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Distinguishing Neighborhood and Workplace Effects on Individual Productivity: Evidence from Sweden

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Abstract: We investigate the effects on individuals' productivity (captured through their wage income) of two social networks in which individuals are embedded: their residential neighborhood and their workplace. We avail ourselves of Swedish micro-level data which makes it possible to identify individual workers, and who they live next to and work with. We vary the spatial extent of the non-workplace social network—from block group to the whole of a metropolitan area—to examine which social community most affects an individual's productivity. We distinguish between individuals engaged in "creative" and "non creative" occupations so as to starkly control for differences in education, training and skills. Our results suggest that residential neighborhoods do matter for individuals' productivity, although the effect is stronger for noncreatives. For both creatives and noncreatives their workplace group has the greatest effect on income.

Keywords: Network effects, Neighborhood, Productivity, Workplace, Creative occupations
JEL codes: J10, R20, R23

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1. Introduction

The spatial division of cities into neighborhoods (or districts) may very well be one of the few universal features of urban life from ancient cities to contemporary urban areas (Kearns and parkinson, 2001; Smith, 2010; Smith et al. 2014). In the words of noted urbanist Lewis Mumford, "Neighborhoods, in some primitive, inchoate fashion exist wherever human beings congregate, in permanent family dwellings; and many of the functions of the city tend to be distributed naturally—that is, without any theoretical preoccupation or political direction—into neighbourhoods." (Mumford, 1954: 258) Much of urban life and organization is structured by and around neighborhoods and as a result they have received a lot of attention on the part of urban sociologists (see, for example, Park, 1916; Hoyt, 1939; Suttles, 1972; Wilson, 1987; Chaskin, 1997; Small, 2009; Sampson, 2012; Small, 2009).

What is a "neighborhood"? This rather straightforward question is surprisingly difficult to answer precisely. A common definition is provided by Sampson (2013: 973): "A neighborhood is a subsection of a larger community—a collection of people and institutions occupying a spatially defined area influenced by ecological, cultural and sometimes political forces." Under this perspective individuals residing in different neighborhoods may be subject to differential provision of economic, social and public goods which can, in turn, affect the individuals'' labor productivity. Such a differentiated provision directly and indirectly affects the current and future well-being of neighborhood residents. An example of this type of neighborhood effect traditionally emphasized in the literature involves differences in educational outcomes brought about by differences in the quality of the locally-provided education and in the involvement of parents in the education of their children (Burtless, 1996; Patacchini and Zenou, 2011).

An essential feature of neighborhoods is that they are the settings for social interactions among its residents, interactions which are not limited to family member (Glass,

1948; Suttles, 1972). Broadly speaking, social interactions arise when individuals (or households) directly, rather than indirectly through markets, affect each other's decisions, preferences, information sets, and outcomes. A neighborhood therefore consists of physically proximate, overlapping social networks linking individuals, and these networks can exert enormous influence on the choices, behaviors, well-being and productivity of the individuals embedded in them (Kearns and Parkinson, 2001; Sampson et al., 2002). There is a large sociological literature on the "contextual effects" whereby the socioeconomic characteristics of a neighborhood affect individuals' social, economic and health outcomes (see e.g., Jencks and Mayer 1990; Sampson, Raudenbush and Earls, 1997; Morenoff et al., 2001; Reardon and Bischoff, 2011; Rothwell and Massey, 2014).

One type of social interaction which is very germane to neighborhoods is role model effects, in which the behavior of one individual in a neighborhood is influenced by the characteristics of and earlier behaviors of older members of his/her social group. Other social interaction which can generate strong neighborhood effects include peer group influences (which refer to reciprocal and contemporaneous behavioral influences), interdependences in the constraints that individuals face (so that the costs of a given behavior depend on whether others do the same), and interdependences in information transmission (so that the behavior of others alters the information on the effects of such behaviors available to a given individual). Each of these types of "imitative behavior" implies that an individual, when assessing alternative behavioral choices, will find a given behavior relatively more desirable if others have previously behaved or are currently behaving in the same way (Roemer and Wets, 1994; Streufert, 2000; Glaeser et al., 2003; Ioannides and Topa, 2010). These and other contextual effects induced by the characteristics of neighborhoods can be expected to affect individuals' productivity and therefore their wages.

Neighborhoods need not be defined or circumscribed by geographic proximity—some notion of proximity in "social space" (in contrast to physical distance) is sufficient for there to be "neighborhood effects" (Akerlof, 1997). The relevant "neighborhood" (or "social space") can therefore be spatially extended over a city or urban area. And individuals' social interactions are of course not limited to those they engage in with their residential neighbors. There is a considerable body of literature extending across the social sciences relating to the role of social interaction in determining individual behavior. This literature suggests that individual decision-making across a wide range of activities is significantly influenced by the behavior of those with whom they have frequent contact. As a result, the composition of the groups within which individuals work and live performs an important role in determining individual outcomes and life chances (Manski, 2000; Durlauf, 2004; Ioannides and Loury, 2004; Christakis and Fowler, 2007; Easley and Kleinberg, 2010). The networks forged and entered into in a residential setting can be expected to operate differently than those in workplaces where interactions among fellow employees are embedded in social networks (Granovetter, 1985).

Urban economists, economic geographers and regional scientists have, for the past two decades, paid a lot of attention to how cities, understood to be spatially-bounded social agglomerations, facilitate learning, matching of skills and construction of economic niches (Rauch, 1993; Glaeser et al, 2004; Duranton and Puga, 2004). A major assumption underpinning the analysis presented here is that individuals, and the social groups they form, are differentiated with respect to how effectively they can benefit from network effects whether in residential neighborhoods or workplace. It seems imminently plausible that human capital, skills, job experiences and workplace situation should significantly affect not only which social groups do individuals form or enter into, but also how much they can learn from through the networks in which they are embedded (Granovetter, 1973). One way to empirical

capture both human capital (i.e., education) and skills embodied in individuals is by differentiating by *occupation*.

Labor economists have long used occupation indicators as a proxy for unobserved skills that a worker possesses. Occupational classification embodies a specific set of skills, training, work activities, and educational requirements (Edwards, 1941; Acemoglu and Autor, 2010). Occupation is not the same as "human capital", as measured solely by educational attainment, as it reflects what someone is actually being paid to do, rather than what they studied or trained for (Levenson and Zhogi, 2007; Florida et al., 2008; Moretti, 2012). Another reason for using an occupational based measure of skills and knowledge is that occupational data is more closely related to the workplace itself. Since we are interested in network effects both from the residential location but also from the workplace location, using an occupational measure is more suitable, since we could assume some individuals work with something else than what they actually studied for.

Occupational classification should facilitate differentiating between those whose productivity would be more likely to be enhanced through networks and connectivity from those whose productivity would be less likely to see a positive impact. Over five decades ago Peter Drucker identified *knowledge workers* as those individuals whose main contribution to the process of wealth creation are their knowledge and skills (Drucker, 1959). Florida (2002) developed a way to operationalize the notion of "knowledge workers" and count them, labeling them the "creative class." The "creative class" (or "creative" workers) is a group of workers whose economic function is to create new ideas, technologies, or designs, and whose occupations are knowledge intensive, require creativity and involve problem solving (Florida, 2002; McGranahan and Wojan, 2007). We note that although there is a strong correlation between the share of creative workers and the share of the workforce with a BA or above, the two groups are not the same (Currid-Halkett and Stolarick, 2011). So, while the average

higher wages earned by the creative class may be partially explained by educational attainment levels, as a group, the creative class has too many members without a Bachelor's degree for education to explain all of the variation.

Using the creative class as a human capital categorization also allows for the investigation of neighborhood and social network effects on those within or without that group, while also providing identification of a group which may create positive externalities for its neighbors. By partitioning the Swedish workforce between creative and non-creative (service, working, and farming occupations) we will be able to examine the potential for differing impacts by human capital categories. Based on a standard Mincer modeling framework (Mincer, 1974), we econometrically estimate the possible network effects using different spatial scales for residential neighborhoods. We separate network effects based on residential location from those stemming from workplace composition, while controlling for individuals' socioeconomic characteristics as well as "urban" versus "suburban" settings. Importantly, we separate adult individuals into two groups depending on whether or not their occupation is "knowledge intensive" (a so called "creative class" job).

The decisions of individuals who share spatial and social milieus are likely to be interdependent, and thus the econometric identification of "neighborhood" effects, and in particular distinguishing residential from workplace community effects, poses intricate data and methodological problems (Ioannides and Topa, 2010). To fully discern the relative importance of residential neighborhood effects compared to workplace neighborhood effects, it is necessary to use utilize spatially fine-grained data on individuals' economic performance, their socio-economic characteristics, places of residence and work, as well as information on those other individuals with whom they reside close to in a residential neighborhood. Such data exists, and we avail ourselves of it. Statistics Sweden collect micro data for all individuals and all establishments (physical locations where paid work occurs) on

a yearly basis. The data is geo-coded down to a very fine geographical level and comes with information about the individual and firm characteristics. In other words, one is able to follow each individual both based on residential location as well as workplace location and on top of that add individual characteristics in terms of income, education, occupation, etc. Individual-level productivity is captured through their *income* (which includes both wages and income accrued from other economic activities).

We consider the following specific questions, from the vantage point of individual productivity effects:

1. Where are the strongest "network effects" to be found, at the level of residential location, workplace location or from the workplace itself?
2. Is it more important to live in a neighborhood with many individuals employed in creative occupations even if the overall metropolitan level of creative employment is low (or the other way around)?
3. Which is relatively more important, who an individual lives or works with?
4. Do the answers to the above questions differ depending on whether an individual is employed in a creative occupation or not?

The general underlying question is simply how big a residential or workplace neighborhood *really* is when it comes to the effect that creative individuals (i.e., individuals employed in creative occupations) have on the wages of other individuals.

The discussion is organized as follows. In the next section we describe the extensive micro-level data set we utilize in the analysis, present the regression variables and discuss how these were constructed. The econometric estimation framework is presented in section three while the estimation results are provided and discussed in section four. Section five concludes with a discussion of the answers to the questions posed above.

2. Micro-level Data: Neighborhoods and Workplaces in Sweden

The results presented here are based on the micro-level longitudinal MONA (Microdata-ON-line-Access) database compiled by Statistics Sweden (the agency of the Swedish government responsible for producing official statistics regarding Sweden). The data used covers every individual and every establishment (physical place of work) in Sweden in the years from 2002 to 2011. We focus our analytical attention on individuals between 20 and 65 years old (who are considered adult workers in Sweden) and who earn a "work income" (i.e., a salary); we exclude from our analysis individuals who stand outside of the labor market. Another selection criterion is that individuals must work in establishments with at least three employees so as to be able to test if there are social network effects in the workplace. The data used for our analyses totals 21,680,741 observations distributed over a ten-year-period (approximately 2.17 million observations per year). Out of these, 8,449,589 observations correspond to the group of individuals with creative knowledge jobs, while 13,231,152 represent "non-creative jobs". In principle every resident of Sweden is included in MONA but for the results presented here we excluded children, retirees, and the unemployed. We also impose the additional data restriction that individuals had to be employed in workplaces with at least three employees. At the end the total number of observations in the database used for the econometric estimations totaled slightly over 2 million per year for ten years.

To capture neighborhood effects at different distance scales, we utilize several spatial units of analysis. Since each individual is geo-coded at the residential and workplace level we are able to identify his or her approximate yet precise location both at home and at work. The neighborhood levels we employ are the following:

Block: this is a 250 x 250 meters area for urban locations, and 1,000 x 1,000 meters for rural locations. We assume that such a small area is the setting for residential neighborhood

dynamics as individuals can get to know and interact with each other. This is equivalent to the "census block" as defined by the U.S. Census Bureau, which is the smallest geographic unit used by the Bureau and which are often grouped into "Block Groups" which in turn are grouped in "Census Tracts" for studies of neighborhood phenomena.[4] So by using data at the Block level we are achieving an unusually fine level of spatial resolution for studies of neighborhood phenomena.

SAMS (Small Area for Market Statistics): this is approximately equivalent to the U.S. Census "tract level." Sweden has approximately 9,200 SAMS distributed across 290 municipalities. We assume this spatial unit accommodates a residential neighborhood or workplace cluster.

Municipalities: This is the most commonly used regional definition for political administration in Sweden and its boundaries are administratively/politically set. A municipality is approximately equivalent to a county in the U.S. Currently there are 290 established municipalities in Sweden

Local Labor Markets: We define 81 Swedish labor markets (equivalent to Metropolitan Statistical Areas in the United States) consisting of a region with an urban center municipality and surrounding suburban municipalities linked by commuter flows.

Table 1 below describes in detail the variables we include in our study:

(Table 1 about here)

In our paper, we use the terms wage and income interchangeable, since our dependent variable is a combination of income from employment activities (wage) and (where applicable) income from business activities (e.g. self-employment).

[4] See, for example, Knneebone, Nadeau and Berube (2011).

3. Estimation Framework

For our estimations we use a standard Mincer regression and expand on the idea of Ioannides and Topa (2010) of individual and contextual affects. We include separate contextual potential influences for both residential location (place of residence) and workplace location (place of work). Our model includes the following variables:

1. Income (a combination of employment wage and incomes from business activities)
2. Education
3. Experience (proxied by age)
4. Gender
5. Marital status (dummy variable)
6. Immigrant (a dummy variable indicating whether an individual was not born in Sweden or was born in Sweden to at least one foreign-born parent).
7. Characteristics of residential location at various geographies including dummies for the residence being in a central city and being in one of the three biggest cities in Sweden (Stockholm, Göteborg, Malmö).
8. Characteristics of workplace location at various geographies including dummies for the workplace being in a central city and being in one of the three biggest cities in Sweden (Stockholm, Göteborg, Malmö).
9. Fixed effects for year and industry (separately and jointly).

The basic estimation equation is

$$lnY_{itr} = \alpha + \beta_1 education_{it} + \beta_2 experience_{it} + \beta_3 experience_{it}^2 + \sum \beta_4 residential\ neighborhood_{tr} + \beta_5 creative\ share\ in\ workplace_i + \sum \beta_6 workplace\ location_{tr} + Z'\gamma + fixed\ effects + \varepsilon_{itr}$$

where *Y* denotes the income level of individual *i* at time *t* living in residential location *r* and working in workplace *r*. Equation (1) explains an individual's income as a function of education and potential labor market experience (with a quadratic term for the experience variable). The Z term is a vector of control variables including gender and immigration background, and additionally, a dummy variable for whether the individual lives and/or works in the city center (compared to a suburb or rural area), an index variable for whether he/she resides in one of Sweden's major metropolitan areas (Stockholm, Göteborg or Malmö); ε is an error term. For the estimation we use an unbalanced panel structure, where we assume fixed effects for time (measured in years) and for the industry the individual works in.

A weakness with our estimation framework is that, unlike in a standard Mincer function, we are not able to include hours worked per week, which we know has a positive impact on income levels. This variable is unfortunately not reported in the MONA dataset. However, we know from aggregated studies by Statistics Sweden that men, on average, work six to eight hours more per week than women (the difference has decreased from eight to six hours between the years 2000 to 2010, the period covered in our study. This difference partly stems from the fact that Swedish men only stay at home one fourth of the time that women do when they have children. Furthermore, in Sweden women tend to have a larger share of their employment in the public sector, which pays lower wages than the private. However, we expect this omitted "hours worked" variable to be partly captured by our gender control variable.

On top of the individual characteristics variable we add the variables that are important for our research questions, namely the residential and workplace location characteristics at different neighborhood levels. We also add information about the share of creative jobs in the workplace.

4. Results

4.1 All Workers in Sweden

We now report the results from a multivariate regression analysis on the possible influence of neighborhood (social networks) effects at different levels of spatial resolution controlling for individual characteristics (Table 2). The regression variables used can be partitioned in two major ways: residential location and workplace location. For each location, which is putatively associated with different social networks and hence different network effects, we investigate the impact on individual-level productivity of being co-located among creative individuals. The different spatial units which we treat as representing different scales of residential neighborhoods are: the *block* (250 square m in urban areas or 1 square km in rural areas), the *SAMS* (the equivalent of a Census Tract in the U.S.), the *municipality* (approximately a county in the U.S.), and the *local labor market* (the equivalent of a Metropolitan Statistical Area).

For each spatial level, we capture the possible effects from being among "creative" individuals by measuring both *shares* (the number of creative workers as a share of the total number of workers for that particular geography) and *density* (the number of creative workers per square km). We also examine the effect on individual productivity of having creative individuals as co-workers, captured via the share of a workplace's work force classified as "creative workers". The results from estimating equation (1), with fixed effects for time and industry, and using all observations, are presented in Table 2.

(Table 2 about here)

The variables with the strongest explanatory value (using standardized coefficients[5]) are those capturing individual-level characteristics, such as gender and age, and the gender variable may be reflecting the effect of hours worked per week. Following these two variables, the share of co-workers who are "creative" has the strongest impact on the income level, followed by years of education, and whether the individual has a migrant background (negative). Migrant background is identified as either being a migrant or having at least one parent who was a migrant. Taken together these results indicate that individual characteristics and the workplace's occupational structure are the major determinants of individual level productivity (proxied through income). However, neighborhood effects, captured via the proportion of an individual's neighbors at the block level who are classified as "creative workers" has a relatively strong and significant relation with individual income. (Interestingly, density of creatives at the block level is not significant.)

Turning to the SAMS level (which recall is roughly equivalent to a Census tract in the U.S.), we find a somewhat weaker, but still strong, positive impact on individual income from working in an area with a higher share and density of creatives working in the same SAMS area. This suggests that the 'productivity' of a workplace's employees is positively affected by the nearby presence of creatives employed by other workplaces located in the same neighborhood. This statistical result could be a proxy for a workplace being located in a cluster of knowledge-intensive businesses in which employment opportunities for creatives are plentiful and so are the opportunities for knowledge sharing to occur. We also find a relatively strong effect from a high density of creative workers in the municipality (approximately a county in the U.S.) where an individual's workplace is located.

Two additional variables with relatively strong impact is also whether an individual is married and live in an urban center rather than in a suburban (non city center) municipality.

[5] Available in the Appendix

When possible metropolitan level effects (local labor market) on individual level income, our results suggest that any such effect is relatively weak. This implies that a high share of creative workers living *very* near to an individual, and having a workplace located in a knowledge cluster both have a strong effect on individual income, whereas just being in a creative metropolitan area is not sufficient. In fact, we find certain negative and significant effects from living in a municipality and/or labor market with a high share of creative labor. We may speculate that at this spatial level a larger supply of creative knowledge workers decreases the average wage level, since knowledge workers then are less scarce.

To summarize, having a high share creative people very near where you live has the strongest impact, followed by creative shares from the SAMS area—both residential and workplace wise. In other words, it is more important where you are specifically located within the metro rather than being in a broadly creative, knowledge metro as such. This also suggests that the neighborhood in terms of network effects is limited to the very nearest block around the individual (from a residential aspect) while it is somewhat wider in terms of workplace effect, where the SAMS (approx. a tract) still has a strong income impact. But beyond this point, the network effects on individual income are significantly weaker.

4.2. Differences between Creative (Knowledge) and Non-Creative Workers

There may be reasons to think that creative workers derive more benefits from being among other creative individuals compared with individuals with non-creative jobs (Florida, 2002; others). We therefore re-estimated the regression framework of equation (1) but this time splitting the individual observation groups based on if the individual has a creative job or not. Table 3 below present the new regression results:

(Table 3 about here)

Starting off with the individual level variables, gender and age are the two strongest factors in explaining individual income levels, both for creative and non-creative workers. Years of education is strong in explaining income levels for creative individuals, while it is weak and negative for non-creative individuals. Having an immigration background is negative and significant for both groups, but it has a relatively stronger negative impact for non-creative individuals.

Looking at the network effects on different levels, for *creative individuals* we find the strongest positive impact from the share of creative workers and the creative worker density in the SAMS (i.e., tract level) where the workplace is located, but also from the share of creative workers and in the SAMS where the individual resides. We also find a relatively strong positive effect from the density of creative workers in the municipality where the workplace is located. The impact from the residential block where the individual resides is on the other hand much weaker, indicating that creative workers probably find their networks in a geographically broader context, and also in a more work-related context. However, and interestingly enough, creative individuals whose workplaces have a higher share of creative individuals have significantly lower income levels. This indicates that it may be good to be a creative worker in a creative cluster, but not necessarily in a workplace where more creative individuals compete in the same wage pool. Also, the marginal effect of the individual creativity may be lower as the workplace creative share increases. Just as in the Equation 1 case above, we find very weak relations between the creative shares in the local labor markets.

For the non-creative individuals, the explanatory power of the different variables is significantly different. In this case, we find one of the positive effects on individual income is from the creative share in the actual workplace – the very same variable that had a negative impact for creative individuals. It may be the case that creative firms have higher average

wage levels due to higher productivity levels, and that non-creative workers can benefit from this. For non-creative individuals there is also a relatively stronger positive effect from living in the city center (and not a suburb) on individual income. Living in a block with a higher share of creative workers has also a relatively stronger impact on the non-creative individual's income level than for creative individuals. We would assume that the people in the very same block would be people one actually knows quite well and it may be that being among other people with a "stronger career path" could be a relatively stronger advantage for non-creative people than for creative ones. We also find weak effects from creative shares and density over larger geographical areas (creative density in the residential labor market excepted), but in general the results suggest that non-creative people have relatively stronger network effects on incomes from neighbors and creative work colleagues, while creative individuals benefit more from being in a work place located in a creative cluster.

5. Discussion

One of the principal questions animating the investigation reported here was to identify the spatial extent of the residential neighborhood which has the greatest effect on individuals' incomes. We examined this by looking at different spatial resolutions—from the smallest block up to the metropolitan area. We distinguished between two types of communities capable of generating network effects: a residential neighborhood and workplace group, and we further distinguished between individuals engaged in "creative" and "non creative" occupations. We think this occupational dichotomy captures the difference between those individuals whose wage income derives from the exercise of high levels of education, training, skills and intellectual capacities from those who do not.

Our results suggest that residential neighborhoods do matter for individuals' productivity, but they matter differently for creative and non-creatives. For the creative

individuals, we find the relatively strongest effects from workplace location. If an individual's workplace was located in a metropolitan area with a high share (or density) of creative employment, creative individuals garnered significantly higher income. This may reveal the advantage for creative individuals of working in a creative cluster with different types of employers where they can change jobs frequently, and where firms compete for the same talent. However, we also found a strong but negative effect for creatives working in a workplace with a higher share of other creatives. This may reflect that within the same firm, the marginal effect from adding one more creative person is not very pronounced, and there are more individuals competing for the same wage pot so to say. At the residential level, creative individuals were the most likely to have a higher income if they lived in a SAMS (approximately an American tract) with a high share of creative individuals.

The results are somewhat different for individuals engaged in non-creative occupations. In contrast to the results for creatives, non-creatives were the most likely to benefit financially from being in a workplace with a high share of creative individuals. This could be a result from higher wage levels in general for creative individuals, which spills over on the non-creative wages. However, the non-creatives had basically no financial advantages from working in a workplace located in a creative cluster with a high share and density of creative individuals. We may assume that the firms are more likely to compete with wages for the creative knowledge workers than the non-creative, and thereby they have less to gain from such "locational advantages". We also found a relatively stronger impact from the residential block level. Individuals employed in non-creative occupations likely rely more on friends and neighbors when it comes to networking. While the creative individuals seemed to have a stronger relation between the creative share in the SAMS, the non-creative individuals seem to rely on a smaller geographical area (the block). Neither of the two occupational groups get a strong positive effect from being in a creative municipality. At the labor market

level (metropolitan area) we found somewhat stronger relations between individual income and creative shares and density for creative workers. Both groups also see positive effects from being located in the very city center (urban regional center resident).

Taken together our results indicate that neighborhood effects on individual-level productivity are different depending upon the educational and skills endowments of individuals. Creative individuals clearly benefit the most from being in a workplace located within a creative cluster, while the closest residential neighborhood has a relatively weaker relation with the actual income level. For non-creative individuals, having a job in a workplace seem to be the most effective in order to get a higher income. However, we would also assume that the number of such jobs to be relatively limited. Given this, the very closest residential block become relatively important. So it seems to be more important where you live/work within the metro than in what metro you live/work in. Given this, the role of spatial segregation becomes even more important, especially for non-creative workers.

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Appendix: Summary Table, Workers by Class (2002-2011)

	CREATIVE ONLY			NOT CREATIVE ONLY		
	MEAN	**MIN**	**MAX**	**MEAN**	**MIN**	**MAX**
Individual Level						
Income	3,950	76	760,656	2,377	76	1,951,063
Age	43.45	20.00	65.00	40.40	20.00	65.00
Education	13.36	8.00	19.00	11.23	8.00	19.00
Gender	0.645	0	1	0.690	0	1
Marital Status	0.533	0	1	0.372	0	1
Immigrant	0.106	0	1	0.166	0	1
Residential Level						
Creative Share in Square	0.543	0	1	0.303	0	1
Creative Density in Square	849.9	0.0	11,936.0	404.3	0.0	11,936.0
Creative Share in SAMS	0.480	0	1	0.344	0.000	0.968
Creative Density in SAMS	4,151	0.0	288,803	1,574	0.0	288,803
Creative Share in Municipality	0.441	0.146	0.826	0.371	0.146	0.826
Creative Density in Municipality	132.82	0.01	680.26	67.35	0.01	680.26
Creative Share in Labor Market	0.423	0.154	0.547	0.382	0.154	0.547
Creative Density in Labor Market	11.306	0.008	19.840	8.328	0.008	19.840
Metro Resident	0.536	0	1	0.349	0	1
Urban Regional Center Resident	0.543	0	1	0.502	0	1
Workplace Level						
Creative Share at Workplace	0.724	0.001	1.000	0.186	0	0.999
Share Creative Workplaces in SAMS	0.508	0	1	0.332	0	0.999
Creative Workplace Density in SAMS	22,264	0	377,147	7,815	0	377,147
Share Creative Workplaces in Municipality	0.452	0.146	0.696	0.370	0.146	0.696
Creative Workplace Density in Municipality	298.63	0.01	1,380.62	132.92	0.01	1,380.62
Share Creative Workplaces in Labor Market	0.430	0.146	0.551	0.385	0.146	0.551
Creative Workplace Density in Labor Market	11.550	0.006	20.216	8.378	0.006	20.216
Metro Workplace	0.568	0	1	0.371	0	1
Urban Regional Center Workplace	0.671	0	1	0.572	0	1
N	8,982,161	8,982,161	8,982,161	13,559,516	13,559,516	13,559,516

Standardized Beta-Coefficients for Equation 1 (Table 2) and Equation 2-3 (Table 3)

	Equation 1	Equation 2	Equation 3
Individual Level			
Age	1,272132	1,621632	1,345397
Age Squared	-1,11256	-1,456	-1,21548
Education	0,102593	0,154599	-0,01066
Gender	0,212618	0,255382	0,187427
Marital Status	0,020637	0,020266	0,004492
Immigrant	-0,0631	-0,03855	-0,07004
Residential Neighborhood Level			
Creative Share in Block	0,065988	0,029855	0,029935
Creative Density in Block	-0,00032	0,00595	-0,00102
Creative Share in SAMS	0,042962	0,080537	0,016815
Creative Density in SAMS	0,003364	0,00418	-0,00169
Creative Share in Municipality	-0,0104	-0,00083	-0,02314
Creative Density in Municipality	-0,0112	-0,00632	-0,00802
Creative Share in Labor Market	-0,02936	-0,03792	-0,01073
Creative Density in Labor Market	0,033361	0,034271	0,026297
Metro Resident	-0,01075	-0,00959	-0,00455
Urban Regional Center Resident	0,025766	0,030499	0,030784
Workplace Location Levels			
Creative Share at Workplace	0,148635	-0,06925	0,080633
Share Creative Workplaces in SAMS	0,040149	0,106441	-0,00114
Creative Workplace Density in SAMS	0,033601	0,051674	0,015577
Share Creative Workplaces in Municipality	-0,0012	0,01382	0,022337
Creative Workplace Density in Municipality	0,034327	0,04917	0,003514
Urban Regional Center Workplace	-0,01075	-0,00959	-0,00455

TABLES

Table 1: Descriptive Statistics

Variable	Description	MEAN	STD DEV	MIN	MAX
Individual level:					
Income	Annual Total Income (100 Swedish Kronor*). This is the total wage from work and income from business activities.	2,929	2,312	76	1,951,063
Age	Age	41.47	12.10	20.00	65.00
Education	Years of Education	12.06	2.30	8.00	19.00
Gender	1=male; 0=female	0.675	0.468	0	1
Marital status	1=married 0=not married	0.434	0.496	0	1
Immigrant	Immigrant or child of immigrant parent(s); 1=yes; 0=no	0.150	0.357	0	1
Residential Neighborhood Levels:					
Creative share in block	Percent of Place of Residence grid square (1km or 0.25km) that are creative	0.397	0.240	0	1
Creative density in block	Creative density of Place of Residence grid square (residents per sq. km)	580.7	1,230.3	0	11,936
Creative share in SAMS	Percent of Place of Residence SAMS (neighborhood) that is creative	0.397	0.181	0	1
Creative density in SAMS	Creative density of Place of Residence SAMS (residents per sq. km)	2,613	13,772	0	288,803
Creative Share in Municipality	Percent of Place of Residence Municipality (county) that is creative	0.398	0.130	0.146	0.826
Creative Density in Municipality	Creative density of Place of Residence Municipality (residents per sq. km)	93.68	188.12	0.01	680.26
Creative share in Labor Market	Percent of Place of Residence FA (metro region) that is creative	0.399	0.099	0.154	0.547
Creative Density in Labor Market	Creative density of Place of Residence FA (residents per sq. km)	9.524	7.635	0.008	19.840
Metro resident	Place of Residence Main Swedish Metro Stockholm, Göteborg or Malmö?; 1=yes; 0=no	0.424	0.494	0	1
Urban regional center resident	Place of Residence in Urban Center? 1=yes; 0=no	0.518	0.500	0	1
Workplace Location Levels					
Creative share at Workplace	Percent of place of work (establishment) that are creative	0.398	0.359	0	1

	workers				
Share Creative Workplaces in SAMS	Percent of place of work SAMS (neighborhood) that is creative	0.400	0.205	0	1
Creative Workplace Density in SAMS	Creative density of place of work SAMS (residents per sq. km)	13,438	43,883	0	377,147
Share Creative Workplaces in Municipality	Percent of place of work Municipality (county) that is creative	0.402	0.140	0.146	0.696
Creative Workplace Density in Municipality	Creative density of place of work Municipality (residents per sq. km)	199	362	0.01	1,381
Share Creative Workplaces in Labor Market	Percent of place of work FA (metro region) that is creative	0.403	0.103	0.146	0.551
Creative Workplace Density in Labor Market	Creative density of place of work FA (residents per sq km)	9.670	7.778	0.006	20.216
Metro Workplace	Place of Work in Main Swedish Metro (Stockholm, Malmö, Göteborg) (1=yes; 0=no)	0.451	0.498	0	1
Urban regional center workplace	Place of Work in Metro Center City (1=yes; 0=no)	0.610	0.488	0	1
N		21,680,741			

***1 USD is approximately equivalent to 6.5 Swedish Kronor; 1 Swedish Kronor is approximately $0.15 US.**

Table 2 – Regression results for creative network effects on individual income level (2002-2011). Dependent variable: log income

	Equation 1
Individual Level	
Age	0.0683**
	(0.00007)
Age Squared	-0.0007**
	(0.00000)
Education	0.0290**
	(0.00006)
Gender	0.2949**
	(0.00026)
Marital Status	0.0270**
	(0.00025)
Immigrant	-0.1149**
	(0.00034)
Residential Neighborhood Level	
Creative Share in Block	0.1784**
	(0.00075)
Creative Density in Block	-0.0000
	(0.00000)
Creative Share in SAMS	0.1543**
	(0.00118)
Creative Density in SAMS	0.0000002**
	(0.00000)
Creative Share in Municipality	-0.0520**
	(0.00197)
Creative Density in Municipality	-0.0000387**
	(0.00000)
Creative Share in Labor Market	-0.1926**
	(0.00399)
Creative Density in Labor Market	0.0028**
	(0.00006)
Metro Resident	-0.0141**
	(0.00049)
Urban Regional Center Resident	0.0335**
	(0.00033)
Workplace Location Levels	
Creative Share at Workplace	0.2690**
	(0.00049)
Share Creative Workplaces in SAMS	0.1272**
	(0.00088)
Creative Workplace Density in SAMS	0.0000005**
	(0.00000)
Share Creative Workplaces in Municipality	-0.0056*
	(0.00187)

Creative Workplace Density in Municipality	0.0000616** (0.00000)
Urban Regional Center Workplace	-0.0173** (0.00029)
N	21,680,741
R-Square	0.299

Fixed Effects	**F Value (Pr > F)**
Year	25052 (<.0001)
Industry 2-digit level (year)	6958 (<.0001)

Standard errors within parentheses; * p<0.001; ** p<0.0001

Table 3 – Regression results for creative network effects on income levels for creative and non-creative workers (2002-2011), Dependent variable: log income

	Equation 2	Equation 3
Individual Level		
Age	0.0906**	0.0578**
	(0.00014)	(0.00008)
Age Squared	-0.0009**	-0.0006**
	(0.00000)	(0.00000)
Education	0.0391**	-0.0032**
	(0.00009)	(0.00009)
Gender	0.3211**	0.2548**
	(0.00038)	(0.00034)
Marital Status	0.0244**	0.0049**
	(0.00039)	(0.00032)
Immigrant	-0.0755**	-0.1003**
	(0.00059)	(0.00040)
Residential Neighborhood Level		
Creative Share in Square	0.0831**	0.0792**
	(0.00114)	(0.00104)
Creative Density in Square	0.0000**	-0.0000*
	(0.00000)	(0.00000)
Creative Share in SAMS	0.2639**	0.0584**
	(0.00182)	(0.00154)
Creative Density in SAMS	0.0000001**	-0.0000001**
	(0.00000)	(0.00000)
Creative Share in Municipality	-0.0038	-0.1044**
	(0.00292)	(0.00261)
Creative Density in Municipality	-0.0000175**	-0.0000277**
	(0.00000)	(0.00000)
Creative Share in Labor Market	-0.2389**	-0.0592**
	(0.00697)	(0.00473)
Creative Density in Labor Market	0.0027**	0.0019**
	(0.00010)	(0.00007)
Metro Resident	-0.0116**	-0.0051**
	(0.00078)	(0.00060)
Urban Regional Center Resident	0.0367**	0.0327**
	(0.00058)	(0.00039)
Workplace Location Levels		
Creative Share at Workplace	-0.1408**	0.2151**
	(0.00082)	(0.00082)
Share Creative Workplaces in SAMS	0.3077**	-0.0037*
	(0.00133)	(0.00115)
Creative Workplace Density in SAMS	0.0000006**	0.0000002**
	(0.00000)	(0.00000)
Share Creative Workplaces in Municipality	0.0599**	0.0933**
	(0.00306)	(0.00231)

Creative Workplace Density in Municipality	0.0000704** (0.00000)	0.0000065** (0.00000)
Urban Regional Center Workplace	-0.0152** (0.00046)	-0.0096** (0.00035)
N	8,449,589	13,231,152
R-Square	0.249	0.206
Fixed Effects	**F Value (Pr > F)**	**F Value (Pr > F)**
Year	8857 (<.0001)	14966 (<.0001)
Industry 2-digit level (year)	991 (<.0001)	3570 (<.0001)

Standard errors within parentheses; * p<0.001; ** p<0.0001