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Abstract

This paper examines social agglomeration externalities. Using survey data from the German Socio-Economic Panel, I examine the link between city size and different measures of consumption, social interaction and social capital. Further, using responses to satisfaction questions, I analyse whether individuals are compensated for diseconomies of agglomeration by positive agglomeration externalities in other areas. This equilibrium hypothesis cannot be rejected.

JEL classification: R22, R23

Keywords: agglomeration, externalities, social interaction.

1 Introduction

About 75% of the population in developed countries live in cities. Since housing prices, commuting costs, congestion, pollution and crime all increase with city size, a good question is, why? Given these obvious costs of agglomerations, the existence of cities must be explained by countervailing agglomeration economies. At least since Alfred Marshall, economists have emphasised the positive role of agglomeration for economic activity. Productivity in big cities is thought to be higher because of larger input markets, knowledge spillovers, and benefits from labour pooling. A large branch of urban economics is concerned with the theoretical modelling and empirical identification of these agglomeration

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externalities (see Duranton and Puga, 2004 for a survey of theoretical approaches and Rosenthal and Strange, 2004 for a survey of empirical studies).

If productive externalities are prevalent, individuals in big cities should receive higher nominal wages which compensate for the higher housing and commuting costs. However, besides facilitating production, cities also serve as centers of consumption and social interactions. This implies that individuals may accept lower real wages in large cities if they are compensated by other agglomeration economies. And, indeed, Tabuchi and Yoshida (2000) and Glaeser et al. (2001) find that while nominal wages increase with city size, living costs increase even faster so real wages decrease with city size. This implies that productive agglomeration externalities alone are not enough to compensate individuals for the diseconomies of agglomeration. Rather, there must be other agglomeration effects which are not capitalised in wages.

The aim of this paper is to assess the importance of various kinds of non-productive agglomeration externalities. I will use the term social agglomeration economies for those agglomeration effects which do not affect individual productivity but still benefit individuals.

While urban economists have traditionally emphasised the role of cities in production, more recent papers have focussed on agglomeration economies stemming from benefits in consumption or social interaction (Glaeser, 2000; Glaeser et al., 2001). Glaeser et al. (2001) argue that cities are centres of consumption. They show that cities with amenities such as good climate and many restaurants per capita have grown faster than cities without such amenities. Consumption externalities also play a central role in the theoretical literature of the new economic geography. Following Krugman's (1991b) seminal contribution, this literature studies agglomeration benefits stemming from the interaction of consumers' love for variety, increasing returns on the firm level and transport costs. An empirical assessment of consumers' evaluation of the consumption benefits provided by agglomeration would therefore also be important for this large and growing branch of economics.

Glaeser (2000) argues that non-market interactions present the future of urban research. Indeed, he argues that one cannot understand cities without understanding nonmarket interactions. It is quite clear that many social interactions are facilitated by spatial proximity. Glaeser (2000, 2004) examines different indicators of social interaction and shows the importance of city size as a determinant. I use many of the same indicators and will comment on them further below. Whereas Glaeser (2000, 2004) mainly shows simple correlations

and OLS estimates, I also present evidence from OLS and, in addition, fixed effects and instrumental variable estimates.

The body of the paper studies how indicators of various kinds of social interaction are influenced by city size. Among these indicators are various measures of consumption, such as visits to restaurants, cinemas, and so on, measures of social interaction such as trust, number of friends, partnership, and measures of 'social capital' such as membership in organisations and political interests.

Finally, I also examine satisfaction with life in general and satisfaction with various specific domains, in particular, housing, job and consumption. The idea is to test an equilibrium hypothesis: if individuals are mobile, in equilibrium, residents of larger cities should just be compensated for the diseconomies in certain domains, such as commuting and housing markets, by agglomeration economies in other domains, such as labour markets, consumption or social interaction.

The results indicate that city size is an important influence on many of these indicators. Some measures of social interaction and social capital reveal positive agglomeration economies while other reveal negative economies. Moreover, including fixed effects washes out individual heterogeneity and at the same time reduces some of the effects of city size. The strongest evidence in favor of agglomeration economies is shown in consumption, while the evidence for social interaction and social capital is somewhat mixed. Moreover, the data on satisfaction indicate that individuals in bigger cities experience higher satisfaction in consumption and lower satisfaction in housing, while they show no marked effect on job satisfaction. Overall life satifsfaction does not seem to depend on city size. Hence, the hypothesis that, in equilibrium, agglomeration economies and diseconomies just balance each other cannot be rejected.

The paper is organised as follows. The next section presents a brief overview of the kinds of social agglomeration externalities considered in this paper. Section 3 describes the data used in the empirical analysis. Section 4 shows the regression results from simple OLS (or ordered logit) regressions. Section 5 addresses selection issues, and the last section concludes the paper.

2 Social agglomeration externalities

In this section, I describe the types of externalities on which the empirical analysis will be based. I will categorise externalities into three types described in the following subsections: consumption, social interaction and 'social capital'. In the last subsection, I briefly discuss agglomeration diseconomies in housing markets and how one can empirically assess whether these are outweighed by agglomeration economies in labour markets or social economies.

2.1 Consumption

There are many goods for which membership must exceed a certain threshold for the good to be profitably supplied. For instance, in small towns, there typically won't be cinemas, theatres or concert halls, and there will be only a limited number of restaurants. Therefore, consumers in bigger cities should benefit from the usage of these 'club goods'.

There is also an important agglomeration externality in consumption which is emphasised by the new economic geography. Models using the Dixit-Stiglitz assumption of consumers' love for variety show that firms locate in cities to be close to consumers and economise on transport costs, and consumers locate in cities to benefit from the lower price index of consumption goods (Krugman, 1991a,b). Hence, individuals move to large agglomerations and take advantage of lower goods prices.

2.2 Social interaction

Man is a social animal. It is relatively obvious that the benefits of social interaction should depend on the size of the relevant group with which one can interact. In this subsection, I present some measures of social interaction used in the sequel.

Trust. Social interactions often rely to a large extent on face to face contacts. In small communities, individuals interact with each other on a day to day basis and may therefore find it easier to trust others in their social relations. However, smaller towns might also be more closed towards outsiders and hence distrust others more when they come from other cities. Hence, on average, the effect of city size on trust is not a priori clear.

Crime. While there are increasing returns in many social interactions, there are also increasing returns to crime. Criminals benefit from a greater number of potential targets

and the lower costs of escape, as well as low probability of apprehension in larger cities. The relationship between city size and crime is well documented (see, for example, Glaeser and Sacerdote, 1999).

Matching. One of the big advantages of city life comes in the form of matching externalities. Since matching markets in cities are likely to be thick, the idea that there are matching externalities in city size seems natural. And indeed, under certain assumptions, one can generate matching functions with increasing returns to scale (see Duranton and Puga, 2004). This idea has generally been applied to labour markets, but the application to marriage markets and other social relationships is obvious.

There are two basic arguments why there would be increasing returns in matching markets. First, individuals will find it easier to find a suitable partner in a bigger city. And second, the quality of any given match is likely to be better in thicker markets. Therefore, one would expect that the benefits of interacting with friends and partners should be higher in cities. However, things are a bit more complex. If cities are better marriage markets, single individuals should be willing to move to cities to find a mate. However, individuals who have found a mate should, other things equal, be more likely to move out of cities to benefit from lower housing costs (Gautier et al., 2005). Therefore, it is not a priori clear whether individuals in bigger cities should be more or less likely to live with a partner.

2.3 Social capital

An important topic in a recent literature, primarily American, is the alleged fall in 'social capital'. Glaeser (2004) discusses how cities shape individuals' incentives to become involved in civic matters and politics. On the one hand, urban proximity might facilitate interaction in political community matters. On the other hand, as argued by Robert Putnam (2000), city residents may also be less likely to be engaged in civic matters and to be 'socially connected'.

2.4 Satisfaction and the balance of agglomeration externalities

Suppose individuals are mobile between cities. Then, in equilibrium, an individual of given type should be indifferent between what size of city he or she should live in. There is a

simple test of this equilibrium hypothesis. Respondents of the GSOEP are regularly asked about their satisfaction with life and other domains such as consumption, housing, or job. Let individual utility be a function $u(c(s), h(s), w(s))$ of consumption (c), housing h, and work w, all of which are a function of city size s. Then, in equilibrium, it should be true that

$$\frac{du}{ds} = u_c c' + u_h h' + u_w w' = 0, \tag{1}$$

where subscripts denote partial derivatives. The data will then allow separate tests of the effect of city size on satisfaction with the domains (consumption, work, housing) as well of the equilibrium hypothesis that life satisfaction is independent of city size, $du/ds = 0$.

3 Data and estimation

3.1 Data

In order to test some of the hypotheses just outlined, I use survey data from the German Socio-Economic Panel (GSOEP).[1] I use the waves from 1993 to 2003. However, some variables are not available for all years (some only for 2003).

Variables and summary statistics are listed in Table 1. The dependent variables are the following.

Consumption. The GSOEP asks individuals about their use of spare time. I use answers to the following questions as measures of consumption:[2]

Now some questions about your free-time. Please indicate how often you take part in each activity: daily, at least once a week, at least once a month, seldom or never?

- Dine out. Go out for a drink or for a meal (café, bar pub, restaurant)
- Cinema. Cinema visits, visits to pop concerts, dance events, clubs
- Concert. Visits to cultural events e.g. concerts, theatre, exhibitions
- Internet. Internet usage outside of work.

[1] See Haisken-DeNew and Frick (2003) for a description of the GSOEP.

[2] In the GSOEP, answers are coded in the order they appear on the questionnaire. Hence, daily would be coded as 1, once a week as 2, and so on. In all these cases, I recoded variables such that if an activity is carried out 'more often' or someone agrees 'more' with a statement, they receive a higher number.

Social interaction. The following measures of social interaction are included in the analysis:

- Trust. What is your opinion on the following statement? On the whole one can trust people. (Totally agree, Agree slightly, Disagree slightly, Totally disagree)
- Friends. What would you say: How many close friends do you have?
- Visit friends. Social intercourse with friends, relatives or neighbors (daily, at least once a week, at least once a month, seldom or never)
- Crime. What is your attitude towards the following areas - are you concerned about them? Crime in Germany (Very concerned, Somewhat concerned, Not concerned at all)
- Door. How often does it occur that you leave the door to your apartment unlocked? (Very often, Often, Sometimes, Seldom, Never)
- Partner. Individual lives in a stable partnership.

Social capital. For social capital, I use the following variables:

- Member: Are you a member of one of the following organisations or unions? trade union? professional body? works or staff council at your place of work? group or organisation that supports the conservation and protection of the environment and/or nature? club or similar organisation?
- Participate. Participation in public initiatives, in political parties, local government (daily, at least once a week, at least once a month, seldom or never)
- Political interest. Generally speaking, how much are you interested in politics? (Very much, Much, Not so much, Not at all.)

Satisfaction. Individuals are asked the following questions about their satisfaction: How satisfied are you today with the following areas of your life? (0 means totally unhappy, 10 means totally happy)

- Life in general

- the supply of goods and services in your area
- your job
- your place of dwelling
- your health.

The GSOEP records the size class of the city where the individual resides in seven classes: (1) under 2,000 inhabitants,(2) 2,000–5,000, (3) 5,000–20,000, (4) 20,000–50,000, (5) 50,000–100,000, (6) 100,000–500,000, and (7) over 500,000 inhabitants. For the study, I recode city size in three categories: small towns (less than 5,000 inhabitants), medium (5,000–100,000) and large cities (more than 100,000). In order to control for other individual characteristics, I include a variety of other control variables, in particular, gender, (log of) real household income, age, education (less than 10 years, 10 years, high school degree, college degree), being unemployed, current health status, number of children, homeownership, living with a partner, dummy for East Germans.

3.2 Estimation

The estimation will be carried out in three steps. First, I will present results from pooled regressions, either by OLS or (ordered) logit. Letting y_{it} a specific dependent variable for individual i at time t, $\mathbf{x}_{it}$ a $1 \times K$ vector of controls, s_{it} city size and ε_{it} an i.i.d. error term, one could estimate pooled OLS equations of the form

$$y_{it} = \mathbf{x}_{it}\alpha + \beta s_{it} + \varepsilon_{it}, \quad t = 1, ..., T, \tag{2}$$

or, in the case of a categorical variable, the ordered logit[3]

$$y^*_{it} = \mathbf{x}_{it}\alpha + \beta s_{it} + \varepsilon_{it} \tag{3}$$

$$y_{it} = k \Leftrightarrow \lambda_k \leq y^*_{it} \leq \lambda_{k+1}, \tag{4}$$

where y^*_{it} is the latent variable and y_{it} the observed categorical variable.

The maintained assumption in either (2) or (3) is that s_{it} (as well as $\mathbf{x}_{it}$) is strictly exogenous for ε_{it}. That means that city size varies in response to some unmeasured variable which, however, affects none of the y_{it}.

[3]For binary variables, there is only one category and hence only one cut-off point in (4).

Several issues arise in the estimation. One potential problem is individual unobserved heterogeneity. Let c_i be a dummy variable for individual i, called a 'fixed effect'. Then, estimation of (2) is biased if some of the elements of $\mathbf{x}$ are correlated with the c_i. Consider the effect of community size on some social interaction variable, say, the number of friends. Then, it is plausible to suppose that sociable individuals will seek environments where they can meet each other, i.e. they will flock to big cities. Hence, community size and individual unobserved heterogeneity may be correlated, so I will also estimate fixed effect models of the form

$$y_{it} = \mathbf{x}_{it}\alpha + \beta s_{it} + c_i + u_{it}, \quad t = 1, ..., T. \tag{5}$$

For estimating panel models with categorical dependent variables, the following procedure is used. For binary dependent variables, I use a standard fixed effects conditional logit estimator. For ordered categorical variables, the dependent variable y_{it} is transformed into a variable

$$y'_{it} = \begin{cases} 1 & \text{if} \quad y_{it} > \bar{y}_i \\ 0 & \text{else} \end{cases}, \tag{6}$$

where $\bar{y}_i$ is the individual mean. The estimated equation is then a fixed effect conditional logit with y'_{it} as the dependent variable. This estimator is a slight variation of that developed by (see Ferrer-i-Carbonell and Frijters, 2004). Other panel models with categorical variables have estimated fixed effects logit models by setting y_{it} to 1 if it exceeds a common threshold, say, the sample mean $\bar{y}$. The estimator in (6) has the advantage of using individual specific cutoffs which implies that fewer cases are lost (see Ferrer-i-Carbonell and Frijters, 2004, for further discussion).

Finally, while fixed effects estimates have the attraction of washing out individual specific heterogeneity, they are less useful for establishing causality. Even if one has good reason to believe that in the FE regressions in (5), $\mathbf{x}_{it}$ and s_{it} are strictly exogenous, this may not be true, and hence, IV estimates may be necessary. In fact, individuals should migrate to cities based on the realisation of agglomeration economies, so s_{it} will be correlated with the u_{it}.[4] I will, therefore, also present evidence using instrumental variables.

[4]See Henderson (2003) for a discussion of the endogeneity issue in estimating productive agglomeration externalities.

4 Pooled regression estimates

Consumption

Results on individual use of leisure time are displayed in table 2. The table shows that, except for classical concerts, men go out more often than women. All activities seem to be normal goods. Healthier individuals go out more, as do those who are employed. Having a partner and having children reduces the probability of going out but increases usage of the internet. Homeownership and education are also significantly positively related to the shown activities.[5]

The results on city size are rather clear. The first column in the table shows that in communities with less than 2,000 inhabitants, individuals go out to bars or restaurants less often than in mid-sized towns. For cities of more than 100,000 inhabitants, the probability of going out for drinks or food is significantly higher than in mid-sized towns. The same pattern holds for cinemas/rock concerts/dancing and classical concerts/theatres/museums. For cinemas, however, the difference between small and mid-sized towns is not significant. The last column in the table shows the effect of city size on internet usage. Here, too, individuals in small towns use the internet less and individuals in large towns more often, and both effects are significant at 5 percent. This corroborates other findings that cities and the internet are complements rather than substitutes (see, e.g, Sinai and Waldfogel, 2004).

Glaeser (2004) also finds positive agglomeration economies for drinking out but negative effects for eating out. He also finds that individuals in central cities are more likely to go to museums and concerts.

Social interaction

The results on social interaction are displayed in Table 3. The first column of the table shows the regression on trust. According to the estimates, people are significantly more trusting when they have higher income, better health, when they are educated, employed, and own their dwelling. Women are somewhat more trusting but this effect is not significant. Surprisingly, trust seems to be somewhat *lower* in small cities and no lower in large than in medium-sized cities. Glaeser (2004), on the other hand, finds lower trust in more

[5]Homeownership may in reality pick up the effect of wealth, which is not controlled for.

densely populated cities.

Results for the regression of the number of close friends are displayed in the second column of table 3. As one might expect, people have more friends (or report to have more friends) when they have higher income, are in better health and educated. According to the estimates, the number of friends in small communities is lower than in mid-sized cities, but not significantly so, while individuals in large cities report significantly more friends. This contrasts with Glaeser's (2000) finding that there is a negative correlation between city size and the number of close friends.

The third column corroborates this pattern: people interact with their friends more when they live in large cities. This contrasts with Glaeser (2004), who finds individuals in central cities are less likely to visit their friends.

Results on concern about crime are displayed in the fourth column of table 3. Individuals are more concerned about crime the *lower* their income, the worse their health, the older they are, the more children they have, and when they have a partner. Homeownership seems to *decrease* worries about crime. These results seem somewhat peculiar, but note that the question refers to general worries about crime, not the individual risk. Interestingly, community size seems to be negatively correlated with worries about crime.

The fifth column shows results from the regression of leaving one's door unlocked. Here we get the expected effects: the larger the city, the less often individuals leave their door unlocked. Thus, while concern about crime shows a negative effect of agglomeration, revealed actions do show the expected pattern. Again, since the crime question concerns general worries about crime, it may simply be that big city residents perceive the general crime risk as being lower while they do see themselves as city residents to be more at risk and act accordingly. An alternative explanation would be a mild form of schizophrenia.

The idea that cities function as matching markets is examined in the last column of Table 3. The results are interesting: in larger cities, the probability of having a partner is significantly lower than in smaller cities. This would not seem to be consistent with increasing returns to scale in matching. A more sophisticated analysis of cities as marriage markets is presented by Gautier et al. (2005). They argue (and present evidence to the effect) that individuals should come to cities to *look for* a partner, but when they have found one, they should move to smaller cities where housing is cheap. Hence, what could be at work here is the effect that individuals with partners are less likely to live in cities.

Social capital

Table 4 displays some results on 'social capital' (see also Glaeser, 2000). According to results shown in the first column, city size does not significantly affect the probability of membership in an organisation. Glaeser (2000, 2004), on the other hand, finds individuals in larger cities are less likely to be member of an organisation or to have attended a club meeting. According to the second column, there is also evidence that individuals in larger cities participate less in politics and civic matters, which seems to be evidence in favour of Putnam's (2000) thesis. Finally, the last column of the table shows that individuals in cities with more than 100,000 inhabitants are significantly more likely to be interested in politics. This also agrees with Glaeser's (2004) finding.

Satisfaction

Finally, let us look at the link between city size and satisfaction. The literature has used answers to happiness questions as proxies of individual utility (Frey and Stutzer, 2002).

As outlined in section 2, if individuals are mobile between cities, urban economics predicts that agglomeration diseconomies through housing and commuting costs have to be balanced by agglomeration economies in other areas, e.g., higher wages or social agglomeration economies. A test of that hypothesis can be performed by examining individual satisfaction with life in general and certain specified domains such as work, dwelling, health, and the supply of goods and services. Results of the test are shown in Table 5.

In general, the regressions show higher satisfaction for women, wealthier and healthier individuals, the young, employed, those with a partner and with children (except for satisfaction with dwelling) and those who own their dwelling (except for satisfaction with supply of goods/services).

The results on city size are somewhat unexpected. For all domains but supply with goods and services, there seems to be an inversely U-shaped relationship between city size and satisfaction. Thus, satisfaction with health, work, and dwelling seems to be largest in mid-sized cities. The second column shows that the larger the city one lives in, the higher the reported satisfaction with the local supply of goods and services. This is consistent with the new economic geography, which emphasises agglomeration economies in consumption. This new test therefore provides direct evidence in support of the NEG models using Dixit-Stiglitz preferences.

Finally, the first column of Table 5 shows results for overall life satisfaction. After controlling for individual characteristics, the table again shows a bell-shaped relation with city size, indicating that the satisfaction maximising city has between 5,000 and 100,000 inhabitants. Glaeser (2000), on the other hand, finds that life satisfaction decreases with (the log of) city size.

Stutzer and Frey (2004) analyse the effect of commuting on happiness, and find that commuters enjoy significantly lower satisfaction than non-commuters, which they interpret as evidence that the basic tenet of location theory – equalisation of utility levels – does not hold. The current result seems to add another piece to that puzzle. In the next section, we will see whether that result stands up to additional testing.

5 Dealing with selection

As argued above, individuals may self select into cities based on individual character traits such as their sociability etc. These individual character traits would thus be correlated with city size and, hence, OLS estimates would be biased and inconsistent. Moreover, if individuals move to cities based on agglomeration effects, city size will be correlated with the error term in regression equations of agglomeration effects, and again, OLS estimates will be biased.

Henderson (2003) performs a variety of tests in his study of productive agglomeration economies. He concludes that instruments are generally weak and that (plant) fixed effects are most likely to take care of selection issues. I will present fixed effects estimates in subsection 5.2. Nonetheless, I will also try to address selection from two different perspectives: the differentiation between stayers and movers (next subsection) and instrumental variables (subsection 5.3).

5.1 Movers versus stayers

The basic selection problem is that individuals might select into cities based on individual characteristics which would then be correlated with agglomeration effects. Hence, one would expect that results should differ according to whether individuals have moved to, e.g., larger cities, or not.[6] In the GSOEP , there are records whether individuals still live

[6]See, also, Charlot and Duranton (2004) and Stutzer and Frey (2004) for this approach.

in their place of birth.[7]

In this subsection, I briefly discuss results from separate regressions for stayers and movers, to see whether selection indeed plays a role. For reasons of space, I will confine the discussion to the pooled regressions on the satisfaction variables.[8] I also discard the results for satisfaction with health to concentrate on the measures most directly linked to standard urban economics.

There are some small differences in the satisfaction of movers and stayers. Satisfaction with job and life seems to be almost identical for both groups. By contrast, movers seem to be significantly more satisfied with goods supply (mean 6.50 versus 6.29 for stayers) and somewhat more satisfied with dwelling (7.50 versus 7.43).

Regression results are shown in Table 6. In general, the effects of city size for stayers and movers seem to be very similar. For satisfaction with work and dwelling, the effect of small cities is less negative for movers than for stayers. Finally, for overall life satisfaction, the results for stayers and movers are quite opposite: stayers show significantly lower satisfaction in small cities and no effect of large cities, while movers show higher satisfaction in small cities and lower satisfaction in large than in mid-sized cities.

Thus, it appears that the movers experience somewhat higher satisfaction with their dwelling and the supply of goods than stayers. However, movers also seem to realise lower agglomeration effects than stayers.

5.2 Fixed effects estimates

In order to control for individual heterogeneity, in this subsection I present results from fixed effects estimation.

Identification of the effect of city size is now based on those individuals for whom city size is not constant in the time period under consideration. In the entire sample, there

[7]Note, however, that this information is not recorded for every person in every year, so it is possible that a person who reported living at her place of birth when this question was asked moved later on and this is not recorded in the survey. The possibility of discarding those years after this question was asked is, however, problematic since it would excessively reduce sample size.

[8]More detailed results are available upon request. In general, the other results display less variation between stayers and movers than the satisfaction regressions. This may indicate that the satisfaction regressions suffer most from potential selection. Since it is most likely that individual migration decisions are based on broad indicators of satisfaction and not on more specific categories of agglomeration effects, it would seem plausible that selection should play the strongest role for satisfaction.

are about 30 percent of individuals for whom community size changes during the 11 years considered, so there is enough variation to identify the effects of city size.

For those categorical dependent variables which are coded in more than two categories, I use fixed effects conditional logit estimates as described above in section 3.2.

Consumption

The results from fixed effects estimates for consumption variables are displayed in Table 7. In general, the results agree reasonably well with the estimates on the pooled data. The effects of city size are also in line with those of the pooled regressions, although they are not as strongly significant. Big city still has a strong positive effect in all three regressions. Small city is negative in two regressions but insignificant throughout. It seems that the big city effect for consumption survives selection, while the small city effect disappears. In other words, large cities have a positive effect on these activities, while the negative effect of small cities seems to be due to the composition of their residency.

Social interaction

The results from fixed effects regressions for the variables of social interaction are shown in Table 8. The results are somewhat different from the pooled regressions. In particular, city size now shows no statistically significant effect on visiting friends. On the other hand, worries about crime are higher in big cities when fixed effects are controlled for, while without fixed effects there is no such effect. The effect of big cities on the probability of living with a partner is, again, negative.

Social capital

Table 9 shows fixed effects estimates for our variables of "social capital". These results differ markedly from the pooled regressions and some of the coefficient estimates seem "unreasonable". For instance, income shows no significant effect on political interest while the effect of being unemployed is of "wrong" sign and that of education insignificant except for high school diploma. The coefficients for city size are interesting: individuals in small cities are less likely to be member of an organisation, while residents of larger cities are more likely to participate in civic matters. Political interest seems to be independent of city size once individual heterogeneity is controlled for.

Satisfaction

The fixed effects estimates for satisfaction regressions are in Table 10. Satisfaction with work and dwelling is not significantly affected by city size anymore once individual fixed effects are controlled for. Satisfaction with health, however, does fall with city size. Also, satisfaction with the supply of goods and services increases significantly with city size, as it does when fixed effects are not controlled for. Finally, individual satisfaction with life does not seem to depend on city sized once fixed effects are included. Thus, one cannot reject the hypothesis that individual mobility leads to an urban equilibrium where individuals cannot improve their utility by moving to a different sized city. Diseconomies of agglomeration, e.g. for health, do seem to be balanced by agglomeration economies in consumption.

5.3 IV estimates

One potential problem with the identification of agglomeration externalities is the endogeneity of the size of cities. If large cities provide benefits to residents that exceed those of smaller cities, these externalities should induce migration responses until an equilibrium is obtained where the benefits of agglomeration are just balanced by the diseconomies in commuting and housing markets. Hence, in regressions of measures of agglomeration benefits on the size of the agglomeration, this size may be correlated with the error term and OLS regressions lead to biased estimates. While fixed effects may be efficient in dealing with selection, they cannot be reliably used to test for causality. In this respect, instrumental variables would be more efficient. However, it is arguably difficult to find valid instruments which are correlated with city size and not with measures of agglomeration effects.

In this subsection, I report results from IV regressions, using city size in 1984 as instrument for current city sizes.[9] Lagged city size is correlated with current city size, while one might reasonably argue that it does not affect current social interaction if the lag is sufficiently long.

For reasons of space, I will report only the results for the satisfaction regressions.[10] These results are displayed in Table 11. Using a Wu-Hausman test, exogeneity is rejected for all domains except dwelling. The results are, however, generally consistent with the OLS

[9] In order to get some more variation, I use dummies for the original size classes ranging from 2 to 7 – size class 1 is excluded in the first stage regressions.

[10] Other results are available on request.

regressions. In particular, for health and job satisfaction, there seems to be an inverted U-shaped correlation with city size. Satisfaction with housing is significantly higher in smaller cities and satisfaction with goods and services significantly higher in larger cities. Overall satisfaction with life, again, does not show significant agglomeration effects. Hence, again, the equilibrium hypothesis that city size should not affect individual utility cannot be rejected.

6 Conclusion

This paper has attempted to shed some light on social interaction economies generated by agglomeration. Individuals, it is argued, benefit from being close to other consumers, not only because they may then be more productive, but also from the benefits of interacting with others socially. These social agglomeration externalities offset agglomeration diseconomies, e.g., in housing markets and commuting. The paper has examined agglomeration effects in consumption, social interaction, and social capital, using a variety of indicators from survey data. These survey data are useful since 'hard' data on social interaction are hard to obtain.

The results are somewhat varied, but there is clear evidence of agglomeration externalities in consumption. This is a significant finding given that much of the 'new economic geography' is based on this type of externalities (see Baldwin et al., 2003; Fujita et al., 1999, for surveys).

Moreover, I have presented some illustrative evidence on agglomeration economies from satisfaction responses. The idea was that individual mobility should lead to an equalisation of satisfaction across different city sizes. Agglomeration economies in some areas, say consumption or social benefits, or productive economies, should be balanced by diseconomies in other areas, such as housing markets. Indeed the paper found some evidence of this effect.

The results point to the potential importance of agglomeration economies in consumption and social interaction for individual location decisions. I have tried to control for the possibility of selection of individuals into cities, but future research may shed more light on this topic, by using different data and looking for better instruments.

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Table 1: Summary statistics

Variable	Mean	Std. Dev.	Observations
Big city	0.543	0.498	115423
Small city	0.071	0.257	115423
Life satisfaction	6.879	1.741	94327
Satisfaction with goods	6.426	2.34	93953
Satisfaction with job	6.883	2.078	57690
Satisfaction with dwelling	7.382	2.089	94098
Satisfaction with health	6.571	2.154	94328
Restaurant	2.604	0.98	24515
Cinema pop concert	2.546	1.059	66534
Concert	2.387	0.926	66534
Internet use	2.228	1.607	10493
Trust	2.604	0.717	10493
Close friends	4.219	4.105	10493
Interact with friends	3.23	0.936	24515
Concern about crime	2.48	0.6	87045
Leave door unlocked	1.826	1.238	10493
Partner	0.789	0.408	115423
member	0.091	0.288	115423
Participate	1.808	0.784	66534
Interest in politics	2.233	0.779	94352
Female	1.523	0.499	115423
Age	44.001	16.607	115423
Income per capita	11846.562	6777.197	94526
Children	0.631	0.959	94531
Unemployed	0.061	0.24	115423
Current health	3.366	0.921	87402
Owner	0.376	0.484	115423
10 years schooling	0.245	0.43	115423
High school degree	0.119	0.323	115423
College degree	0.311	0.463	115423
East	0.273	0.446	115423

Table 2: Consumption

	Dine out	Cinema	Concert	Internet
Female	-0.333	-0.246	0.279	-0.667
	(0.017)**	(0.012)**	(0.012)**	(0.028)**
Partner	-0.484	-0.743	-0.414	-0.043
	(0.023)**	(0.016)**	(0.016)**	(0.039)
Log (HH income)	0.600	0.449	0.470	0.576
	(0.017)**	(0.012)**	(0.012)**	(0.027)**
Current health	0.214	0.181	0.252	0.100
	(0.010)**	(0.007)**	(0.007)**	(0.016)**
Age	-0.027	-0.116	0.044	0.015
	(0.003)**	(0.002)**	(0.002)**	(0.006)*
Age squared	-0.000	0.000	-0.000	-0.001
	(0.000)	(0.000)**	(0.000)**	(0.000)**
Unemployed	-0.391	-0.262	-0.392	-0.101
	(0.034)**	(0.022)**	(0.023)**	(0.056)†
Children	-0.398	-0.344	-0.272	-0.116
	(0.010)**	(0.007)**	(0.007)**	(0.015)**
Owner	0.048	0.146	0.324	0.174
	(0.019)*	(0.013)**	(0.013)**	(0.032)**
10 years schooling	0.293	0.461	0.648	0.595
	(0.021)**	(0.014)**	(0.014)**	(0.034)**
High school degree	0.531	0.671	1.317	1.205
	(0.037)**	(0.025)**	(0.027)**	(0.053)**
College degree	0.514	0.679	1.550	1.154
	(0.028)**	(0.019)**	(0.020)**	(0.040)**
Small city	-0.229	-0.015	-0.243	-0.187
	(0.033)**	(0.023)	(0.023)**	(0.051)**
Big city	0.175	0.155	0.196	0.177
	(0.018)**	(0.012)**	(0.012)**	(0.030)**
East	-0.626	0.105	-0.106	-0.144
	(0.022)**	(0.014)**	(0.015)**	(0.040)**
Observations	46983	116380	116380	22560
Log likelihood	-59376.74	-121526.75	-112888.29	-25844.23

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 3: Social interaction

	Trust	Friends	Visit friends	Crime	Door	Partner
Female	0.069	-0.122	0.114	0.214	-0.009	-0.181
	(0.026)**	(0.056)*	(0.017)**	(0.010)**	(0.026)	(0.012)**
Partner	-0.052	-0.036	-0.426	0.236	0.001	
	(0.035)	(0.075)	(0.024)**	(0.012)**	(0.036)	
Log (HH income)	0.164	0.311	0.041	-0.106	0.040	1.197
	(0.024)**	(0.051)**	(0.017)*	(0.010)**	(0.025)	(0.013)**
Current health	0.391	0.397	0.152	-0.120	-0.033	-0.066
	(0.016)**	(0.032)**	(0.010)**	(0.006)**	(0.015)*	(0.007)**
Age	-0.008	-0.032	-0.111	0.015	0.004	0.056
	(0.005)	(0.010)**	(0.003)**	(0.000)**	(0.005)	(0.002)**
Age squared	0.000	0.000	0.001	-0.000	-0.000	-0.000
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Unemployed	-0.302	-0.182	0.104	0.020	-0.108	0.381
	(0.053)**	(0.113)	(0.034)**	(0.020)	(0.054)*	(0.024)**
Children	-0.007	-0.108	-0.036	-0.026	0.129	0.711
	(0.016)	(0.033)**	(0.010)**	(0.006)**	(0.015)**	(0.009)**
Owner	0.112	0.219	-0.017	-0.032	0.277	-0.178
	(0.029)**	(0.062)**	(0.019)	(0.011)**	(0.030)**	(0.014)**
10 years schooling	0.044	0.147	-0.155	0.017	0.048	0.259
	(0.032)	(0.069)*	(0.021)**	(0.012)	(0.033)	(0.015)**
High school degree	0.393	0.248	-0.041	-0.422	0.163	-0.377
	(0.055)**	(0.117)*	(0.038)	(0.022)**	(0.054)**	(0.025)**
College degree	0.409	0.439	-0.013	-0.600	0.346	0.325
	(0.040)**	(0.085)**	(0.028)	(0.016)**	(0.039)**	(0.022)**
Small city	-0.112	0.005	-0.071	0.057	0.240	0.116
	(0.048)*	(0.102)	(0.033)*	(0.020)**	(0.046)**	(0.024)**
Big city	0.032	0.269	0.094	-0.039	-0.179	-0.198
	(0.029)	(0.061)**	(0.019)**	(0.011)**	(0.029)**	(0.013)**
East	-0.334	-0.305	-0.550	0.576	-0.046	0.128
	(0.037)**	(0.081)**	(0.023)**	(0.013)**	(0.038)	(0.016)**
Constant		0.553				-13.136
		(0.576)				(0.140)**
Observations	22560	22560	46983	163720	22560	164753
Log likelihood	-22904.48		-58721.04	-138653.73	-27463.93	-81906.75
R-squared		0.02				

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 4: Social capital

	Member	Participate	Interest in politics
Female	-0.764	-0.326	-0.848
	(0.020)**	(0.017)**	(0.010)**
Partner	-0.068	-0.113	-0.016
	(0.027)*	(0.023)**	(0.012)
Log (HH income)	0.361	0.169	0.255
	(0.020)**	(0.017)**	(0.009)**
Current health	0.006	0.073	0.091
	(0.011)	(0.010)**	(0.006)**
Age	0.108	0.054	0.029
	(0.004)**	(0.003)**	(0.000)**
Age squared	-0.001	-0.000	-0.000
	(0.000)**	(0.000)**	(0.000)**
Unemployed	-0.570	-0.104	-0.160
	(0.043)**	(0.035)**	(0.019)**
Children	-0.072	-0.006	-0.078
	(0.012)**	(0.010)	(0.005)**
Owner	0.195	0.369	0.169
	(0.021)**	(0.019)**	(0.011)**
10 years schooling	0.281	0.171	0.659
	(0.024)**	(0.022)**	(0.012)**
High school degree	0.294	0.412	1.294
	(0.042)**	(0.038)**	(0.021)**
College degree	0.507	0.641	1.407
	(0.029)**	(0.026)**	(0.016)**
Small city	-0.020	0.272	-0.038
	(0.036)	(0.031)**	(0.018)*
Big city	-0.012	-0.031	0.154
	(0.021)	(0.019)†	(0.010)**
East	-0.138	-0.036	-0.094
	(0.027)**	(0.022)	(0.012)**
Constant	-6.279		
	(0.219)**		
Observations	58403	116380	164419
Log likelihood	-32152.35	-58861.17	-178715.03

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 5: Satisfaction

	Life	Goods	Work	Dwelling	Health
Female	0.151	0.034	0.048	0.161	0.045
	(0.009)**	(0.009)**	(0.011)**	(0.009)**	(0.009)**
Log (HH income)	0.293	0.042	0.262	0.146	0.045
	(0.009)**	(0.008)**	(0.012)**	(0.009)**	(0.009)**
Current health	0.967	0.292	0.694	0.368	2.296
	(0.006)**	(0.005)**	(0.007)**	(0.005)**	(0.007)**
Age	0.013	0.016	0.002	0.018	-0.007
	(0.000)**	(0.000)**	(0.001)**	(0.000)**	(0.000)**
Age squared	-0.000	-0.000	-0.000	-0.000	0.000
	(0.000)**	(0.000)**	(0.000)†	(0.000)**	(0.000)**
Unemployed	-0.928	-0.117	-2.100	-0.221	-0.124
	(0.018)**	(0.017)**	(0.042)**	(0.017)**	(0.018)**
Children	-0.070	-0.028	-0.005	-0.116	0.019
	(0.005)**	(0.005)**	(0.006)	(0.005)**	(0.005)**
Partner	0.138	-0.053	-0.051	0.069	-0.093
	(0.011)**	(0.011)**	(0.015)**	(0.011)**	(0.011)**
Owner	0.223	-0.227	0.051	0.932	0.073
	(0.010)**	(0.010)**	(0.013)**	(0.010)**	(0.010)**
10 years schooling	-0.041	-0.038	0.038	-0.010	-0.014
	(0.011)**	(0.011)**	(0.014)**	(0.011)	(0.011)
High school degree	0.049	0.104	-0.040	-0.083	-0.059
	(0.019)*	(0.019)**	(0.024)	(0.019)**	(0.020)**
College degree	0.015	0.073	0.049	-0.038	-0.011
	(0.014)	(0.014)**	(0.017)**	(0.014)**	(0.014)
Small city	-0.114	-0.724	-0.059	-0.059	-0.101
	(0.017)**	(0.017)**	(0.022)**	(0.017)**	(0.017)**
Big city	-0.035	0.187	-0.067	-0.138	-0.067
	(0.010)**	(0.009)**	(0.012)**	(0.009)**	(0.010)**
East	-0.616	-0.409	-0.229	-0.279	-0.334
	(0.012)**	(0.011)**	(0.015)**	(0.012)**	(0.012)**
Observations	164406	163170	98476	163605	164368
Log likelihood	-289343.74	-350610.26	-194050.30	-309838.54	-272806.70

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 6: Satisfaction (Movers vs stayers)

	Small city		Big city		Observations	Log likelihood
	Coeff.	Std. error	Coeff.	Std. error		
Life (Stayers)	-0.104	(0.023)**	0.013	(0.014)	74828	-130812.18
Life (Movers)	-0.079	(0.031)*	-0.052	(0.017)**	53671	-94323.55
Goods (Stayers)	-0.652	(0.023)**	0.243	(0.014)**	74080	-160603.59
Goods (Movers)	-0.767	(0.032)**	0.187	(0.016)**	53372	-114106.16
Work (Stayers)	-0.099	(0.029)**	-0.035	(0.018)†	45615	-89618.18
Work (Movers)	0.021	(0.042)	-0.057	(0.022)**	29717	-58581.14
Dwelling (Stayers)	-0.099	(0.023)**	-0.083	(0.014)**	74271	-139287.20
Dwelling (Movers)	0.034	(0.031)	-0.152	(0.017)**	53559	-98855.33
Health (Stayers)	-0.081	(0.023)**	-0.057	(0.014)**	74790	-123271.98
Health (Movers)	-0.110	(0.031)**	-0.034	(0.017)*	53670	-89426.99

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 7: Consumption (FE logit)

	Dine out	Cinema	Concert
Partner	-0.523	-1.191	-0.730
	(0.059)**	(0.047)**	(0.051)**
Log (HH income)	0.278	0.218	0.208
	(0.040)**	(0.029)**	(0.032)**
Current health	0.144	0.082	0.099
	(0.022)**	(0.016)**	(0.017)**
Age squared	0.000	-0.003	-0.005
	(0.000)	(0.000)**	(0.000)**
Unemployed	-0.263	0.010	-0.046
	(0.060)**	(0.042)	(0.046)
Children	-0.338	-0.264	-0.152
	(0.027)**	(0.021)**	(0.024)**
Owner	-0.086	-0.173	-0.252
	(0.057)	(0.044)**	(0.049)**
10 years schooling	0.093	-0.104	-0.239
	(0.069)	(0.058)†	(0.065)**
High school degree	0.451	-0.170	-0.228
	(0.106)**	(0.085)*	(0.096)*
College degree	0.222	-0.353	-0.494
	(0.101)*	(0.087)**	(0.097)**
Small city	0.077	-0.077	-0.032
	(0.093)	(0.068)	(0.075)
Big city	0.130	0.255	0.335
	(0.051)*	(0.038)**	(0.042)**
Observations	22259	108256	108421
Log likelihood	-7844.88	-23983.43	-20239.55

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 8: Social interaction (FE logit)

	Visit friends	Crime	Partner
Partner	-0.419	0.136	
	(0.069)**	(0.040)**	
Log (HH income)	0.022	-0.003	-0.503
	(0.057)	(0.033)	(0.054)**
Current health	0.066	-0.054	0.010
	(0.028)*	(0.015)**	(0.028)
Age squared	0.000	-0.000	-0.008
	(0.000)	(0.000)**	(0.000)**
Unemployed	0.132	0.028	-0.021
	(0.074)†	(0.041)	(0.076)
Children	-0.072	0.027	0.380
	(0.037)†	(0.022)	(0.037)**
Owner	0.101	0.039	0.300
	(0.074)	(0.042)	(0.071)**
10 years schooling	-0.040	0.027	0.503
	(0.082)	(0.048)	(0.075)**
High school degree	0.108	-0.003	-0.427
	(0.153)	(0.078)	(0.132)**
College degree	-0.144	-0.071	1.127
	(0.127)	(0.072)	(0.130)**
Small city	0.009	0.056	-0.013
	(0.103)	(0.065)	(0.118)
Big city	-0.084	0.064	-0.197
	(0.062)	(0.036)†	(0.061)**
Observations	15011	70316	20604
Log likelihood	-5414.82	-28720.76	-7194.75

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 9: Social capital (FE logit)

	Member	Participate	Interest in politics
Log (HH income)	0.109	0.096	-0.020
	(0.054)*	(0.037)**	(0.021)
Current health	0.010	0.000	0.071
	(0.025)	(0.019)	(0.011)**
Age squared	0.001	-0.007	-0.001
	(0.000)**	(0.000)**	(0.000)**
Unemployed	-0.141	0.041	0.054
	(0.080)†	(0.053)	(0.032)†
Children	-0.155	-0.026	-0.020
	(0.039)**	(0.027)	(0.017)
Partner	0.103	-0.534	0.173
	(0.080)	(0.058)**	(0.036)**
Owner	0.042	-0.222	-0.077
	(0.074)	(0.056)**	(0.034)*
10 years schooling	0.185	-0.304	0.052
	(0.097)†	(0.075)**	(0.041)
High school degree	0.013	-0.558	0.219
	(0.154)	(0.109)**	(0.062)**
College degree	-0.021	-0.762	0.015
	(0.136)	(0.110)**	(0.061)
Small city	-0.378	0.076	0.058
	(0.122)**	(0.087)	(0.055)
Big city	-0.030	0.425	0.025
	(0.065)	(0.051)**	(0.030)
Observations	73705	109397	117251
Log likelihood	-10013.52	-15265.57	-45886.61

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 10: Satisfaction (FE)

	Life	Goods	Work	Dwelling	Health
	Life	Goods	Work	Health	Dwelling
Partner	0.322	-0.106	-0.145	-0.062	0.233
	(0.029)**	(0.029)**	(0.036)**	(0.032)†	(0.029)**
Log (HH income)	0.141	0.030	0.104	0.028	-0.008
	(0.018)**	(0.017)†	(0.026)**	(0.019)	(0.017)
Current health	0.653	0.145	0.445	1.673	0.188
	(0.010)**	(0.009)**	(0.012)**	(0.013)**	(0.009)**
Age squared	-0.000	-0.001	-0.000	-0.000	0.001
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**
Unemployed	-0.740	-0.127	-1.397	-0.084	0.031
	(0.027)**	(0.026)**	(0.059)**	(0.029)**	(0.026)
Children	-0.003	-0.017	0.034	-0.016	-0.074
	(0.014)	(0.013)	(0.017)*	(0.015)	(0.014)**
Owner	0.122	-0.183	-0.011	-0.025	1.240
	(0.028)**	(0.027)**	(0.034)	(0.030)	(0.029)**
10 years schooling	-0.083	-0.050	0.089	-0.015	-0.039
	(0.034)*	(0.033)	(0.047)†	(0.037)	(0.034)
High school degree	-0.136	-0.007	0.028	-0.100	-0.228
	(0.052)**	(0.050)	(0.081)	(0.056)†	(0.052)**
College degree	0.008	-0.018	0.138	-0.089	-0.059
	(0.050)	(0.049)	(0.065)*	(0.054)	(0.050)
Small city	0.041	-0.189	0.068	0.020	0.077
	(0.045)	(0.043)**	(0.057)	(0.048)	(0.045)†
Big city	-0.012	0.074	0.007	0.009	-0.173
	(0.024)	(0.023)**	(0.030)	(0.026)	(0.024)**
Observations	153050	156794	89420	154372	151062
Log likelihood	-65985.18	-70239.85	-38863.67	-58065.09	-66504.25

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.

Table 11: Satisfaction (IV estimates)

	Life	Goods	Work	Dwelling	Health
	Life	Goods	Work	Dwelling	
Small city	0.003	-1.242	0.052	0.213	
	(0.057)	(0.081)**	(0.108)	(0.068)**	
Big city	-0.001	0.226	-0.223	-0.153	
	(0.025)	(0.035)**	(0.047)**	(0.030)**	
Geschlecht	0.140	0.083	0.114	0.206	
	(0.018)**	(0.025)**	(0.032)**	(0.021)**	
Log real household income	0.194	0.140	0.279	0.096	
	(0.018)**	(0.025)**	(0.037)**	(0.021)**	
Current health	0.913	0.426	0.781	0.427	
	(0.010)**	(0.014)**	(0.019)**	(0.012)**	
Age	-0.021	-0.011	0.029	-0.014	
	(0.003)**	(0.005)*	(0.008)**	(0.004)**	
Age squared	0.000	0.000	-0.000	0.000	
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	
Unemployed	-0.650	0.028	-2.007	-0.169	
	(0.044)**	(0.062)	(0.131)**	(0.052)**	
Children	-0.073	-0.052	-0.045	-0.160	
	(0.012)**	(0.016)**	(0.018)*	(0.014)**	
Partner	0.291	0.113	0.038	0.245	
	(0.024)**	(0.034)**	(0.045)	(0.029)**	
Owner	0.172	-0.016	0.036	0.863	
	(0.020)**	(0.028)	(0.036)	(0.024)**	
10 years schooling	0.034	0.022	0.033	0.063	
	(0.023)	(0.033)	(0.039)	(0.027)*	
High school degree	-0.039	0.073	-0.069	-0.164	
	(0.043)	(0.061)	(0.075)	(0.051)**	
College degree	0.004	-0.002	0.092	-0.004	
	(0.032)	(0.045)	(0.050)†	(0.038)	
East	0.000	0.000	0.000	0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	
Constant	1.526	2.455	0.653	4.136	
	(0.211)**	(0.295)**	(0.426)	(0.248)**	
Observations	29831	29601	15030	29722	

Year dummies included. Standard errors in parentheses.

† significant at 10%; * significant at 5%; ** significant at 1%.