Emerging Intra-Urban Geographies of the Cognitive-Cultural Economy: Evidence from Residential Neighbourhoods in Dutch Cities

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Abstract

Most existing research on advanced economic activities focuses on either inner-city milieus or suburban industrial parks. We contend, however, that residential neighbourhoods constitute a milieu for economic activities which require the input of high-skilled labour or, to follow Allen Scott, *cognitive-cultural* activities which are characteristic for contemporary urban economies. Based on a longitudinal data set of company-level data, we show that a significant share of economic activities in urban residential neighbourhoods can indeed be classified as cognitive-cultural and that this share has been growing over the period 1999-2008. We present an analysis of the spatiality of the embeddedness of these activities. In particular, we focus on their traded and untraded interdependencies. For this part of the analysis we use survey-data of 370 businesses based in Dutch residential neighbourhoods. Overall, cognitive-cultural activities maintain many untraded interdependencies on a local level, whereas they maintain most traded interdependencies on a supra-local level. They appear to be making frequent use of both local buzz as well as of supralocal 'pipelines', and are thus embedded on various spatial scales. Residential neighbourhoods, then, have to be taken more seriously not just as places of consumption but also as milieus of production for more advanced economic activities.

Urban residential neighbourhoods as sites of cognitive-cultural production

Are we witnessing a reversal of the long-term trend of ever increasing spatial separation between place of work and the home? Lewis Mumford (1961) observed how the "… intimate connexion of industrial and domestic life" of the pre-industrial age gave way to the rise of "the exact antithesis" namely "the segregated, legally sterilized residential quarter" of the industrial era. Now, half a century later, it seems as if industrial and domestic life are once more becoming intimately intertwined at least in certain economic activities (Carter and Mwaura, 2015). The combined effects of an erosion of economies of scale, outsourcing and cheap powerful information and communication technology have increased, in principle, the degrees of freedom regarding the location of a (small) business (Clark, 2015). In this article, we will explore the role of residential neighbourhoods as locations for more advanced economic activities, or what Allen Scott (Scott, 2008; Scott, 2012) has labelled *cognitive-cultural activities* comprising a wide variety of high-skilled work. Already much research has been done on these kind of economic activities and we can also observe a growing body of literature on economic activities in residential areas (Mason et al., 2015; Beckers and Kloosterman; Folmer, 2014; Risselada et al., 2013; Daniel et al., 2014; Sleutjes and Schutjens, 2013; Sleutjes, 2012).

Much less attention has been paid at the increasing importance of residential neighbourhoods as loci of advanced economic activities (Mason et al., 2015). Residential neighbourhoods have traditionally been the location for mom-and-pop stores and small-scale personal services catering to a local clientele. With the interrelated changes in digital technology and the organisation of production we now observe how these neighbourhoods are increasingly becoming home to cognitive-cultural activities thereby changing the economic geography of cities with possibly far reaching consequences.

In order to comprehend the emerging geography of cognitive-cultural activities in residential neighbourhoods we need to assess 1) are cognitive-cultural activities becoming more important in residential neighbourhoods; and 2) what kind of spatiality of embeddedness do they display? In particular, we examine the spatiality of their traded and untraded interdependencies through a comparison with more traditional economic activities like retail and personal services.

Our study is based on two types of data. We use register data from the Chamber of Commerce as well as survey data from businesses in fifteen residential neighbourhoods in five Dutch cities, namely Amsterdam, Dordrecht, Leiden, Utrecht and Zoetermeer. We will first briefly dwell on the general changes in the production system (section 2). After that, we explain the methodology (section 3). Then, we present the findings of our research (section 4). We end with discussing the wider implications of our findings (section 5).

Emerging intra-urban geographies of the cognitive-cultural economy

In a series of important publications, Allen Scott (Scott, 2012; Scott, 2011; Scott, 2008; Scott, 2007) has outlined the contours of an emerging geography of *cognitive-cultural* capitalist urban economies. In his view, these urban economies can only compete globally by fostering economic activities that rely on high inputs of knowledge (cognitive) and creativity (cultural). These economic activities tend to be vertically disintegrated, spatially concentrated, and strongly embedded in networks. The intertwined processes of technological change, intensified global competition, the unbundling of value chains including the rise of project-based work, and an increase in both the fragmentation and the volatility of consumer demand have thus created new landscapes of production and consumption (Dicken, 2011; Gabriel and Lang, 2006; Kloosterman, 2010b; Scott, 2012; Scott, 2011).

The *minimum efficient scale* has dropped in many economic activities as the fixed costs for starting a firm have decreased mainly due to ever cheaper computing and communication technology particularly of internet-based business tools such as specific apps and PayPal, to outsourcing, and because of smaller production series as a result of the increased volatility in demand (Mason et al., 2015; Oecd, 2010). In addition, since the neoliberal turn in 1980s, policies favouring entrepreneurship have lowered legal, institutional and fiscal barriers regarding setting up a business in many countries. The opportunity structure, then, has shifted thereby creating more openings for small businesses, which are part of the cognitive-cultural economy and, hence, crucially dependent on knowledge-intensive labour inputs.

To compete, such firms tend to focus on aspects of quality, for instance, on the service offered or on the aesthetic or symbolic content of their products. This protection may be limited in time as volatile consumer demand can rapidly shift to another product. Firms in advanced urban economies, then, have to deploy cognitive-cultural capabilities to maintain the uniqueness of their product. *High-tech* or *high-concept* products and continuous innovation are, hence, key characteristics of the cognitive-cultural economy. The ability to compete in such an environment is at least partly contingent on being embedded in an innovative milieu which enables the exchange of 'tacit' knowledge; experience and know-how that cannot easily be codified. Traded and untraded interdependencies constitute the conduits that facilitate processes of localized learning and innovation (Hutton, 2016; Kloosterman, 2010a; Boschma, 2005; Storper and Venables, 2004; Storper, 1997; Maskell et al., 2006; Bathelt et al., 2004; Gertler, 2003; Gertler, 2008). Traded interdependencies refer to monetised input-output relations between suppliers, clients and business partners. Untraded interdependencies are non-monetised relationships which are first and foremost

social in nature. These can also have important economic returns as they can involve the exchange of information on opportunities or know-how (Storper, 1997). Cognitive-cultural firms, then, tend to be part of larger networks, partly based on spatial proximity, partly on relational proximity with partners and clients elsewhere (Maskell et al., 2006).

Existing studies of the spatiality of cognitive-cultural industries generally focus on two types of spaces. Studies looking at inner cities or specific 'cultural districts', the first type, account how creative individuals and artists have transformed former industrial spaces in inner cities into incubators for cognitive-cultural production (Hutton, 2004; Hutton, 2016; Lloyd, 2004; Martins, 2015). Brownfield sites, old docks and former warehouses offer 'authenticity' and artistic presence that is benevolent to 'cultural products' and attractive to artists and creative workers (Scott, 2008; Scott, 2011; Zukin and Braslow, 2011). These studies show how the influx of art and creativity in these areas has made them more attractive as living environments, consequently driving a process of gentrification (Hutton, 2016; Pollard, 2004).

The second type of quintessential space for cognitive-cultural activities is the high-tech cluster with Silicon Valley as the shining example. Studies on these spaces tend to focus on clusters of the 'digital economy', which can take various forms such as concentrated activity in inner cities, on research campuses with their corollary service providers or more spread out over large conurbations (Nathan and Vandore, 2014; Phelps, 2004){Tavassoli, 2014 #399.

For both types of spaces, studies highlight the aforementioned importance of (relational) proximity to others and the opportunity for information exchange {Balland, 2013 #400}(Boschma, 2005). Spatial proximity of firms that are active in the same or related industries allows them to maintain

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relationships based on common trust and information build-up (Maskell and Lorenzen, 2004). This allows for swift changes in input and output in order to adjust to changing consumer demands. Scott (2007) considers the social and business relationships entrepreneurs, firms and their workers maintain as increasingly important assets in the cognitive-cultural economy(Hatch, 2013). Studies, then, consistently highlight the importance of social networks and face-to-face contact for cognitive-cultural industries. The kind of 'buzz' that allows these businesses to thrive, is strongly associated with inner-city areas and creative clusters. (Durmaz, 2015; Martins, 2015; Williams and Currid-Halkett, 2011; Kloosterman, 2010a; Storper and Venables, 2004; Hutton, 2004; Hutton, 2016).

Extant literature on high-tech districts and creative clusters has thus contributed to our understanding of how cognitive-cultural activities are organized in these two types of spaces. We maintain however, that there is a third space that needs to be considered when analysing cognitive-cultural urban economies. Residential neighbourhoods in non-central areas have been mainly neglected as a location for cognitive-cultural activities. There is thus a knowledge-gap on the presence and the embeddedness of cognitive-cultural economic activities in more 'mundane' or 'banal' urban spaces like residential neighbourhoods (Reuschke et al., 2015; Collis et al., 2010; Phelps and Ozawa, 2003; Phelps, 2012; Williams and Williams, 2011).

The residential neighbourhoods in our study are neither 'cultural clusters' in the above-mentioned sense, nor are they designated hubs of high-tech businesses. The residential function is clearly dominant. They were planned to accommodate the residential function, often including a small local shopping centre or a central shopping street to service local residents. They display relatively low densities of population and businesses. Residential neighbourhoods generally do not possess

the aesthetic qualities said to inspire creative or innovative activities. They provide fewer semi-public spaces and opportunities for (spontaneous) interaction nor are they characterized by an 'active street life', especially during the weekday (Martins, 2015; Durmaz, 2015). Still, as our data show, residential neighbourhoods are home to significant numbers of cognitive-cultural activities.

Several arguments can be made as to why cognitive-cultural activities would locate in residential neighbourhoods. First, the decline in the minimum efficient scale of production in conjunction with cheap digital information and communication technology has expanded opportunities for small businesses and, in addition, have increased, in principle, the scope regarding the location of a (small) business (Clark, 2015; Ekinsmyth, 2011; Ekinsmyth, 2013; Pratt, 2000). Secondly, especially for small firms it might be cheaper and constitute a low-risk start to run a business from a non-central location, particularly from home (Reuschke et al., 2015). Thirdly, running a business from or close to home may offer flexibility and the possibility of combination with other activities (e.g. child care, Ekinsmyth, 2011). Notwithstanding increasing numbers of home-based businesses, there is no conclusive evidence on how these businesses are embedded in their local environment (Reuschke et al., 2015).

In the Netherlands, home-based businesses constitute about 60 per cent of all businesses in residential neighbourhoods (Risselada and Folmer, 2012). For so-called liberal professions (architect, lawyer, general practitioner, visual arts) one is allowed to use one third of the floor space to start a home-based business without prior permission from the municipality. In all other cases the economic activity needs to agree with the zoning plan, which usually only forbids retail and cafes and restaurants at home (Folmer and Risselada, 2013).

Residential neighbourhoods are thus becoming more attractive as business locations. By looking at the development of the share of cognitive-cultural activities in these areas as well as examining how they are spatially embedded allows us to determine whether residential areas are truly becoming more important as a production milieu for cognitive-cultural industries or whether they are simply a convenient place for business location while production, networking and exchange take place elsewhere. Given the dynamics of contemporary urban economies, we expect that the rising share of cognitive-cultural activities is reflected in the trends of economic activities in residential neighbourhoods. In addition, we expect that given their position in the value chain, cognitive-cultural activities are much more likely to maintain supralocal networks of traded and untraded interdependencies compared to traditional activities in residential neighbourhoods.

Methodology

Cognitive- cultural activities defined

Allen Scott's (2007) definition of which activities embody the cognitive-cultural dimension of contemporary capitalism is fairly broad. His definition covers all industries that involve to a large extent less or non-standardised labour processes relying on relatively high intellectual or affective capabilities. Consequently, high-technology (e.g. software development) and high-concept (e.g. fashion design) activities sectors as well as high-end personal services (e.g. financial advice) are part of this cognitive-cultural economy. Consequently, we follow Scott's conceptualization and define the signature activities of the new economy *by the nature of the work that they involve* as they require either high-skilled cognitive or ditto cultural labour inputs which are essential to engage in the production of less- or non-standardized goods and services.

The population of this study consists of businesses in residential neighbourhoods that are registered with the national Chamber of commerce. These are mostly small- and medium sized enterprises, including one-person businesses and including both home-based and non-home-based businesses (see online supplement for an illustration of premises that non-home based businesses occupy). Freelancers or individual entrepreneurs registered with the Chamber of Commerce are also included in this study. Non-profit and government-related activities are excluded from analyses. We use two main data sources in this article. First, a secondary dataset consisting of Chamber of Commerce data supplemented with employment data (LISA). This dataset contains data on business establishments on postcode level from 1999-2008. We use the LISA data to address our first research question on how the share of cognitive-cultural activities in residential areas has developed during this time period. Our second source of data is survey data on business owners in residential areas collected by ourselves in 2011.We use the survey data to analyse how cognitive-cultural businesses are embedded in residential neighbourhoods.

Operationalisation

The first research question refers to the quantitative development of cognitive-cultural activities in residential neighbourhoods. We address this question by analysing LISA data for our research cities over the period 1999-2008. LISA data is not able to present a fully inclusive view of cognitive-cultural activities since it is based on standard SIC codes. There has been criticism on using standard industry classifications (SIC) for defining the 'creative economy' (Markusen, 2006). By using LISA data, one inevitably excludes many cognitive-cultural activities that are registered under non-cognitive-cultural labels. Likewise, some SIC codes that we categorized as cognitive-cultural inevitably will also include rather standardized and inflexible work, as not all activities in publishing industry for example are creative or innovative. The definition of cognitive-cultural

firms and traditional firms we applied to the LISA dataset aligns closely with Scott's (2007) definition of cognitive-cultural activities (See online supplement for classification of SIC codes).

For the second research question regarding embeddedness we use a more fine-grained procedure to define cognitive-cultural activities. To be able to distinguish whether respondents are engaged in cognitive-cultural or traditional activities, we combine self-reported information and interviewer interpretation. We asked respondents to identify their activities with three questions. First, we asked them to select their core business from a list of industries. Second, we asked them to classify their main activity as 'knowledge- or technology intensive', 'standardized', 'craft' or 'other'. Third, we asked respondents to describe their main activity in their own words (see online supplement for survey items).

We classified those respondents who selected as their core business manufacturing, construction, wholesale, retail & car repair, transport & storage, restaurant, hotel & bar and real-estate as 'traditional businesses'. However, if these respondents answered 'knowledge- or technology intensive', 'craft' or 'other' to the second question (i.e. counter-intuitive to the classification of the core activity), we scrutinized their answer to the third question to decide if the business was a cognitive-cultural activity. For example, a respondent who selected 'construction' as her core activity and answered 'other' on the second question but described herself as 'architect' in the third question was categorized as 'cognitive-cultural business'. Another example; a respondent who selected 'education' from the list of core activities and answered 'other' on the second question while describing her business as a driving school was categorized as traditional. Respondents who selected health & wellbeing, culture, sports & leisure, financial services and other services were all categorized based on their answer to the third question since these sectors contained too much

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variation on the second question (see the online supplement for a detailed overview of how all respondents were categorised). We are confident that by using these three indicators we have a fine-grained definition of businesses who are doing cognitive-cultural work. By applying this categorization we have effectively created a control-group in our data allowing us to compare cognitive-cultural with traditional businesses and learn if the former truly are embedded differently. Arguably, the traditional industries are also likely to have been affected by new technologies and forms of knowledge. However, we think this classification holds since the non-standardised products of cognitive-cultural industries are characterised by qualities derived from high-level concepts and aesthetics.

In our questionnaire we have operationalised traded interdependencies as business relations that involve direct or indirect monetary compensation. We asked respondents what share of their business relations and clients come from the same neighbourhood, from adjacent neighbourhoods, from the rest of the city, and from outside the city. We defined untraded interdependencies as non-monetised types of contact and asked respondents how often they had any type of 'contact with other entrepreneurs'. For both types of interdependencies we also enquired after their relevant scale levels. In total we included nine survey items about their interdependencies (see also appendix A). All survey items were measured on an ordinal scale with four or five answer categories. We have used categorical principal component analysis (CATPCA) to assess whether the survey questions load on two distinct dimensions of traded and untraded interdependencies. CATPCA allows for principal component analysis of these Likert-type answer scales while preserving their ordinal nature (Linting et al., 2007).

City and neighbourhood selection

The large-scale survey conducted in 2011 was part of a larger research programme on economic activities in residential neighbourhoods in the Netherlands sponsored by the NICIS institute in which five municipalities-i.e. Amsterdam, Dordrecht, Utrecht, Leiden, and Zoetermeer-participated by providing additional funding and support in gathering the data. All cities are located in the Randstad region, the large conurbation in the West of the Netherlands. Four of them are "typical" Dutch cities with sizeable 17th century historical cores, surrounded by 19th century, early 20th century, and, further out, post-WWII neighbourhoods. Only Zoetermeer, a farming village only 50 years ago, has been almost completely built after 1970 as part of a new-town strategy to alleviate the pressure on The Hague (van der Cammen and Klerk, 2006). The two largest cities, Amsterdam (811,000 inhabitants) and Utrecht (328,500 inhabitants), have shown a rather strong population growth in the past few years (CBS, 2014). Both have relatively high shares of higher educated, young people (partly because of their being centres of higher education) as well as non-Western immigrants (Marlet and van Woerkens, 2012)[i]. Dordrecht, Leiden and Zoetermeer have 118,000, 121,000 and 123,000 inhabitants respectively and all three more or less stable regarding population size (CBS, 2014). In Dordrecht and Zoetermeer, the average age of the population is higher than in the other cities, while Leiden also has a relatively high share of higher educated and young people due to its status as a university town.

The classification of residential neighbourhoods is made on the basis of postal code areas. First, only areas with more than 500 residential addresses are selected. This group is divided into three categories: neighbourhoods with a city centre function, neighbourhoods that have an industrial site within them and the residue is categorized as "purely" residential neighbourhoods (Raspe et al.,

2010). Research neighbourhoods were selected from this last category. In each of the five research cities, three residential districts were selected, all of which comprise two to five smaller neighbourhoods. In each city, we made sure to select neighbourhoods of various socioeconomic status. The fifteen selected districts are diverse in terms of building period and housing types. None of the selected neighbourhoods are part of the city centre, and their average distance to the city centre is 3.5km. The neighbourhoods are spatial areas with an average size of 4,600 neighbourhood residents, ranging from 1,000–13,000 residents (see also the online supplement). In terms of square kilometres, the researched neighbourhoods range between 0.3 and 2.5 km^2. For the survey, a random sector-stratified sample of 1,683 businesses in these fifteen neighbourhoods was drawn from the LISA database, the employment register covering all firm establishments in the Netherlands. The sample included both home-based and non-home based businesses. We personally handed out the questionnaires to the sampled businesses. With 370 returned and usable questionnaires, the response rate was 22%. Questionnaires were exclusively completed by owner-managers or co-owners of businesses.

Results

First, we present our findings on the development of the share of cognitive-cultural activities in residential neighbourhoods in the five research cities based on the LISA data. Second, we present multivariate analyses of our survey data to explore the embeddedness of cognitive-cultural businesses in the neighbourhood, controlling for other firm- and individual-level characteristics.

Share of cognitive-cultural economy in residential neighbourhoods

Figure 1 and Figure 2 were produced with the LISA data covering our research cities for the period 1999-2008. These figures confirm the expectation of a shift with regard to the intra-urban geography of economic activities towards an increasing share of cognitive-cultural activities in urban residential neighbourhoods. Figure 1 shows the development of the share of cognitive-cultural businesses in residential neighbourhoods across the five research cities.

Figure 1 about here

Figure 1 shows that in all cities an increase in the share of cognitive-cultural industries in residential neighbourhoods can be observed. The share of cognitive-cultural activities in residential neighbourhoods is already relatively high to start with and growing; from 36 to 50 per cent in Utrecht, for example. Amsterdam and Leiden also show a strong increase while the increase in Zoetermeer and Dordrecht is smaller. Figure 2 shows the location of cognitive-cultural industries across different parts of the city. Amsterdam, the capital city, is the only city where we see a 'typical' spike of cognitive-cultural activity in the inner city. Nevertheless, the graph also shows that residential neighbourhoods are catching up to the inner city as location for cognitive-cultural activities. In Utrecht, residential neighbourhoods have the highest share of cognitive-cultural activity compared to other neighbourhood types. Remarkably, about half of the economic activities located in industrial areas in Leiden can be labelled as cognitive-cultural. This is related to the Bio Science Park – a large industrial park in Leiden which specialises in life sciences. In all cities residential neighbourhoods (with and without an industrial area within their borders) are accommodating a relatively high share of cognitive-cultural activities compared to inner cities and industrial areas (with Leiden as the exception). The implication of this finding is that we need to consider residential neighbourhoods as places of production that are gaining importance and will

continue to do so in advanced urban economies since it is expected that economic growth will predominantly take place in the cognitive-cultural industries (Scott, 2011).

Figure 2 about here

Embeddedness of cognitive-cultural economy in residential neighbourhoods

To address the question of embeddedness we first conducted a principal component analysis to assess whether we can observe a distinct structure in our data of traded and untraded interdependencies maintained by the respondents in our sample. Next, we conducted multivariate regressions to examine the embeddedness of both cognitive-cultural and traditional businesses.

The distribution between cognitive-cultural and traditional businesses in our sample (N=370) is nearly equal, with 48 per cent (N=178) of firms operating in cognitive-cultural industries which is higher than the average share of 37 per cent of cognitive-cultural firms in the fifteen research neighbourhoods in the five research cities (in 2008, see Table 1). Cognitive-cultural firms are thus slightly overrepresented in our sample, as are micro enterprises. Our best measures of population means are from 2008 (based on LISA data) whereas our sample was drawn in 2011 (see online supplement for details on population and sample means).

CATPCA can be used to reveal an underlying structure in the data and to obtain quantified component scores that we can use to conduct further regression analyses. We conducted the CATPCA analysis on the nine survey items that we used to capture the traded and untraded interdependencies (see Appendix 1 for the PCA). From the analysis, we can distinguish two components as shown in Table 1.

Table 1 shows that both business relations and the share of customers on various scale levels load on the component of traded interdependencies. Therefore, we gain confidence that these items capture a different type of relationship compared to the items on frequency of contact with other entrepreneurs. Within the dimension of traded interdependencies we can observe a distinct pattern: respondents with a high component score on traded interdependencies generally have a high share of customers from outside the city and a high share of business relations from outside the city. These respondents are thus very much oriented to a supralocal market. A low score on this dimension indicates a strong local orientation to traded interdependencies. The items on frequency of contact with other entrepreneurs capture untraded interdependencies between entrepreneurs. The CATPCA shows that these items load on the same dimension implying that entrepreneurs who maintain more untraded interdependencies do so on multiple scale levels: the neighbourhood, adjacent neighbourhoods, and other parts of the city and outside the city.

We use these component scores as dependent variables in regression analyses (OLS). We introduce other individual and firm characteristics that might explain traded and untraded interdependencies: being home-based (two categories), age of the firm, the number of hours spent on the business and number of hours spent at the business address, number of years located in the neighbourhood and number of employees. We introduce gender and the educational attainment of the entrepreneur (three categories) as control variables. We also introduce dummy variables for the five research cities to capture any variance due to our respondents being located in different cities. We calculated ICC(1) for the fifteen research neighbourhoods. ICC's indicated that less than 1% of the variance in the dependent variables is attributable to group differences making the data unsuitable for

multilevel modelling (Snijders and Bosker, 1999). This also reassures us with regard to the city of Amsterdam as a second-tier global city potentially biasing our results.

We expect that running a cognitive-cultural business will be positively related to the frequency of untraded interdependencies an entrepreneur engages in as this is what the literature suggests. We expect that cognitive-cultural entrepreneurs are more likely to score high on traded interdependencies – indicating a supralocal orientation - as their specialized products and services are more likely to have a dispersed supply chain. Also, their products and services are likely to draw a more spatially dispersed clientele. We propose that being home-based is associated with a strong local orientation, implying a low score on traded interdependencies. The lack of research on home based business keeps us from specifying its relation to untraded interdependencies. Home-based businesses may be more isolated or they may be strongly networked in the neighbourhood. Age of the firm might have either effect on traded and untraded interdependencies: Older firms are more likely to have an established name and draw from a very broad circle of customers yet they might also have a stable clientele and do not invest in expanding it further. We would expect older firms to maintain more untraded interdependencies because they might know more people due to time and experience while on the other hand young firms might be more eager to learn from other (starting) entrepreneurs and expand their business opportunities. Time spent on the business address is expected to be negatively related to both traded and untraded interdependencies since being sedentary decreases opportunities for establishing these types of relationships. Table 2 displays descriptive statistics for all variables used. Table 3 presents the results of the regression analyses.

Table 2 and 3 about here

Model 1 and 1a show the determinants of untraded interdependencies. Being a cognitive-cultural business has a positive and significant effect on the untraded interdependencies an entrepreneur maintains. This confirms our expectation. Being home-based has a negative and significant effect on untraded interdependencies. Home-based entrepreneurs display a lower 'connectedness' with other entrepreneurs on all scale levels compared to firms located in an office, shop or other type of commercial real estate. More time spent by the entrepreneur on his/her business results in more untraded interdependencies, indicative of the time investment required for building networks. We find no significant effects for firm age, education, years located in the neighbourhood and the time spent on the business address. However, it was argued by Schutjens and Stam (2003) that young firms expand their networks up to a certain age and then stop investing in networks, implying a potential curvilinear relationship between firm age and inter-firm interdependencies. In model 1a we have included an interaction effect for cognitive-cultural businesses and business location (i.e. being home-based or not). We can observe that the interaction term is not significant, yet it renders the effect of being a cognitive-cultural business insignificant. This indicates that *non*-home-based businesses have more untraded interdependencies irrelevant of their sector.

Model 2 -2b show the determinants of traded interdependencies. We see that being a cognitive-cultural business has a positive and significant effect on traded interdependencies, indicating a stronger supralocal market orientation compared to traditional firms. This confirms our expectation. Cognitive-cultural businesses are much more likely to source clients and business relations from outside the neighbourhood and the city that they are located in. The results indicate that being home-based is positively related to traded interdependencies. This finding is rather

counterintuitive as we expected home-based businesses to have a strong local orientation. The strong negative effect of hours spent on the business address on traded interdependencies implies that being sedentary (i.e. in one location) is indicative of a more local market orientation, as we expected. There is a small positive and significant effect of employees on traded interdependencies suggesting that larger businesses have a more supralocal market orientation. More time spent by the entrepreneur on his/her business results in more traded interdependencies, again pointing towards the time investment that is necessary for building networks (Bathelt et al., 2004) Again, we find no significant effects for firm age, years located in the neighbourhood and education. We see that entrepreneurs in Zoetermeer score higher on traded interdependencies, and are thus more likely to be oriented towards a supralocal market. This may be a reflection of the smaller size of Zoetermeer's economy. Interestingly, we observe a substantial negative effect of gender on traded interdependencies, implying that female business owners are more local in their orientation. From model 2a we learn that the interaction effect for cognitive-cultural businesses and business location does not influence the original model. However, in model 2b we added an interaction term for gender and business location, to further explore the negative effect of gender on traded interdependencies. From the literature on 'mumpreneurs' we have learned that many women who run businesses from home are also caretakers and that for these women the everyday spaces of the community and the neighbourhood are highly relevant in running their business because they are tied to the 'spatio-temporal routines of childcare work'(Ekinsmyth, 2011; Ekinsmyth, 2013). The interaction term is not significant, and we see that the effect of home-based business is no longer significant. The negative effect of gender remains significant, indicating that this is first and foremost a gender effect rather than an effect of business location.

Conclusions: re-mix, re-model

We are currently witnessing, arguably, a partial reverse of the long-term trend of an ever increasing spatial separation of functions which started even before the Industrial Revolution: a re-mix of functions at the level of homes and residential neighbourhoods. This re-mix is part of a much larger fundamental transition of the spatio-organisational format of production in advanced urban economies driven by the intertwined processes of technological change, globalization and individualization. At the same time it entails interrelated trends towards self-employment as well as home-based businesses.

Our study shows that residential neighbourhoods are now to be taken seriously as spaces for high-skilled forms of production as they show increased levels of cognitive-cultural activities. Overall, cognitive-cultural activities are maintaining more untraded interdependencies on all scale levels, while they maintain most traded interdependencies on a supra-local level. They appear to be making frequent use of both local buzz as well as of supralocal 'pipelines', and are thus embedded on various spatial scales (Bathelt et al., 2004). Their organisation of production thus reflects a complex supralocal division of labour in terms of inputs and outputs. Our study makes clear that cognitive-cultural businesses are also primarily targeting supralocal markets as they offer products and services that have a wide market appeal.

At the same time, the residential neighbourhood offers a place to forge untraded interdependencies as we have seen that cognitive-cultural entrepreneurs are more likely to maintain untraded interdependencies in- and outside the neighbourhood. We have also seen that business location plays an important moderating role in both traded and untraded interdependencies. Home-based businesses seem to have some specific organisational traits that influence their interconnectedness despite their sectoral orientation. This raises questions as to whether home-based businesses are

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rather isolated, and if so, if this is the case by choice or whether they connect to other entrepreneurs in ways that our survey was not able to capture. We found that female business owners tend to be more oriented to local markets. This points to an interesting difference between men and women in how they make use of the neighbourhood environment.

What emerges from our study is an evident departure from the more conventional image of neighbourhood economies dominated by mom-and-pop stores, low-end personal services and other assorted economic activities aimed at the local clientele. Innovative activities, focused on non-standardized products, catering to non-local markets and requiring the input of cognitive-cultural labour can be found in considerable numbers in residential neighbourhoods. The horizons of these firms stretch far beyond the own neighbourhood, in terms of traded and untraded interdependencies. Cognitive-cultural production on a small scale seems to suit a home-based environment. Some of these firms which will grow out of the seams of the home will move to more central urban or even mono-functional areas after the start-up phase.

Yet, especially for home-based businesses it holds that the preference to stay home-based is strong and a relocation decision is intertwined with the family situation (Ekinsmyth 2011, 2013; Risselada and Schutjens, 2016). Even if they do relocate, they often look for business accommodation in their own neighbourhood (Mackloet et al., 2006). Residential neighbourhoods, then, are (much) more than just incubator areas but are becoming specific business environments in their own right. It seems plausible that these changes in the spatio-temporal division of labour and the concomitant mixing of functions will affect a whole range of spatial levels: that of individual dwellings, streets, neighbourhoods, and cities and of urban systems (Martins, 2015).

From a more policy-oriented perspective, it appears that as production activities become more integrated in residential quarters, both the built and the regulatory environment have to allow more mixed uses and throw up fewer barriers to changes in (combinations of) uses. As stated by Harrison et al. (2004):

"…new economy production no longer requires people to work together in the same physical space to access the tools and resources they need to produce their work. Production can be spatially decentralized and reintegrated back into other aspects of life ... a much finer granularity of interplay between work and leisure becomes possible"

To foster the exchange of knowledge, sharing of resources and to alleviate the relative isolation of running a businesses from home urban planners may have to look at the possibilities of establishing third spaces for meeting and co-working in these neighbourhoods. This might entail new forms of regulation and flexibilisation of zoning plans.

This (re-mix) of functions will also offer opportunities for cities with an extensive pre-industrial built environment which evolved around a finely-grained mix of functions. In a sense, then, cities are getting back to more pre-industrial combinations of work and other activities and policy makers should be more aware of the economic opportunities offered by residential neighbourhoods and be less focused on mono-functional business districts. These changes will also require a rethinking of the relationship between the city as a site of production and a site of social reproduction as these become more intertwined (Beckers and Kloosterman, 2014; Folmer and Risselada, 2013). It may also entail a revision of firm location theories as the concept of firm as a closed-off and spatially fixed unit is eroded and different considerations, such as the possibility to combine work and care,

have to be taken into account (Buliung, 2011; Ekinsmyth, 2011). Locational theories used to be solely focused on business concerns, but with the intertwining of different functions at a very low level of scale, that of the home itself, other issues come into play. The present conceptualizations of 'the firm' and 'enterprise' do not seem adequate for explaining the phenomenon of the self-employed and home-based business (Taylor, 1999). As Taylor suggested, we need to look for different analytical instruments to get a better understanding of these rather fluid economic entities that are becoming a more prominent part of the urban landscape. This will require a broader approach of how entrepreneurs work and how businesses fit in within the wider scheme of the owner's life. More in-depth, qualitative analysis, and ethnographic observation is needed to unravel the different configurations of businesses in residential neighbourhoods. Exploring home-based businesses in these ways may also offer new insights regarding why they are found more in particular neighbourhoods and also how they benefit from which types of agglomeration economies.

The shift to a cognitive-cultural economy does not mean that everything will change-we do not believe in epochalist readings of history. Instead, we view this very important change as adding a new layer to advanced urban economies, partly replacing other, older layers. This new layer consists of landscapes of production and consumption which are geared towards products with a high cognitive-cultural content. This re-mixing of functions in residential neighbourhoods necessitates a re-modelling of the built environment on different levels (from the individual home to the city as a whole), of the politics towards businesses, and also a re-modelling of locational theories.

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Appendix A: CATPCA

A categorical PCA was conducted on the nine survey items displayed below. CATPCA is seen as the nonlinear equivalent of principal component analysis. The advantage of CATPCA is that it allows for analysis based on nominal and ordinal variables. Likert-scale types of items are often treated as numerical variables. However, CATPCA provides a more robust outcome since it treats the variables at their appropriate measurement level (Linting et al., 2007). Two components were retained in the final analysis. The table shows the component loadings. The interpretation of the loadings suggests that one component represents the issues pertaining to the location of customers as well as business relationships (i.e. involving monetary compensation). The second component represents the frequency of contact with other entrepreneurs on different scale levels.

**Summary of factor analysis (factor loadings below .40 are not shown)**

Item	Component loadings	
	Traded interdependencies	Untraded interdependencies
Share of customers from the own neighbourhood	-.813	
Share of customers from outside the city	.790	
Share of business relationships in the own neighbourhood	-.792	
Share of business relationships in adjacent neighbourhoods	-.706	
Share of business relationships outside the city	.734	
Frequency of contact with entrepreneurs from the own neighbourhood	-.514	.608
Frequency of contact with entrepreneurs from adjacent neighbourhoods	-.424	.786
Frequency of contact with entrepreneurs from other parts of the city		.841
Frequency of contact with entrepreneurs from outside the city (but within the country)		.703
Eigenvalues	3.59	2.35
% of variance explained	39.98	26.15

Endnotes

[i] The shares of population from non-Western origin (2012): Amsterdam 35; Utrecht 21; Dordrecht 17; Leiden 14; Zoetermeer 17.

Figures & Tables

Figure 1: CC activities as a share of the total economic activity in residential neighbourhoods 1999-2008.
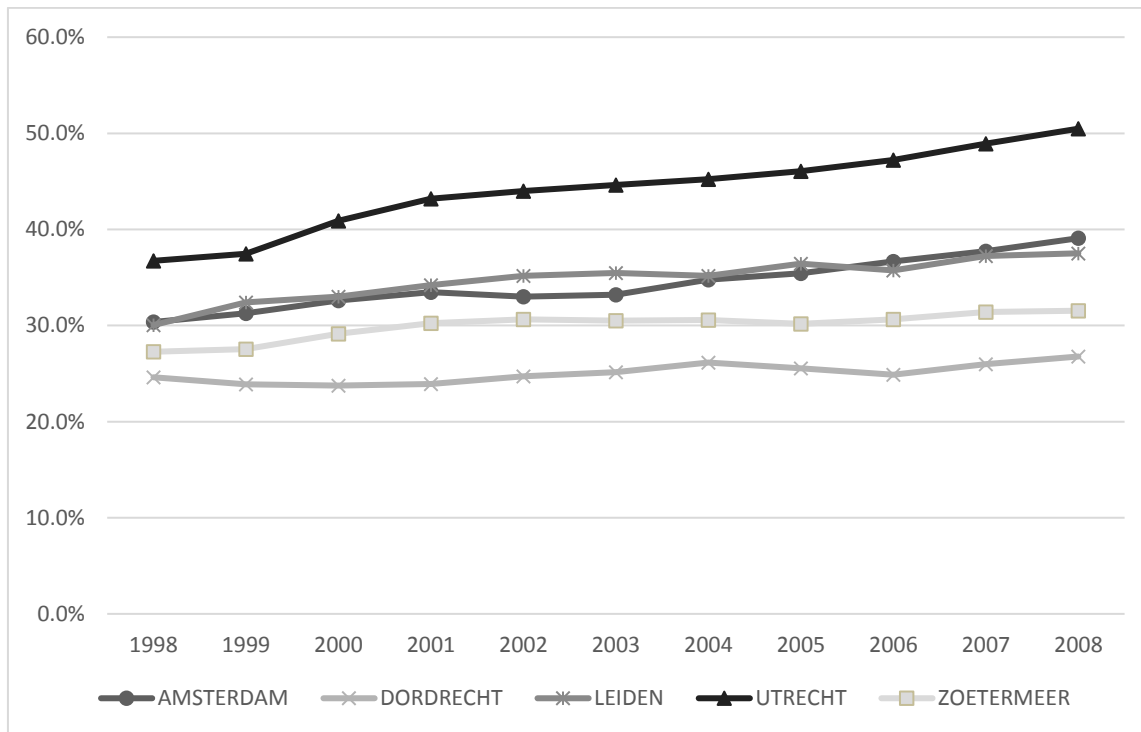
Data source: LISA (calculations by the authors – see also appendix B for sector classification)

Figure 2: CC activities as a share of the total economic activity across neighbourhood types 1999-2008.
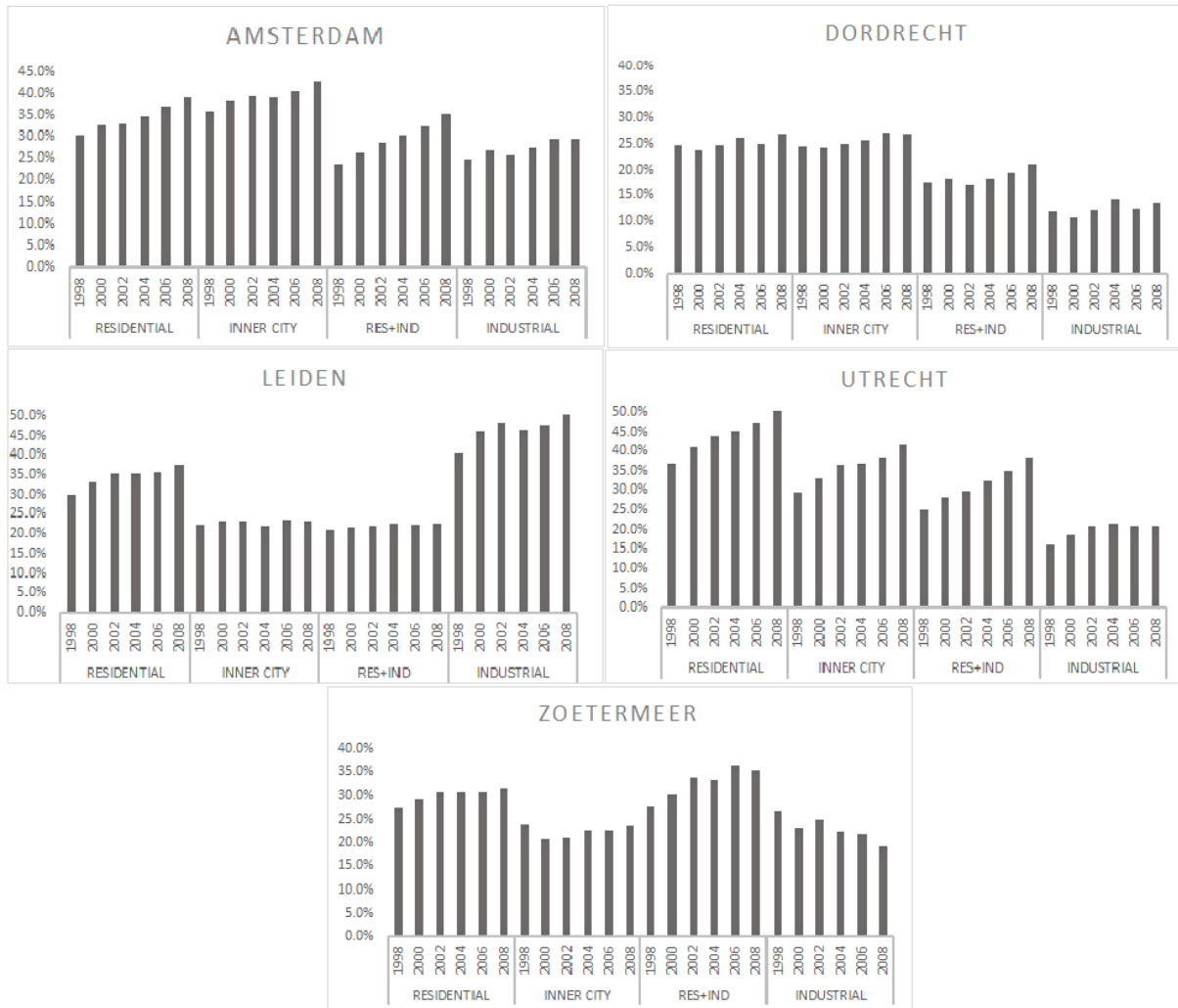
Table 1: Components from CATPCA (see appendix A)

1. Traded interdependencies	2. Untraded interdependencies
Share of customers from own neighbourhood	Frequency of contact with other entrepreneurs from the own neighbourhoods
Share of customers from outside the city	Frequency of contact with entrepreneurs from adjacent neighbourhoods
Share of local business relations	Frequency of contact with entrepreneurs from other parts of the city
Share of business relationships outside the city	Frequency of contact with other entrepreneurs from outside the city (nationwide)

Table 2: Descriptive statistics

	%	N	Min	Max	Mean	SD
Dependent variables						
Market orientation		370	-2.18	1.61	-.0032	1.024
Untraded interdependencies		370	-2.78	2.83	.0058	1.00
Key independent variables						
Cognitive-cultural business (1 = cognitive-cultural, 0=traditional)	48%					
Home-based-business (1 = HBB)	67%					
Average time spent on business (hours p/w)		362	0	100	41.04	17.92
Average no. of hours spent at business address p/w		364	0	85	27.4	17.35
Firm age		361	0	112	16.32	15.7
Years located in neighbourhood		362	0	91	12.6	11.8
Number of employees (FT + PT)		360	0	500	4.8	30.92
Control Variables						
Gender (1= female)	38%					
Educational attainment						
1 = Primary or secondary education	24.2%					
2 = Higher vocational or college degree	41.2%					
3 = University degree	34.6%					
City dummies (reference category = Amsterdam)						
Dordrecht	17.0%					
Leiden	15.7%					
Utrecht	17.3%					
Zoetermeer	27.6%					

Table 3: Untraded interdependencies and market orientation: OLS regressions

	Model 1 DV: untraded interdependencies	Model 1a DV: untraded interdependencies	Model 2 DV: traded interdependencies	Model 2a DV: traded interdependencies	Model 2b DV: traded interdependencies
	Standardized coefficients				
City					
Zoetermeer	-.090	-.084	.174***	.174***	.173***
Utrecht	-.087	-.096	-.010	-.012	-.008
Leiden	-.044	-.044	.068	.068	.066
Dordrecht	-.085	-.090	.020	.019	.018
Cognitive-cultural business	.132**	.031	.329***	.314***	.327***
Home-based business	-.138**	-.203**	.135**	.126*	.105
Years located in the neighbourhood	-.085		-.071	-.070	-.070
Firm age	.005	-.029	.028	.029	.032
Time spent on business	.211***	.214***	.126*	.126*	.128*
Hours spent at business address	-.074	-.081	-.298***	-.299***	-.306***
Employees	.005	.007	.090*	.090*	.091*
Cognitive-cultural *HBB		.146		.022	
HBB*female					.082
Control variables					
Female	.037		-.135***	-.134***	-195**
Vocational or college degree	.050	.047	.095	.095	.095
University degree	.093	.097	.031	.031	.035
N	309	309	309	309	309
R	.313	.320	.568	.568	.570
R^2	.098	.103	.323	.323	.324

*p<.10   **p <.05   ***p< .00