)(y-z)\delta}}{2\delta},$$

$$\lambda_{high} = \frac{\varepsilon + \sqrt{\varepsilon^2 - 4(1-\beta)(y-z)\delta}}{2\delta},$$

where  $\varepsilon = yk(r+\phi)$  and  $\delta = (1-\beta)\phi^2 - \beta yk$ . The two roots for the arrival rate,  $\lambda(\cdot)$ , will generate two roots for the unemployment rate by use of (1).<sup>22</sup> This case corresponds to the left hand figure in *figure 1*.

<sup>21</sup> To impose  $\eta = 0.5$  does not seem to be a too heroic assumption. To set  $\eta = 0.5$  is a bit on the high side though, according to Blanchard and Diamond (1989), who concluded that  $\eta$  is about 0.4. This is something that we will elaborate on in the numerical examples below. The parameter  $\alpha$  is a parameter that we know far less about than what we know about  $\eta$ . To assume  $\alpha = 2$ , is hence an arbitrary assumption. This implies that a one percent increase in the stock of unemployed in relation to employed, will reduce the social and psychological cost of being unemployed with two percent. In the appendix we use numerical examples and discuss the implications of letting  $\alpha$  depart from 2.

<sup>22</sup> For two positive solutions for the arrival rate  $\lambda$ , and hence for two solutions with  $u < 1$  to exist, we need that  $\varepsilon^2 - 4(1-\beta)(y-z)\delta > 0$ , and  $\delta > 0$ . As we impose  $\eta = 0.5$  and  $\alpha = 2$ , the wage curve becomes linear. The condition  $\delta > 0$  simply assures that the linear wage curve has a negative slope. Recall that a necessary condition for multiple equilibria is that the effect on the social and psychological cost of being unemployed dominates the effect on the saved vacancy costs. However, in the appendix we also allow for a non-linear wage curve, where the wage curve may be positively sloped in some intervals of tightness.

## Appendix 2: Numerical results

The aim of the numerical exercise is to examine whether multiple equilibria can emerge for plausible parameter values. We calibrate the model to yield plausible outcomes of unemployment, and the associated expected duration of unemployment and vacancies. We only consider the case with exogenous search effort. As was clear from the analyses in the main body of the paper, to allow for endogenous search intensity makes it even more likely that multiple equilibria will emerge.

The matching function is taken to be a Cobb-Douglas function,  $H=av^{1-\eta}u^\eta$ . The psychological cost of unemployment is a decreasing function of unemployment. More specifically we have:

$c(u) = \tau (u/(1-u))^{-\alpha}$  or  $c(u) = \pi u^{-\alpha}$  or  $c(u) = d(1 + \exp(b(u - 0.1)))$ . A quarter of a year is taken to be the time unit. We assume that the bargaining power between workers and firms are equal, i.e.,  $\beta = 0.5$ . Productivity is normalized to unity,  $y=1$ . The separation rate is set at  $\phi = 0.07$ , which corresponds to an annual separation rate of approximately 30 percent. The discount rate is set to  $r = 0$ . The parameter  $\eta$  will take on values between 0.4 and 0.5. Blanchard and Diamond (1989) concluded that  $\eta$  is approximately 0.4. However,  $\eta = 0.5$  fulfills the ‘Hosios condition’,  $\eta = \beta$ , and is often assumed in numerical simulations, presumably for that reason. The remaining parameters,  $a$ ,  $z$ ,  $k$ ,  $\tau$ , and  $\alpha$ , are chosen so as to yield two equilibria with the low level of unemployment rate being approximately 6.5 percent, with an associated expected unemployment duration of about one quarter, and an expected duration of vacancies of about one month. The vacancy cost parameter is set at  $k=5$  in all the numerical examples. With  $k=5$ , the expected vacancy costs amount to slightly more than twice the quarterly producer wage at the low unemployment equilibrium.

The first numerical exercise corresponds to the analytical case considered above, where it was possible to write the equation determining tightness as a second order equation in the arrival rate,  $\lambda(\cdot)$ . Recall that this case assumed  $c(u) = \tau(u/(1-u))^{-\alpha}$  and  $\eta = 0.5$  and  $\alpha = 2$ , which corresponded to assumption that the wage curve in figure 2 is linear, i.e.,  $w = \beta y + (1 - \beta)z - (\tau(1 - \beta)\phi^{-2} - \beta y k)\theta$ . Considering the slope of the wage curve, it does not seem to be too difficult to generate a wage curve that has a negative slope, i.e.,  $\tau(1 - \beta)\phi^{-2} - \beta y k > 0$ . Moreover, as the intercept of the

wage curve,  $\beta y + (1-\beta)z$ , never exceeds the intercept of the job creation curve,  $y$ , and the slope of the wage curve is partly dependent on  $\tau$ , it follows that we can fairly easily derive two equilibria for the unemployment rate as both  $z$  and  $\tau$  can be considered to be free parameters. See the first column in *table A1* for an example.

Let us now depart from the case where the wage curve is linear. Reducing  $\eta$ , given  $\alpha = 2$ , or increasing  $\alpha$ , given  $\eta = 0.5$ , will make the wage curve concave. ( $\alpha(1-\eta) > 1$  is the necessary and sufficient condition for the wage curve to be concave in this case.) We can, in this case, easily produce similar numbers as in the first column by letting  $\eta$  take the value  $\eta = 0.45$ , and use  $a$  and  $z$  to calibrate the model. Reducing  $\eta$  to 0.45 will induce the wage curve to become positively sloped for low values of tightness and to be negatively sloped for high values of tightness.

Next, we consider the following cost function:  $c(u) = \tau u^{-\alpha}$ . That is, the cost of unemployment depends negatively on the number of unemployed workers, rather than on the number of unemployed workers in relation to the number of employed workers. In this case, the wage curve will be slightly convex if  $\eta = 0.5$  and  $\alpha = 2$ . Reducing  $\eta$  will, however, tend to make the wage curve concave in this case as well. The second column in *table A1* refers to this case.

The third column in *table A1* is derived by using the logistic cost function;  $c(u) = d(1 + \exp(b(u - 0.1)))$ . Three equilibria then emerge, where two are stable and one is unstable. The numbers in the two stable equilibria are shown in the table. This case corresponds to the right-hand figure in *figure 2*.

**Table A1.** Multiple equilibria.

<i>Variables</i>	$c(u) = \tau (u/(1-u))^{-\alpha}$	$c(u) = \tau u^{-\alpha}$	$c(u) = d(1 + e^{b(u-0.1)})^*$
	<i>Linear Wage Curve</i>	<i>Nonlinear Wage Curve</i>	<i>Nonlinear Wage Curve</i>
	$\eta=0.5, a=1.68, z=0.92$	$\eta=0.4, a=1.68, z=0.92$	$\eta=0.4, a=1.75, z=0.6$
$u_L$ (%)	6.5	6.8	6.3
$\theta_{uL}$	0.36	0.37	0.42
$u \text{ duration}_L$	0.99	1.04	0.96
$v \text{ duration}_L$	0.36	0.39	0.40
$u_H$ (%)	12.9	12.3	16.6
$\theta_{uH}$	0.07	0.13	0.07
$u \text{ duration}_H$	2.11	1.99	2.85
$v \text{ duration}_H$	0.17	0.25	0.20

Parameters:  $\beta = 0.5, y = 1, \phi = 0.07, r = 0, k = 5, \alpha = 2, \tau = 0.0095, b = 50, d = 2.3$ .

\* This cost function gives rise to three equilibria (two stable equilibria and one unstable equilibrium). The numbers in the column refers to the two stable equilibria.

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