Opinion Paper

My home is my castle assessment of city love in Sweden

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A B S T R A C T

This paper offers a novel contribution to an evidence-based assessment of the attractiveness features (or perceived qualities) of cities or urban neighbourhoods, based on a quantitative evaluation of such areas by introducing and applying what is called ‘city-love’ analysis. To put this new concept in context, we offer first a concise overview of related and complementary notions (e.g. happiness, satisfaction, well-being, quality of life, contentment). Then we propose a new departure for attractiveness research pertaining to micro-based information on residents or users of cities by introducing the notion of a ‘city-love production function’. This function expresses the ability of cities to enhance the love or appreciation for a city or its neighbourhoods through an appropriate combination of five specific ‘city capital’ constituents. We test the validity of this so-called ‘Pentagon’ approach to city love by means of the city-love production function using a multivariate econometric model based on extensive heterogeneous statistical data on municipalities in Sweden and complemented with cell phone data. Our results are confronted with empirical ‘big data’ on the appreciation of Swedish places – and their characteristics – taken from social media platforms. The study offers also interesting findings from an advanced spatial-econometric and multilevel modelling approach. Our estimations show that the concept of the city-love production function allows us to quantitatively uncover important determinants of citizens’ love for their local environment.

“My House, My Rules, My Pleasure”
(Donatella Versace)

1. Introduction

The quantitative empirical appreciation of places where people live, work or recreate has in recent years turned into a popular research topic. This is, inter alia, illustrated by the emergence of the ‘geography of happiness’, which has become a rising research domain in human, urban and economic geography (see Ballas, 2018). The focus in this new strand of literature is, in particular, on the specific urban conditions which shape feelings or perceptions of human happiness. An interesting example of this new strand of literature can be found in an applied quantitative investigation by Florida, Mellander, and Rentfrow (2013), who analyse the happiness of residents in relation to, among other variables, city size. It is noteworthy that, over the past decade, a wealth of spatially-oriented happiness studies in different countries has been published.

A recent application of the new wave of interest in urban happiness can be found in the extensive Dutch Atlas for Municipalities on the theme of ‘Happiness’ (see Marlet & van Woerkens, 2017). In this nationwide comparative study of all the municipalities in the Netherlands, the authors collected a broad set of individual and local happiness-related indicators and transformed these statistically into a quantitative aggregate estimate of municipal happiness in the country. Examples of indicators used in this Dutch Atlas are, for example, employment, health, safety, pleasant environmental space, etc. The results showed that most larger cities in the country had a relatively low level of happiness, while various medium-size cities shared a relatively higher degree of happiness. This finding for the Netherlands is supported by another recent happiness study on US cities, which shows that the inhabitants of the biggest cities are the least happy (see Florida, 2016).

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These studies prompt an important question: Is city size a major decisive condition for urban happiness? Or are there any other factors involved?

According to Marlet and van Woerkens (2017), happiness in a city is not a uni-dimensional, but a broad and multifaceted concept. The recent interest in urban happiness studies has emerged not only from a sociological angle, but also from an economic and geographical perspective. In general, studies from these fields argue that happiness reflects the individual contentment or satisfaction of a person with her/his own state of life and her/his perception and appreciation of the contextual and environmental conditions of her/his life. It may thus be seen as a degree of individual or collective place-based contentment that is the result of person-specific, group-specific, and context-specific conditions. Clearly, different disciplines may offer contrasting views on the spatial life conditions of people in a city (see also Section 2). For example, neoclassical economics analyses how choices on alternative means utilised under scarcity conditions in a city affect an individual’s satisfaction or well-being (see Frey, 2018), while human geography – in relation to broad spatial-environmental conditions – may address the location-specific conditions that influence an individual’s feeling of contentment with – or affection for – her/his external physical or social environment (Ballas, Dorling, & Henning, 2017). And urban sociology may focus on the ways a societal or community structure or organisation (e.g. social capital) impacts an individual’s or group’s feeling of well-being or life satisfaction (Veenhoven, 2000). The notion of urban happiness appears to be in many cases fuzzy, intuitive, and not defined in operational or measurable terms. It is often not a characteristic identifier of a place, but more an ad-hoc description of an individual’s feelings or emotions that may also be subject to external conditions. From that perspective, it seems plausible that happiness is less suitable as a clear-cut signpost for measuring the perceived quality of life in cities in a solid, comparable way. But are there other more satisfactory concepts? This is one of the challenging questions in this study.

As well as the concept of happiness, we find in the current literature various other related concepts, such as well-being, quality of life, contentment, or satisfaction, which also express the opinion or perception of a person in space on the attractiveness of a place or neighbourhood (see Section 2). These notions have all been used in the recent empirical literature and have led to new informed insights on the experienced quality or appreciation of a place. In many cases, these notions are even used interchangeably, which may cause ambiguous research outcomes. These qualitative evaluations also have their own intrinsic weaknesses, as will be pointed out in the concise overview of research outcomes. These qualitative evaluations also have their own intrinsic weaknesses, as will be pointed out in the concise overview of research outcomes.

2. Conceptual framing

In this section we briefly outline various concepts that have been used in the recent literature to express the appreciation or affection of individuals or groups for their individual, social and physical habitat. This part serves to position the research scope of the present paper in the existing literature. We concisely present the notions of happiness, quality of life, well-being, satisfaction, contentment and, finally, city love.

It is noteworthy that the above-mentioned concept of happiness has already gained quite some popularity in the early history of classical economic thinking, in particular by Jeremy Bentham (1843) and John Stuart Mill (1869) – witness their views on utilitarian principles and the greatest happiness for the greatest number of people. In later stages of economic theorising, the goal of happiness as an anchor point for human choices was replaced by utility-maximising behaviour by rational agents. It is only in recent decades that happiness has again come to the fore, thanks to the works of Sen (1999, Sen 2008), Frey and Stutzer (2002), Easterlin (2003), Layard (2006), Headey, Muffels, and Wooden (2008), Aydin (2010), Bok (2010), Edwards and Pelle (2011), and De Neve, Dierer, Tay, and Xuereb (2013). So it is clear, therefore, that nowadays there is much scope for and interest in a solid and analytical study of happiness as a key concept in the social sciences including geography and economics.

As mentioned already in Section 1, happiness research also has a long tradition in sociological and social-psychological research, ranging from a qualitative or conceptual angle to a quantitative-analytical perspective (Inglehat & Klingemann, 2000). Interesting and original contributions to quantitative measurement studies on happiness from a social science perspective can be found in the pioneering studies of Veenhoven (1991, Veenhoven, 2002). Econometric studies are more rare; for few notable exceptions, we refer to Hirschberg, Massoumi, and Slotte (1991), Ber- nini, Guizzardi, and Angelini (2013) and Decanèq and Lugo (2013). Clearly, happiness research has become a new field, to the extent that some scholars even speak of the 'new science of happiness' (see De Neve et al., 2013).

From a geographical perspective, urban-oriented happiness studies have also been on a rising edge over the past decades (see e.g., Argyle, 1999; Markus & Kitayama, 1991; Yang, Hsee, & Zheng, 2012; Jeon, Shin, & Jang Lee, 2014), but quantitative econometric studies are still...
rather scarce (see, e.g., Florida et al., 2013; Burger et al., 2017).

It is noteworthy that the spatial research on local happiness runs partly parallel to another strand of applied literature; namely, Quality of Life (QoL) studies. This has become a rather mature scientific field, in which social indicators, quality of life variables, or trust in governance institutions usually play a prominent role. The focus in this research is often on empirically observed, usually aggregate indicators. Many studies on QoL address meso or macro indicators, while a few find their origin in micro-based empirical perception data. At an aggregate level, the notion of the HDI (Human Development Index) developed in the UNDP (2011) has gained much popularity. This multidimensional systematic indicators approach is often used for comparative purposes. In the same vein, other related or complementary indices have also been developed, for instance, the ISEW (Index of Sustainable Economic Welfare) by Daly and Cobb (1989) and the HPI (Happy Planet Index) by NEF (Marks, Abdallah, Simms, & Thompson, 2006). In addition, systematic sets of individual and micro-based, place-specific determinants of QoL (see, e.g., Flanagan, 1978) have also received quite some attention. A broad spectrum of applied studies can be found in the recent literature (for applications, see, e.g., Copestake, Guilien-Royo, Chou, Hinks, & Velazco, 2009; Collins, 2013; McCrea, Shy, & Stimson, 2014; Kulczyk-Dynoswa and Kachnir, 2014; Tomaszewski & Perales, 2014; Rybakows, 2016; Aroca, Gonzalez, & Valdebenito, 2017; Boeing, 2019).

In general, QoL is related to the place-based (or locationally-oriented) health or environmental status, comfort and/or happiness experienced by a person or to the level of local or daily satisfaction or well-being of a person or group. It may relate to hedonic well-being or to integrated life evaluation, including personal life satisfaction in the urban system concerned. Examples of relevant QoL indicators are: human health, social cohesion, voluntary participation, education, etc. (see also Burckhardt, Anderson, Archenholdt, & Hagg, 2003). Relevant studies in relation to social well-being at the local level can be found in, among others, Blomquist (2006); Delmelle, Thill, and Wang (2016); Gough and McGregor (2007); Marans and Stimson (2011); Naudé, Rossouw, and Krugell (2009); Rappaport (2009), and Shucksmith, Cameron, Merridew, and Pichler (2009). It should be noted here that, in the literature, local QoL research often runs in parallel to the geography of well-being (see Aslam & Corrado, 2012), which is another important stream in the recent literature to be considered here.

The scientific literature shows that local subjective well-being is shaped by a complex array of factors, ranging from local social capital and spatial concern to quality of the environment and geographical accessibility (see Andrews & Withey, 1976; Keyes, 1998; Smerley-Tomic, Hewko, & Hodgson, 2004; Lytras, Visvizi, Chopdar, Sarirete, & Alhalabi, 2020). To disentangle such factors a comprehensive multivariate analysis is often advocated and is also often applied in practice. Similarly, path models and structural equation models may be used. An original model-based study on this issue can be found in Bernini et al. (2013). In this context the complementary notion of local satisfaction in relation to well-being often plays a crucial role in a quantitative micro-based analysis (see also Hayo & Seifert, 2003; Huppert et al., 2005; McGil livray, 2007; Lenzi & Perucca, 2016; Okulicz-Kozaryn, 2012; Oswald & Wu, 2010; Lytras et al., 2020). Clearly, well-being often has a more subjective meaning, but it may overlap sometimes also with QoL or with satisfaction. Studies on well-being are often found in the socio-economic, socio-psychological or health-oriented literature, while QoL is often found in statistical comparative studies on the social or broader physical living environment. Satisfaction is often regarded as a personal feeling about the extent to which various human goals are achieved; and this concept has also become popular in the scientific literature and will now be addressed briefly.

The notion of satisfaction as an anchor point for judging the people’s state of mind regarding the assessment of their local environment is a concept that also deserves some attention here. In the traditional micro-economists’ view on the world, a person is normally supposed to maximize her/his utility. However, it has been argued by Nobel Laureate Herbert Simon (1955) that the principle of ‘bounded rationality’ is a more realistic paradigm for studying and understanding human behaviour, as information is never complete, and transaction costs may become prohibitive. Consequently, the actual perception of external conditions by people reflects essentially a ‘satisficing’ attitude. This would also hold for the citizens’ appreciation of their local environment. Thus, their expressions of opinion on local QoL or on their well-being in a local context do not necessarily reflect the ‘optimal’ choice state of the system, but at best an acceptable state (see also Bjørnskov, Gupta, & Pedersen, 2008; Cummins, 2000; Diener, 2006; Kahneman & Krueger, 2006; Lambiri, Biagi, & Royuele, 2007; Mohan & Twigg, 2007; Simonofski, Vallé, Serral, & Wautelet, 2019; and Türksever & Atalik, 2001; Simonofski et al., 2019). It is evident that here the worlds of psychologists and economists are often quite different. Nevertheless, the fact that, in 2002, a psychologist (Daniel Kahneman) received the Nobel Prize in Economics shows that meaningful bridges between economists and psychologists may be found. This is also witnessed in various neo-classical hedonic price and evaluation models in urban economics (for an overview and application, see, for example, Helbich, Brunauer, Vaz, & Nijkamp, 2014).

Satisfaction (and the associated notions of happiness and well-being) – in either an objective or a subjective sense – is generally not shaped by external or uncontrollable forces; it is a multidimensional research concept that usually assesses the gap between an ‘ideal state’ and the actual perceived state of a person. The related stressors or tension parameters for personal life satisfaction are – as is clear from the above literature – quite diverse, e.g., poverty, environmental deterioration, unemployment, human health conditions, suppression, corruption, low access to public amenities, lack of community sense, and so forth.

As already mentioned, there is a wide array of individual or collective evaluation indicators for an individual’s appreciation of her/his individual or external life context or environment. In the literature, sometimes we also find the term ‘contentment’ (see, e.g., Cybriwsky, 2011a, 2011b), but, in the description of such terms, it turns out that they are usually being used interchangeably with happiness and satisfaction. In this context, we may refer to Sen (1985), who makes a distinction between measurable indicators of, and conceptual ideas about, an individual’s life satisfaction or happiness: “valuing a life and measuring the happiness generated in that life are two different exercises” (p. 12).

It is thus clear that various – partly overlapping and partly complementary – concepts of citizens’ appreciation abound in the literature. This is also found back in the currently popular studies related to nudge theory which contextualize individual and social appreciation (see e.g. Thaler & Sunstein, 2008). In our approach we introduce and use a new summary concept for the appreciation (‘love’) of individuals or groups for the city or neighbourhoods in which they are living, working, or socializing, viz. ‘city love’. It will be used here as a quantitative umbrella notion for place-based affection that captures most of the above-mentioned concepts on individual or collective attachment to local neighbourhoods, in the sense that it contains both revealed behaviour and stated preference information. City love is the outcome of an evaluation process or assessment of an agent on the characteristic attractiveness conditions of a locality which have a welfare-enhancing effect (e.g. through social support systems, authentic historical heritage, accessible and reliable public transport, trustworthy and effective governance institutions, sufficient pool of job opportunities, etc.). Clearly, to operationalize the inclusive concept of ‘city love’, we need to identify appropriate and measurable indicators in order to test our basic proposition that the heterogeneous constituents of the urban habitat are together co-determining human happiness in the city. This will be further addressed in Section 3.
3. City-love assessment

3.1. Conceptual city-love model

Generally speaking, the concept of ‘love’ is usually regarded as a strong feeling or emotional affection arising out of personal ties or bonds. Such feelings of attachment may originate from subjective appreciation, devotion or admiration, historical and socio-cultural links, or commonly shared interests. In general, love represents a positive relationship with someone else or with the surrounding objects or entities in the surrounding world, and presupposes strong bonding and bridging mechanisms. In our city-love analysis, this concept refers to feelings of appreciation for – or of emotional commitment to – a city, a neighbourhood or the socio-cultural or socio-political climate (or ‘ambiance’) in a city. Since usually these feelings of appreciation are at any geographical scale latent variables, we have to use proxy variables in our measurement model. We will employ four types of proxies: (i) a revealed preference variable of residents related to the willingness to move or to stay; (ii) a stated preference variable reflecting the residents’ wellbeing; (iii) a spatial variable indicating the geographical leisure pattern of residents; (iv) the social media attractiveness of a given location in Sweden, on the basis of TripAdvisor data from visitors. We refer to Section 4 for more details on the data.

We introduce here – in a way similar to Camagni (2009) and Capello’s (2019) conceptualisation of ‘territorial capital’ – the notion of ‘city capital’ to express a portfolio of drivers for local satisfaction outcomes. In our study this satisfaction is called ‘city love’. The constituents of the city-love production function to be included in our measurement model are, in particular: social capital, cultural capital, green capital, economic capital, and infrastructure capital. In addition to official statistical data on Swedish municipalities, we will later on also introduce and employ digital ‘big’ data from mobile telephone operators and from the TripAdvisor platform to test and interpret our city-love assessment scores.

The value attached by inhabitants to tangible and intangible amenities in cities (‘city capital’) or in distinct neighbourhoods is typically the result of a pluriform (multidimensional) assessment indicator; it may range from social capital to art exhibitions (Glaeser, Kolko, & Saiz, 2001). Consequently, city love cannot be measured by a single measuring rod, but calls for a pluriform assessment based on a range of appropriate indicators making up for the ‘city-love’ (CL) production function:

$$CL = f(SC, CC, GC, EC, IC),$$

where:
- **SC** = social capital providing local contacts and safety for people;
- **CC** = cultural capital generating authenticity and urban ambiance feelings;
- **GC** = green capital representing a wide range of ecological amenities and natural resources;
- **EC** = economic capital providing means of living, jobs and welfare in the area concerned;
- **IC** = infrastructural capital facilitating accessibility and (material and virtual) connectivity for inhabitants.

In Subsection 3.2 we will describe the building blocks of the CL function.

3.2. Foundation of the conceptual model

We first explain here the structure of this equation. The stock variables (‘city capital’) represent a cumulative productive capacity shaped over a longer period that impact on the instantaneous feelings of happiness of urban inhabitants and may thus be regarded as structural exogenous factors which determine instantaneous human happiness (‘city-love’) in a given time period. The methodological underpinning of this equation originates particularly from various literature sources and provides the following foundation stones for the above model specification:
• A city is a geographic concentration of people living together in relatively high densities, as a result of social and economic externalities which provide increasing returns to scale, in particular agglomeration and urbanisation advantages (see, e.g., Hellwell & Putnam, 2005; Hellwell et al., 2017; Kourtit et al., 2015; Lazear, 1999; Stokols, 2007). The Copernicus Urban Atlas (2018) gives a wealth of information on current city formation and structures shaped by people living together (see also Mumford, 1961). Consequently, long-range bonding and bridging motives of interacting persons lie at the heart of social capital (SC) as a driver for city love.

• Cities are usually evolutionary, partly self-organizing agglomerations which often have a long economic, political and social history. In the development of a city, many cultural and historical landmarks have been created which together shape a specific identity or a particular urban ambiance (see, e.g., Bourdieu, 1981; Fleury-Bahi, Felonneau, & Marchand, 2008; Haugen & Vihlen, 2015; Mommass, 2004; Zukin, 1998). Such cultural assets may date back to the early history of cities, but their current presence influences the love for a city. This means that cultural capital (CC) is one of the external conditions of city love. A further exposition on the endogeneity problem of cultural capital can be found in Kourtit et al. (2019).

• Next, in high-density urban areas the presence of open public space is normally seen as very important. Thus, the presence of accessible urban green parks, water, or public squares is often regarded as a stimulus for enjoying city life (see, e.g., Leyden, 2003; Burns, 2005; Lund, 2003; Witten, Exeter, & Field, 2003). Green capital (GC) – as a long-lasting environmental asset in a city – is apparently an important facilitator of city love.

• City formation and growth would not take place if there were – beside other reasons – no economic motives for people and business to geographically cluster together (see also Capello & Nijkamp, 2004). Urban economics has provided an extensive literature on the various agglomeration economies that are structurally incorporated in the economic capital (EC) in a city.

• Finally, a city has an internal infrastructure network to connect people and activities, as well as an external – sometimes global – network which connects it to people in other places (see, e.g., Neal, 2012; Castells, 2011; Handy & Clifton, 2001; Weber, 2003). In conclusion, infrastructure capital (IF) – as a general form of open-access connectivity provisions – will be included as one of the explanatory factors for city accessibility and connectivity.

3.3. A pictorial decomposition

The ‘city-love’ model with the above-mentioned five driving forces is also supported by a concept in the literature known as a ‘Pentagon model’ (see Nijkamp, 2008); the assumption of five critical drivers for an outcome variable has been tested in several case studies and has found quite some empirical validity in the literature. Fig. 1 offers a pictorial representation of the general architecture of this model as the basis for our ‘city-love production function’. This is an illustrative multi-layer constellation with the above mentioned five main indicators comprising a set of more detailed (sub-)indices (illustrated in small circles in Fig. 1). In this case, the city-love (CL) production function is based on a multi-layer decomposition of its multivariate determinants. Such decomposition methods are rather common tools in complex systems and design optimization studies (see e.g. Fortin, Lemieux, & Firpo, 2011). This figure forms the foundation stone for our empirical approach.

It is evident that the ‘city-love’ concept may have different appearances in different empirical contexts. For a consistent comparative study of ‘city love’ for distinct cities in a given country, it is pertinent to use a database with the same identifiers. Such indicators may be grouped under a limited number of main characteristic headings, so that essentially a multilevel database has to be created. Based on the concise literature overview above, we put forward the hypothesis that the collection of the above mentioned five categories of urban capital is decisive for the creation of city-love, embodied in what we call here city-love production function CL (see Eq. (1)). Thus, our ‘city-love production function’ contains five production factors (‘city capital’) that are responsible for the love feelings of the inhabitants. This approach runs – as noted before – parallel to previous works of Capello (2019) and Camagni (2009), who introduced the notion of ‘territorial capital’ to show that welfare in space is shaped by a combination of different forms of territorial assets in an area.

The research challenge of the present study is now to test the existence of our city-love production function on the basis of detailed real-world data on Swedish municipalities and related appropriate telephone and social media data. As mentioned above, this empirical examination will be pursued in two stages, viz. using (i) detailed individually-based local data related to the constituents of the CL production function; and (ii) perception data which comprise many individual expressions of appreciation for these localities by visitors, derived from ‘big data’ social media information extracted from the TripAdvisor platform and supplemented with mobile phone mobility data. The nature and characteristics of these databases will be described in Section 4.

4. Data on city-love (CL) indicators

The CL production function makes use of a wide range of data drawn from an extensive collection of data sources. In this section, the dependent variables and each of the five types of Pentagon factors will be described in detail in the context of Swedish municipalities. The variables are generated to represent the situation in or around the year 2014, but due to data limitations, some data are also pooled during some years close to 2014, so as to refer to the nearest possible year of observation. The used data are aggregated to municipality levels, but two other geographical units are used as well in our analyses (Counties and Local Labour Market areas abbreviated as LLMs). The choice of these geographical units is motivated by their socioeconomic functions for inhabitants. Municipalities are responsible for general care, schooling and planning related matters, while health-care and transport is organised on a county level. And, LLMs depict the observed regions of commuting. There are in total 290 municipalities and 21 counties in Sweden, while the spatial delimitation is stable over time (the last administrative alteration was a county-level change for one municipality in 2007). The LLMs vary slightly over time, as their composition is based on observed commuting patterns between municipalities. We make use of flows observed during the year 2014 for the delimitation of LLMs. Exact definitions of LLMs are determined by Statistics Sweden (SCB, 2020). In the Appendix A, Fig. A1 is showing the spatial distribution of the spatial units used in our analyses. Descriptive statistics pertaining to all used variables are presented in Table A1 in the Appendix A.

4.1. Dependent variables

In order to test how well the CL production function model performs, we populate the model not only with measurable indicators that correspond to theoretical assumptions and earlier findings from the literature, as already described in the previous sections. More important is the formulation and identification of a set of dependent variables that can be used to express the love for locations or places; in other words, the CL variable is a multidimensional spatial attachment indicator. In our study we use four aggregate proxy variables that reflect like a prism the manifold features of ‘city-love’. We make use of several relatively different and complementary variables measuring or approximating city love. As argued above, one of the motivations for using a range of different variables – rather than one indicator – is also to test how well each of the CL variables perform individually.

A first proxy variable, essentially based on a revealed spatial preference assumption, is the Net Population Change (NPC) over time (Feser
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have used directly accessible data from the years 2013 and 2014 (we fluctuations, been rather stable over the past decade, and in this case we for the local CL findings. The NPC trend in Sweden has, apart from small variables collected and available for the same time period. This variable is formulated as follows:

\[ NPC = \frac{\text{Outmigration}_{\text{Population}_{\text{m},1}} - \text{Population}_{\text{m},1}}{\text{Population}_{\text{m},1}} \times 100 \]  

NPC may be regarded as a local attraction indicator. It is essentially based on Tiebout (1956) ‘voting the feet’ principle: residents will tend to move to another city, if their appreciation for the amenities of the city concerned is low. Clearly, the principle assumes that migration is guided by complete information and freedom to choose residence, while no prohibitive cost is associated with migration or commuting, etc. In reality, there may of course be a substantial mismatch between motives for migration and the possibility to realize migration to a new destination. The second dependent proxy variable used for CL is based on a stated preference approach and uses data on surveyed and self-evaluated mental wellbeing/happiness; it is based on individual information of citizens. This variable is built on data collected from regular large-scale surveys conducted in all Swedish municipalities (Socialstyrelsen, 2014). Since the exact number of surveyed individuals in each municipality is not listed, we made use of a municipal average value between 2010 and 2014 to ensure that a sufficient number of respondents’ answers are used in the formation of the variable concerned.

The third dependent variable in our model, called NDR (Network Data Record), is derived from the MIND database at Uppsala University which provides the spatial whereabouts of between 1 and 2 million mobile phones over time. By recording the municipality where all these phones were located during a typical night-rest hour (2 a.m. to 3 a.m.) on a Thursday morning in each month in the year 2017, we are able to compare the choice of location during a typical vacation month (July) in Sweden with the municipality of residence during a typical more work-intensive period (see, for instance, also Müller, 2004 on the usage of vacation homes by Swedes). Several studies have been conducted in the Nordic realm addressing the urban to rural relocation during summer, the migration towards vacation homes upon retirement, and the amenities of areas which see an increase in tourism and vacation home frequency during the vacation season (Müller & Marjavaara, 2012; Müller, 2004; Pitkänen, 2008). The dependent variable used here expresses the ratio of the number of mobile phones in July to the average number of phones during the entire year. Clearly, owing to ethical considerations, we are not allowed to observe phones in municipalities with very few inhabitants. Consequently, only 270 (out of 290) municipalities are included in the analysis which uses this variable. Our assumption is that more well-liked locations also are more frequented during holidays (e.g., the islands of Gotland and Oland, both situated in the Baltic Sea, and several coastal towns along the southern and western coasts of Sweden).

Finally, we also construct a dependent variable from the ranking of popular destinations in Sweden according to data obtained from TripAdvisor’s visitors ranking during the summer of 2018. The variable was created by associating popularity rankings of attractions with specific municipalities. Each municipality was given the highest-ranked attraction position (i.e. the same rank as the highest-ranked attraction in the municipality). Since attraction popularities are correlated with population size, we assume that attraction popularity follows, by default, the population size of the municipality, and, by subtracting the population size rank from the attraction rank, a crude measure of population-adjusted destination appreciation could be obtained. The TripAdvisor database contained ranking data for attractive urban amenities in a total of 180 Swedish municipalities.

These four dependent variables capture the most characteristic features of the love for the city or its neighbourhoods in Sweden. They are considerably distinct from each other and designed for the purpose of identifying different but complementary elements of the love for a place. In the next parts of this section, on the explanatory data for CL indicators, the independent variables in the city-love production function will be presented. The independent variables (‘city capital’ variables) are listed separately in Subsections 4.2 - 4.6 under headings corresponding to the different Pentagon model components.

4.2. Social capital (SC)

The variables in the class of social capital (SC) are chosen as proxies for the social network features of the resident population in each of the 290 municipalities in Sweden, and also correspond to well-known findings in the literature. The first variable employed is voter participation among eligible voters during the 2014 national elections. Voting participation is a commonly used variable in sociological and political science studies to measure the degree of community participation. The second variable is metropolitan stability that indicates the share of the municipality’s inhabitants who have lived in the municipality for more than 5 years. This variable corresponds to the local embedded knowledge about the community and the sense of belonging. Our third variable, MPR vaccination, functions as an indicator of the trust in media and medical science, where the percentage of vaccinated children (offered free vaccination) is used to indicate local responsibility values. Finally, the number of reported violent attacks directed towards individuals per 100,000 inhabitants annually is used to describe the degree of fear (or, inversely, the degree of safety) felt in the local community. Clearly, other indicators can be imagined, but the lack of comparable data among all municipalities constrains our choice. Nevertheless, these four variables may be regarded as rather representative proxies for social capital.

4.3. Cultural capital (CC)

Cultural capital has gained a prominent position in social science research (see Bourdieu, 1984; Kourtit & Nijkamp, 2019). Here, the relevant variables are selected to depict the jobs and qualifications that can typically be associated with the production and consumption of culture. The first variable is educational attainment, where the share of higher-educated individuals is used as a proxy for cultural capital. The three remaining variables are: percentage of employed workers (in the total for the municipality) in the hotel business; NGO jobs (including sports, religious activities, and similar activities); and, finally, the number of jobs in the cultural sectors, including a wide range of activities, such as free arts, museums, music, etc. The underlying assumption is that cultural capital – through its related community activities – is a determinant of love for the city.

4.4. Green capital (GC)

The local and surrounding physical environment is the focus of the third type of indicators. All the variables in this group have been specifically designed to capture the environment surrounding each home coordinate of residence in Sweden. The coordinate data are drawn from the PLACE database located at Uppsala University. We make use of all official residential coordinates (around 800,000 unique residential coordinates associated with the official resident population for the year 2014) and match, through GIS, the locations to spatial qualities in the

1 More information about MIND can be found @ http://equipop.kultgeog.uu.se/mind/
physical landscape. Three of the variables indicate the share of individuals who were found to reside in those locations described as farm areas, wild nature (forests and grassland), or locations close to water. The fourth variable, no amenity, expresses the share of individuals in each municipality who reside in locations (in a GIS system) where there is no water, natural reserve, sea, or water within a 500-metre radius from their home. So, this indicator also measures access to these environmental amenities. The digital maps used to describe the surroundings of the populations were generated only for the year 2018. However, the mapped material is very stable over time.

4.5. Economic capital (EC)

The economic capital variables aim to capture the productivity indicators that contribute to welfare and employment of any municipality. Four variables are considered here, all of which are commonly used in studies on growth and economic resilience (see Östh, Reggiani, & Nijkamp, 2018; Östh, Dolciotti, Reggiani, & Nijkamp, 2019). The first variable is the local business environment, which describes the average ranked business climate in each municipality. The second variable is the degree of economic diversification per municipality (industrial mix). The third variable is income equality, which is measured as an inverse Gini coefficient of income distribution in each municipality. Finally, the fourth variable is regional affordability, which measures the share of individuals who spend less than 35% of their income on housing in each municipality.

4.6. Infrastructural capital (IC)

To measure infrastructure capital we use five different spatial interaction related variables. The first two variables measure the degree and nature of commuting; the first variable targets the size of commuting flows by measuring the share of cross-municipality commuting in the sum of total workers who reside in their municipality of origin, while the second variable attempts to classify the municipalities according to their role in the labour market by indicating whether the municipality acts as a labour market core, or whether local commuting is directed towards the labour market core, the labour market suburbs or the periphery.

The third and fourth variables (three and four) constitute municipality-aggregated measures of population density where the median log-distance to reach the 50 and 400 nearest individuals from each populated location in Sweden is calculated using EquiPop (Östh & Türk, 2019; Östh, 2014). The coordinate data are drawn from the above-mentioned PLACE register. Finally, the share of individuals per municipality who had access to an Internet broadband speed of at least 100mbps Internet at home is used as an indicator of digital accessibility as part of infrastructural capital in a spatial context.

5. Analytical modelling approach

The indicators mentioned above are quantified by using an extensive micro- and meso-database. They are organised according to the decomposed structure with five constituents of ‘city capital’, as discussed above. First, the significance of the four dependent variables shaping CL (i.e., NPC data, happiness data, NDR data and TripAdvisor data), as outlined above, will be examined using a linear regression model. These regression results provide an indication of how well the CL production function variables work, and how they compare with each other. Spatial autocorrelation tests for geographical interdependencies will be carried out as well.

Next, in order to test for random effects on alternative geographical levels, we also employ here an advanced linear multilevel approach. These multilevel analyses are conducted here only when NPC and happiness/wellbeing are used as dependent variables, since in that case all Swedish municipalities are included in the data set. The alternative geographical levels for our Swedish data are: LLMs (local labour markets) and Swedish Counties, while the choice of geographical units is motivated by people’s mobility behaviour and temporal-spatial restrictions (and the geographical level of an LLM), and by factors that may be spatially organised to support policy strategies in the Swedish regional administration (i.e., the County). For each variable and geographical level, we run in this case a regression without fixed effects (also called a random effects ANOVA or ‘empty’ model, since no explanatory variables are introduced) and a full model in which the entire range of independent variables is introduced.

The ‘empty’ model for our CL function is formulated as:

\[ Y_{ij} = \gamma_0 + u_j + e_{ij}, \]

where the variance is divided between the regional level \( u_j \) (LLM or County) and the municipality level \( e_{ij} \). The variance that falls within different geographical levels can be used to express the percentage of variance in CL-dependent variables on the regional and municipality level. The full model differs from the empty model by also introducing the fixed effects of explanatory variables. By comparing the variance distribution to that of the empty model, it is possible to examine to what extent the fixed effects affect regional and local levels. The full model is formulated here as:

\[ Y_{ij} = \gamma_0 + y_1x_{ij} + y_2x_{ij} \ldots + y_{nx}x_{ij} + u_j + e_{ij}, \]

Model (4) is essentially the empirical model used to test our basic hypothesis on the critical conditions for city love CL. The related model estimates will be provided and interpreted in Section 6. As mentioned above, spatial interdependencies may play a significant role in our model estimations (see e.g., Fischer & Getis, 2016; Lesage & Pace, 2009; Kelejian & Piras, 2017), and therefore, in our empirical model estimations this issue will be explicitly considered.

Clearly, in the spatial context of Sweden, the presence of spatial interdependencies may cause biased estimations (Anselin, 1995). The residuals from the linear regressions are therefore, used to test for spatial autocorrelation (SA). If the SA is significant and considerable then the model may be mis-specified in that it fails to pick up existing important geographical patterns that influence the outcomes. We test for two kinds of SA using both a global measure (Moran, 1950) and a local measure of SA (Anselin, 1995). The basis for both SA models is the following formulation:

\[ I = \frac{N}{W} \sum \sum w_{ij}(x_i - \bar{X})(x_j - \bar{X}) \]

\[ \sum (x_i - \bar{X})^2 \]

where \( X \) represents the residual, \( \bar{X} \) represents the mean of \( X \), and \( W \) represents a spatial weight matrix used to specify how geography is taken into consideration (contiguity borders, in our model). For the local SA, the local patterns are observed and saved. In our maps, the local SA patterns are indicating which parts (if any) show a regional cluster of higher or lower residual values. In situations where the map is indicating a substantial number of clusters of residual values, the model is clearly geographically not well-balanced.

6. Estimation results

The results from our investigations are now presented in the following subsections. In Subsection 6.1, the results from the successive linear regressions are presented and discussed. Next, Subsection 6.2 introduces explicitly the additional (visitor-oriented) TripAdvisor perception data in the regression analysis. In Subsection 6.3 we map the predicted and observed levels of Happiness and Net Population Change (NPC), and test for both the local and the global degrees of Spatial Autocorrelation (thus, SA) of the regression residuals; the SA of residuals from the linear regressions are presented and discussed. Next, Subsection 6.2
Table 1

Results from linear regressions using happiness, Nat Population Change (NPC), concentration of phones during the vacation season (NDR), and Trip Advisor rankings. Significance levels indicated are: 99.9% = ***; 99% = ** and 95% = *.

| Observations |
|---------------|
| 290 |
| 290 |
| 270 |
| 180 |

**ECONOMIC CAPITAL**

| Coef (Std. Error) |
|-------------------|
| 0.435 (0.685) |
| 0.126 (0.538) |

**BORDERLINE CAPITAL**

| Coef (Std. Error) |
|-------------------|
| 0.105 (0.685) |
| 0.126 (0.538) |

6.4 addresses explicitly the spatial dependencies in the TripAdvisor regression results, while in Subsection 6.5 we look more closely at the spatial scale aspects using multilevel regressions.

6.1 Linear regression results

Table 1 presents the results from the tested linear regressions on the available cross-sectional data for the 290 municipalities in Sweden. Due to data constraints – or lack of data for specific years – we were unable to compile all data for the same year. Most register data, including election results, are available for the year 2014; that is why this is the chosen year of study. GIS-generated data, such as the share of nature surrounding individuals, stem from our study available for the year 2018. Clearly, the spatial distribution of areas such as lakes, forests, oceans, etc., is stable over time, and since the variables are reflecting the overall access to natural amenities on an aggregate level, even moderate changes of land use will have very limited effects on our findings. Therefore, this small mismatch in years is acceptable. Table 1 contains an extensive presentation of the various regression results.

The regression using happiness as a dependent proxy variable for city-love (see first column in Table 1) reaches an adjusted $R^2$ of 43.5%. The cultural capital variables apparently do not significantly affect city happiness, but, in the social capital group of variables, metropolitan stability (share of long-time residents) has a significantly positive impact on happiness, while violent crime has a significant and negative impact on happiness. In the infrastructural capital group, the location of residents in second-level tiers of the labour market (i.e., in neither the core nor the periphery) are significantly and positively associated with happiness. An increasing distance to the 400 nearest neighbours has also a positive and significant impact on happiness. Both of these variables suggest that individuals prefer areas that are not too isolated and not too densely populated. None of the green capital variables appears to be significant, while among the economic variables only income equality was significant and negatively associated with happiness. The fact that income-equality disparity is negatively associated with happiness is likely to result from the economic structure of those municipalities where larger and amenity-rich locations attract wealth (according to the above-mentioned Tiebout hypothesis). And, consequently, economic inequality versus happiness indicates that places with population growth are not necessarily connected with variables that express a high love or appreciation of happiness.

An interesting finding of this inequality effect is that none of the cultural capital variables has an impact on urban population growth (NPC) (see second column in Table 1). Secondly, the two social capital variables that render significant results are the inverse of what could normally be classified as place appreciation. The share of long-term residents (metropolitan stability) is negatively associated with population growth, while the number of violent crimes has a positive impact on population growth. The infrastructural capital variables indicate that all areas besides the core are losing population, and that the most remote parts of the labour market are even losing significantly. The lower is the population growth, and, inversely, the longer the distance to the 50 nearest neighbours variables indicate that places with population growth are not necessarily connected with variables that express a high love or appreciation of happiness.

None of the green capital variables appears to contribute significantly to population growth, while in the economic capital group, regional affordability has a negative impact on population growth; this makes sense, as housing in growing areas is more expensive compared with areas that are losing population. Municipalities with lower economic growth in the 30 closest municipalities tend to have a lower population growth. This table indicates that none of the cultural capital variables has a significant impact on population growth, while the economic capital variables are negatively associated with population growth.
diversification are also growing; this is because the suburban municipalities close to the metropolitan areas usually have low economic diversification and high rates of commuting towards the regional centre (for a thorough discussion on the relationship between commuting and spatial-economic dynamics and resilience, we refer to Osth, Reggiani, & Galiazzo, 2015 and Osth, Dolciotti et al., 2018).

These results are in line with earlier studies (see, for instance, Chen & Rosenthal, 2008), which show that, though people prefer amenity-rich areas, firms prefer to locate jobs in larger urban areas. The growth of urban areas and internal migration trends are therefore not connected to city love, but rather to the economic realities, which, in turn, means that overall internal migration patterns are not useful for properly understanding the city love index.

The NDR (Network Data Record) regression, based on location-specific place-based data from cell phone providers, has a lower explanatory power, with an adjusted $R^2$ of around 12% (see column 3 in Table 1). Most of the introduced variables do not have a significant effect on the spatial distribution of phone users during the month of July as compared with the rest of the year. Only three variables appear to have a significant impact on the NDR variable. During the month of vacation, municipalities that have greater shares of cross-municipality border commutes (i.e. mostly residential areas surrounding core labour market areas) experience a significant decrease in the number of phone calls. In addition, the phones are less likely to be used in areas that are classified as having a beneficial business environment, but they are more likely to be located in areas with farm life. Overall, during vacation periods people tend to relocate to areas that are less work-related (business-climate and commuting) and more amenity-oriented (rural areas and farm-life).

6.2. TripAdvisor data analysis

In our subsequent, complementary part of the research, we examined, as an additional exercise, a collection of relevant ‘big data’ from the TripAdvisor platform, so as to capture our perceived appreciation of cities and neighbourhoods. Many data on Swedish municipalities were collected from the TripAdvisor Platform, and introduced in summary form in our regression analysis. The final regression employs detailed individual TripAdvisor data, but our analysis is limited to 170 municipalities (out of 290 municipalities) due to limitations in the TripAdvisor database (see column 4 in Table 1). The regression appears to reach an adjusted $R^2$ of 53%. In contrast to the previous regressions, cultural capital turns out to be important, with a significant and strong effect of the share of employment in hotels and NGO jobs on the TripAdvisor rank, and a weaker negative and significant effect of education on the ranking. The positive effects of hotel jobs on ranking is as anticipated. The negative impact of education on ranking is likely to be connected to variations in the skill needs for, and geographical concentrations of, higher-educated employees in certain regions, particularly the larger urban areas, and of the lower shares of highly-educated employees in tourist-oriented areas, who are often located in areas with nearby coasts or proximity to winter-sport facilities. Among the other groups of variables, significant values were retrieved for violence that has a negative impact on TripAdvisor rankings. Positive effects were found for third-level municipalities in labour markets (i.e. the more remote areas of the labour market), as well as for income equality and regional affordability. The positive effects suggest that important recreation- and vacation-oriented municipalities in, for instance, coastal areas are ranked higher in TripAdvisor. Clearly, ‘big’ data like those from the TripAdvisor platform provide additional quantitative insights into the appreciation for the city, i.e. the city love.

Overall, the use of different dependent variables results in a relatively varied set of results, in which the temporal dimensions may play an important role. The long-term Net Population Change (NPC) model shows that growth regions are production-oriented, and that violence, expensive housing costs, etc. have negative effects that follow from economic gains. With regard to seasonal (NDR) and short-term (TripAdvisor) effects, the general focus is directed towards more green areas, culture and less commuting and stress. Compared with the first (happiness) model, these findings appear to be more in agreement with short-term models than with the more productivity-oriented NPC-model.

Fig. 2. Maps showing reported (2a) and predicted (2b) levels of happiness, regression residuals (2c) and SA tests (2d).
6.3. Spatial interdependency and autocorrelation (SA) analysis

By mapping the regression results for the empirics in the relevant areas and municipalities in Sweden, we can now monitor in more detail how closely the predicted and observed values are aligned. But, more importantly, we can also assess whether there are manifest spatial patterns in the residuals. We will now present findings for the first (happiness) indicator. Fig. 2 contains four maps, the first and second of which (Fig. 2a & b) show reported and predicted happiness. The two maps are relatively similar, the main difference being that the reported happiness has more variability at local levels. The maps reveal that happiness is more ‘abundant’ in rural areas located at a distance from the metropolitan cores. The residuals map (2c) shows how the differences between modelled and reported happiness are spatially distributed.

By employing next global and local Moran’s I estimations (Anselin, 1995; Moran, 1950), we can test whether the residuals tend to cluster (i.e., whether there is a spatial autocorrelation (SA) of the residuals) in ways that suggest that the analytical approach and the model design behind the city-love production function is lacking vital components. The results illustrated in Map 2d of Fig. 2 show that the global SA of the residuals is insignificant, and that the local Moran’s I test cannot detect any local clusters of residuals (note that a few outliers are lower and higher than the surrounding ones, while a few locations with pairs of high and low residual values are found, but they are few and spread out in no particular geographical pattern).

It is now interesting to explore the existence of the presence of SA for the other city-love indicators. We will therefore, now present the SA results for the Net Population Change (NPC).

Fig. 3 presents the regression results from the NPC regression. Also in this case, the predicted and the observed values are distributed in a similar manner, and the expected pattern is the pattern which indicates that population growth takes place close to the metropolitan core areas. The residuals appear to be more scattered and the SA tests reveal that there is no SA on global or local levels.

Next, we will report the SA results for the residuals of the cell-phone data-based regression. In contrast with the previous findings presented in Figs. 2 and 3, confirmatory tests could not be executed with sufficient accuracy for the regression results from the NDR model (see Fig. 4). The reason is that here some municipalities are missing (NDR data were only available for 270 out of the 290 municipalities), and, as revealed by the map in Fig. 4, the missing municipalities are clustered, thus making the SA test less reliable. The predicted and observed values are relatively similar, both suggesting that vacation visits (mainly in July) are more common in those areas which are far from the metropolitan core and close to nature and the coastal shore. The residual plot shows that there is some geographical clustering of residuals (SA tests of the data indicate a weak and barely significant autocorrelation). The detailed results are shown in Fig. 4.

6.4. Social media (TripAdvisor) data analysis

As mentioned, in our quantitative analysis we have also used extensive (‘big’) data from the TripAdvisor Platform. Fig. 5 shows the predicted and observed results from the TripAdvisor data regression analysis. The results indicate that rural areas are higher ranked, especially compared with metropolitan districts. As in the previous case, the presence of missing municipalities (in this model only 180 municipalities are available) makes an SA test of the residuals unreliable, but we can see from the maps that the estimated and observed estimations are similar, and that the residual plot is relatively fragmented and contains no obvious and visible cluster of values.

6.4.1. Multi-level modelling analysis

Finally, we will undertake a more advanced multilevel regression analysis.
Fig. 4. Maps showing reported (4a) and predicted (4b) levels of NDR in July, and regression residuals (4c). Legend: Due to several missing cases, SA tests were not executed.

Fig. 5. Maps showing reported (5a) and predicted (5b) levels of TripAdvisor rank values and regression residuals (5c). Legend: Due to several missing cases, SA tests are not executed.
Table 2

Empty multilevel model results, with the distribution of random effects between municipality and two sets of regions (LLM and County), for both NPC and Happiness.

| Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coeff. (Std. Err.) |
|---------------------|---------------------|---------------------|---------------------|
| constant            | –0.0027             | 0.0004              | 0.0004              |
| (0.00037)           | (0.00066)           | (0.00044)           | (0.00044)           |
| Log likelihood      | 480.19289           | 483.12577           | –599.96677          |
| (24.3 %)            | (34.2 %)            | (23.6 %)            | (22.8 %)            |
| Observations        | 290 (114 groups)    | 290 (21 groups)     | 290 (114 groups)    |
|                     |                     |                     |                     |
| Random-effects factors |                   |                     |                     |
| Region              | 0.000562            | 0.00071             | 1.449537            |
| (24.3 %)            | (34.2 %)            | (23.6 %)            | (22.8 %)            |
| Municipality        | 0.001752            | 0.001851            | 2.78305 (65.8)      |
| (75.7 %)            | (72.3 %)            | (76.4 %)            | (76.3 %)            |

NPC (LLM) NPC (County) HAPPINESS (LLM) HAPPINESS (County).

The potential organisation of amenities provided on a regional level by the regional administration (County).

The results from estimating the empty models indicate that roughly 25 % of the net population change can be attributed to regional effects (similar for both LLM and County), and 75 % to effects on the municipality level (see Table 2). The size of the regional share of variation is an indicator that population growth is active at greater spatial levels than the municipalities alone, and that a substantial part of the net population change is distributed within each region. City love (CL) based on happiness has a greater regional random effect compared with NPC, in which 34 % of the happiness relates to the LLM level. For the county regression, the regional random component is considerably lower (23.6 %) which also is similar to the NPC-results. The clear LLM results indicate that the regional geography of the commuting areas is contributing to the spatial pattern of city-love results. From the linear regressions and the maps, we know that city love is concentrated in specific geographical areas. In the subsequent steps we will now examine to what extent the introduction of fixed effects alters the regional component, and whether the fixed effects are similar in strength and orientation to what we observed in the initial linear regressions.

Legend: Model names capture the relevant dependent variables and the relevant regional level.

Next, we will show the findings from the full model. The random effects distribution in the full model of multilevel regressions (see Table 3) appears to be different from that shown in the empty model. Only around 1.5 % of the variation can be attributed to any of the

Table 3

Full multilevel model results, with the distribution of random effects between municipality and two sets of regions (LLM and County), for both NPC and Happiness, as well as fixed effects for the city-love production variables.

| NPC (LLM) | NPC (County) | HAPPINESS (LLM) | HAPPINESS (County) |
|-----------|--------------|-----------------|--------------------|
| CULTURAL CAPITAL | Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coef. (Std. Err.) |
| Educational attainment | –0.0035 (0.0033) | –0.0033 (0.0034) | 0.2899 (0.1773) |
| Hotel jobs | –0.2662 (0.2479) | –0.3077 (0.2473) | 26.8266 (13.1951) |
| NGO jobs | –0.1405 –0.0849 | 20.468 42.3421 | NGO jobs |
| Culture jobs | 1.1715 (1.2323) | 1.0452 | –138.6152 (72.0272) |
| SOCIAL CAPITAL | Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coef. (Std. Err.) |
| Metropolitan stability | –0.0156 (0.0041) | –0.0154 (0.0041) | 0.6031 (0.2233) |
| MPR vaccination | 0.0007 (0.001) | 0.0007 (0.001) | 0.0963 (0.0516) |
| Violence | 0.00001 (0.00001) | 0.00001 (0.00001) | –0.0096 (0.00034) |
| Voter participation | 0.0017 (0.0028) | 0.0016 (0.0028) | 0.1692 (0.151) |
| INFRASTRUCTURAL CAPITAL | Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coef. (Std. Err.) |
| Commuting | –0.0056 (0.0045) | –0.0063 (0.0247) | 0.1672 (1.3222) |
| LLM (prime – ref.) | –0.0024 (0.0055) | –0.0024 (0.0055) | 0.6889 (0.2985) |
| second level | –0.0104 (0.0071) | –0.0105 (0.0069) | 0.1757 (0.407) |
| third level | –0.0424 (0.0144) | –0.0401 (0.0142) | 1.1696 (0.801) |
| lowest level | 0.0288 (0.0066) | 0.029 (0.0066) | 1.2986 (0.3528) |
| Distance to k – 400 nearest neighbours | –0.1551 (1.3467) | –0.1551 (1.3467) | 0.1382 (0.1552) |
| Distance to k – 50 nearest neighbours | –0.0333 (0.0054) | –0.0339 (0.0054) | –0.6248 (0.2902) |
| Broadband | 0.0002 (0.0001) | 0.0002 (0.0001) | –0.0137 (0.0068) |
| GREEN CAPITAL | Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coef. (Std. Err.) |
| Farm life | –0.0101 (0.0215) | –0.0062 (0.0213) | 1.6964 (1.1679) |
| Nature life | 0.0015 (0.0274) | –0.0019 (0.0275) | 1.7151 |
| Water front life | –0.1255 (0.0698) | –0.1416 (0.0713) | 0.3166 (3.7792) |
| No amenity | –0.0015 (0.0123) | –0.0002 (0.0124) | 0.1514 (0.6618) |
| ECONOMIC CAPITAL | Coeff. (Std. Err.) | Coeff. (Std. Err.) | Coef. (Std. Err.) |
| Business environment | 0.0032 (0.0024) | 0.0032 (0.0024) | 0.1156 (0.1281) |
| Economic diversification | –0.0063 (0.0026) | –0.0055 (0.0026) | –0.8638 (0.1416) |
| Income equality | 0.0005 (0.0026) | 0.0008 (0.0027) | –0.2732 (0.1421) |
| Regional affordability | –0.0187 (0.0029) | –0.0187 (0.0029) | 0.1293 (0.1555) |
| CONSTANT | –0.0809 (0.1003) | –0.0848 (0.1011) | 72.8206 (5.3777) |
| Log likelihood | 621.3172 | 621.6318 | –536.2044 |
| Observations | 290 | 290 | 290 |
| Random-effects Parameters |                   |                     |                     |
| Region | 3.98E-05 (1.7 %) | 3.86E-05 (1.5 %) | 0.519651 |
| Municipality | 0.000771 | 0.000777 | 1.994049 (2.253859) |

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7. Discussion

7.1. Theoretical contribution

The present study offers both conceptual/methodological and empirical/policy-oriented contributions to the wealth of urban quality of life studies. Starting from the currently popular notion of urban happiness – originating from both the geography of happiness and the economics of happiness –, the paper provides first a concise synthesis of major strands of research in this field. It argues that – despite their interesting analysis frameworks and empirical findings – most studies are rather limited in nature and neglect the integral attachment of residents to their daily living environment.

The make a step forward – both theoretically and operationally –, our study then resorts to the notion of ‘city capital’ as an umbrella concept that comprises the main determinants of the residents’ appreciation for their city and its neighbourhoods. In this context, the concept of ‘city love’ is introduced as an integral place-based affection that captures the individual and collective attachment to local neighbourhoods.

City love is then conceived of as a multi-dimensional indicator that is not a given state in a city, but is created through the intervening impacts of at least five moderator variables (social capital, cultural capital, green capital, economic capital and infrastructural capital). This leads to a so-called ‘city-love production function’ that is represented in the form of a Pentagon model. Thus, our study makes important theoretical/conceptual progress in understanding better the drivers of urban happiness of residents.

7.2. Implications for practice

The proposition of the key role of an urban love production function is next empirically tested through advanced spatial econometric-statistical modelling techniques on the basis of extensive data on Swedish municipalities. Two types of spatially disaggregate data systems on Sweden are used in our empirical application, viz. a broad range of official Swedish municipal statistical data and a big data source originating from localized perceptual and value information from the TripAdvisor platform. In addition, we use also cell phone data of Swedish subscribers to trace the mobility patterns of residents during leisure time (e.g. holidays).

To test also the scale sensitivity, different levels of geographical scale are employed, viz. municipalities, counties and local labour markets. The modelling experiments have been applied to each of these scale levels. This has also led to the need to apply a multi-level econometric model. A representative range of plufiorm proxies for each of the five constituents of the city-love production function has next been used in the present study.

The empirical results reveal very interesting findings. Despite the heterogeneity in variables approximating city love, the empirical outcomes are rather robust. Our results are largely in agreement with earlier studies (see e.g. Chen & Rosenthal, 2008), but are relevant at a much greater degree of urban granularity. The results are supported by findings from the TripAdvisor data platform.

The robustness of our empirical modelling results are finally also tested through the use of spatial interdependency and autocorrelation analysis. Overall, our hypothesis of the validity of a city-love production function based on five city capital constituents in a Pentagon model stands the empirical test on the basis of Swedish municipalities.

7.3. Limitations and future prospects

Our study on city love in Sweden is based on extensive data. Clearly, our empirical work has some limitations. Next, to detailed official statistics, it would be important to have also detailed spatially-oriented perceptional data accruing from individual surveys. Clearly, in another context (see Wahlström, Kourtit, & Nijkamp, 2020) such highly-granular data could be used for some specific Swedish cities. An extension of such a database to all Swedish municipalities would provide a rich source of relevant information.

Another question is of course the stability of city love over time. Against this background, a multi-temporal (and ideally, a panel) approach would be highly desirable.

Finally, our findings have a high policy relevance. For sustainable city policy it is a prerequisite to know the drivers of the citizens’ satisfaction, not only in terms of the physical environment (e.g., infrastructure, built environment), but also social and intangible capital (e.g., ‘urban ambiance’). In summary, our city-love study calls for more conceptual and empirically testable research on the attachment feelings of citizens.

8. Conclusions

The storyline of the present study is concerned with the appreciation of residents and/or visitors for the quality of the urban environment. Both meso- and micro-expressions of attachment are employed to assess ‘city love’ (CL), on the basis of the concept of a city love production function. This function is estimated by using the multidimensional notion of ‘city capital’, a methodological construct which originates from what is called the Pentagon model. The local databases for Sweden are then complemented with micro-information, such as that obtained from the TripAdvisor Platform.

The regression results tell us a range of interesting stories. In particular, the NPC (Net Population Change) deals less with love and happiness for any particular place, but is rather a response to the realities of the labour market. The NPC is also an indicator which reflects the level of attraction/dissatisfaction with the urban area for most individuals during longer time periods. The vacation period and the TripAdvisor (shorter terms) data tell us more about the desires and aims of people’s lives – it is clear that congested, busy areas and business-
be defended on theoretical or empirical grounds, but the availability of the empirical data used. Clearly, in principle, other data could be articulated. This is an important message from the paper.

A large set of appropriate indicators (including both official statistics and informal social media data), it is possible to arrive at a quantitative assessment of city love, in the new overall framework of a city-love production function. This first full-fledged applied study on city love appears to be instrumental in gaining a better understanding of the citizens’ love for their daily environment.

Our findings highlight that city-love is an empirical multi-component affection variable. Based on a solid methodological foundation and an extensive set of appropriate indicators (including both official statistics and informal social media data), it is possible to arrive at a quantitative assessment of city love, in the new overall framework of a city-love production function. This first full-fledged applied study on city love indicates that this approach may also be fruitfully applied in city case studies elsewhere.

Finally, it should be admitted that the use of many heterogeneous data in our study may prompt questions on the precise selection mechanism of the empirical data used. Clearly, in principle, other data could be defended on theoretical or empirical grounds, but the availability of countrywide consistent data limited our choice. It goes without saying that there is much scope for more data-driven research on city-love feelings.

CRediT authorship contribution statement

Karima Kourtit: Writing - original draft, Conceptualization, Data curation, Methodology, Project administration, Writing - review & editing, Investigation, Resources. Peter Nijkamp: Writing - original draft, Methodology, Writing - review & editing, Supervision, Validation. John Osth: Software, Visualization, Methodology, Writing - review & editing, Validation, Funding acquisition.

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Appendix A. Descriptive Data and Maps

Table A1

Descriptive statistics for all variables included in the analyses. Note that the LLM variable is nominal (coded 11, 20, 30 and 50 representing prime, second, third and lowest level municipalities).

| Variable                          | N  | Mean       | Std. Dev | Min   | Max   | %   |
|----------------------------------|----|------------|----------|-------|-------|-----|
| **CULTURAL CAPITAL**             |    |            |          |       |       |     |
| Educational attainment           | 290| 3.45E-12   | 1        | -0.802085 | 8.422831 |     |
| Hotel jobs                        | 290| 0.0065349  | 0.0084769 | 0 | 0.0894857 |     |
| NGO jobs                          | 290| 0.0094512  | 0.0027353 | 0.0024377 | 0.0242692 |     |
| Culture jobs                      | 290| 0.0016336  | 0.0015178 | 0 | 0.015441 |     |
| **SOCIAL CAPITAL**               |    |            |          |       |       |     |
| Metropolitan stability            | 290| -1.03E-11  | 1        | -5.303334 | 1.709731 |     |
| MPR vaccination                   | 290| 97.58337   | 1.83023  | 89.51613  | 100 |     |
| Violence                          | 290| 857.1241   | 350.4328 | 137 | 3665 |     |
| Voter participation               | 290| -5.85E-18  | 1        | -5.065997 | 2.710498 |     |
| **INFRASTRUCTURAL CAPITAL**      |    |            |          |       |       |     |
| Commuting                         | 290| 0.3591854  | 0.1748327 | 0.0402748 | 0.7921739 |     |
| LLM (prime – ref.)                | 85/290| Nominal variables 11 | 11 | 29% |     |
| second level                      | 159/290| Nominal variables 20 | 20 | 55% |     |
| third level                       | 41/290| Nominal variables 30 | 30 | 14% |     |
| lowest level                      | 5/290| Nominal variables 50 | 50 | 2% |     |
| Distance to k – 400 nearest neighbours | 290| 7.487737 | 0.8567512 | 4.60517 | 9.917542 |     |
| Distance to k – 50 nearest neighbours | 290| 6.15173  | 0.8729478 | 0 | 8.490252 |     |
| Broadband                         | 290| 51.03641   | 20.2394  | 3.532137 | 97.61335 |     |
| **GREEN CAPITAL**                |    |            |          |       |       |     |
| Farm life                         | 290| 0.1778085  | 0.118398 | 0 | 0.9792881 |     |
| Nature life                       | 290| 0.1844027  | 0.1029907 | 0 | 0.4701839 |     |
| Water front life                  | 290| 0.0267521  | 0.0358687 | 0 | 0.2582592 |     |
| No amenity                         | 290| 0.5219442  | 0.2000683 | 0.0066997 | 0.9983862 |     |
| **ECONOMIC CAPITAL**              |    |            |          |       |       |     |
| Business environment              | 290| -3.45E-12  | 1        | -1.763687 | 1.826932 |     |
| Economic diversification          | 290| 3.1E-11    | 1        | -3.918316 | 2.190559 |     |
| Income equality                   | 290| -2.41E-11  | 1        | -2.270631 | 4.56989 |     |
| Regional affordability            | 290| -1.38E-11  | 1        | -1.338942 | 4.396635 |     |
| **DEPENDENT VARIABLES**          |    |            |          |       |       |     |
| Happiness                         | 290| 84.73475   | 2.168464 | 77.4475 | 89.102 |     |
| NPC                               | 290| 0.0081129  | 0.0529971 | -0.136852 | 0.356949 |     |
| NDR                               | 270| 1.998387   | 0.4990643 | 0.3768116 | 5.393617 |     |
| TripAdvisor                       | 180| -3736.555  | 4904.212 | 0 | 180 |     |
Fig. A1. Map A1A is showing the spatial distribution of municipalities in Sweden. Municipalities are the fundamental statistical units used in this study. Map A1B indicates the delineation of local labour market areas (LLMs) in Sweden. Map A1C shows the distribution of counties in Sweden.

Appendix B. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi: https://doi.org/10.1016/j.ijinfomgt.2020.10.2213.

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