MSc thesis STREEM

An index based analysis of the transition to metropolitan governance in the Netherlands
descriptive evidence of locational patterns in functional urban areas

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Abstract

There is an increasingly evident mismatch between persistent administrative boundaries and the flows in our metropolitan systems. The mismatch and a quest for more financially efficient public service delivery has resulted in an ongoing transition to various forms of metropolitan governance, including amalgamation of component local governments. The difficulty of such a transition, including which communities dominate and which communities are on the outer is a concern. The severity of the challenge could depend on the spatial variation of socioeconomic factors, political opinions and preferences in metropolitan areas. In order to measure such variation we describe the difference between administrative and functional urban areas in the Netherlands before establishing indices (diversity measures) in key dimensions to adequately capture the degree of heterogeneity of preferences between component communities. The index values along key dimensions are then consolidated into a measure based on Euclidean distance for each pair of the 279 communities making up metropolitan areas in the Netherlands. Greater distances between communities imply that a transition to metropolitan government or any metropolitan governance arrangement might be more difficult. By focusing on the five metropolitan areas in the Netherlands where discussions of metropolitan governance are mature (Amsterdam, Rotterdam, Den Haag, Eindhoven and Zwolle), we provide evidence of which communities might transition more easily and which communities might require more transitional effort. We show there are some communities on the fringes of their allocated metropolitan areas that likely orient themselves towards other surrounding metropolitan areas, suggesting possible misallocation.

The research provides a more coherent starting point for discussions about the transition to metropolitan governance in the Netherlands, since there seems to be limited evidential basis for the definition of metropolitan areas and which subnational governments should consider merging or making decisions together and why. Future research will need to be more specific about the relationship to inter-disciplinary governance theory and the relationship to political and economic transaction costs. The results offer central government tacticians and other public policy stakeholders insights on specific metropolitan area composition and which component communities might be first to merge on the way to consolidated metropolitan government.

Keywords: functional urban areas, metropolitan governance, regional governance, diversity

Contents

1. Introduction

The motivation for this research is the increasingly evident mismatch between persistent administrative boundaries and the flows in our functional urban systems (OECD, 2012). The challenge manifests in a diversity of important academic and policy discussions about for example: the benefits and costs of local government amalgamation programs, subnational government size, public good provision, statistical inference challenges associated with spatial economic analysis and of course metropolitan and regional governance.

Each of these academic discussions have chosen a different path for their analysis with some focusing solely on public finance and reduction of public spending (cost efficiency), some on service quality, some on political transaction costs and others on the balance or legitimacy of democracy itself. We choose here to focus on the regional spatial patterns of functional urban areas in the Netherlands, ultimately exploring the implications of diversity and concentration in urban populations for a transition to effective metropolitan governance and decision making arrangements. We find the conversation about legitimacy of any potential metropolitan government or governance arrangement in the Netherlands particularly important given the social corporatism (more colloquially: the polder model) practiced in the Netherlands throughout the 20th and into the 21st century. What is particularly intriguing about studying metropolitan governance is that it encourages *"imperfect answers to big questions about the* ***changing conditions for ordered rule rather than perfect answers to small questions about the precise*** *impact of different policies, services and regulations"* (Ansell & Torfing, 2016).

The pursuit of governments or decision making processes better representing expanding urban extents is not a new phenomenon: the number of municipal units in the Netherlands continuously declined from 1.209 in 1850 to 355 in January 2019 due to amalgamations (OECD, 2014; CBS, 2019). Since 2012, the Dutch central government has been planning to amalgamate Dutch municipalities so that each municipality has a residential population of over 100.000, which is vaguely consistent with the EC-OECD definition of functional urban area cores in that it emphasises residential population (Dijkstra et al., 2019). The rationale for amalgamations can be summarised as seeking an increase in administrative power and delivering economies of scale in local public services to meet budgetary pressures. At the same time, metropolitan governance without metropolitan government is emerging (see for example popular media discussions about ***Metropoolregios***) and will continue to evolve over the coming decades.

The point is: metropolitan governance is already being pursued in the Netherlands and it is conceivable metropolitan governments will form over the long term. The difficulty of that transition, including which communities dominate and which communities are on the outer, might depend on the spatial variation of socioeconomic factors, political opinions and preferences in metropolitan areas. It would be useful for policymakers and community leaders to understand what some of the relevant dimensions are in their metropolitan area.

Taking inspiration from studies of structural heterogeneity (for example: income inequality), the vertical and horizontal dimensions of metropolitan governance, polarisation, regional specialisation and locally a discussion about a new spatial arrangement for municipalities (e.g., Marlet & van Woerkens, 2014), we pursue a descriptive location based analysis using measures of diversity. We develop and analyse measures of diversity that could be used to explore the governance implications of various urban boundary concepts in the Netherlands. More specifically we show what we might expect to learn about resulting metropolitan governance arrangements in the Netherlands from recasting urban populations according to measures other than labour market size, or production efficiency (public good service unit cost) resulting from exploitation of economies of scale, size and scope. The measures we develop provide alternate uses for the Krugman Specialisation Index, although we use the Gini method to understand income inequality.

The research approach can be understood in three steps:

a. Describe the difference between administrative and functional urban areas in the Netherlands
b. Establish indices (diversity measures) in key dimensions to adequately capture the degree of heterogeneity of preferences in a given functional urban area
c. Analyse and discuss the index outcomes in the context of a transition to effective metropolitan governance, political/ economic transaction costs and the legitimacy of redistributive policy

By exploring a set of key dimensions in component communities, we develop a set of conceptual distances between them. The intimation is greater distances between communities in key dimensions might make either decision making in any metropolitan governance arrangement or the formation of a metropolitan government more difficult. The results are not necessarily a commentary on which governments should merge or seek to collaborate and why. They instead provide further insight on the issues that might require effort if effective metropolitan governance is to be delivered in specific metropolitan areas. By focusing on the five metropolitan areas in the Netherlands where discussions of metropolitan governance are reasonably mature (Amsterdam, Rotterdam, Den Haag, Eindhoven and Zwolle), we provide evidence of which communities might transition more easily and which communities might require further thought an effort.

2. Placing the research in the literature

Given we are interested in the difficulty of any transition to metropolitan governance for metropolitan areas in the Netherlands, there are some key concepts we need to explore before developing and justifying an appropriate research method.

Spatial extents of urban areas

Any research method will clearly require a position on ***what a functional metropolitan or urban area is and how that differs from or relates to an administrative or statistical boundary***. The early part of this section deals with the relevant challenges associated with defining cities or metropolitan areas.

Relevant theoretical frameworks applied to subnational government and public goods

There are multiple theoretical frameworks in various streams of economics that will help us form a position on ***the role of preference heterogeneity in transitions to metropolitan governance*** in the Netherlands. The middle of this section explores the relevant theoretical frameworks for the concepts of: vertical and horizontal arrangements of government, optimal government size, transaction costs and governance.

Empirical tools

We follow with a brief discussion of the relevant empirical tools – more specifically ***measures of absolute and relative diversity (specialisation) and concentration***. The choice of measures with full knowledge of their attributes is clearly a critical part of our methodology.

At the conclusion of this section it should be clear to the reader why there is an opportunity and a need to explore the questions of metropolitan governance in the Netherlands from economic perspectives beyond the often used cost minimisation and public goods frameworks.

2.1. Functionally defined cities and administrative boundaries

One of the key challenges of studying urban areas is defining them in a practical way that is consistent with the phenomena of interest (e.g., Antikainen, 2005; Dijkstra et al., 2019; Eaton & Eckstein, 1994; Eeckhout, 2004; Krugman, 1996; OECD, 2012; Zipf, 1949). The OECD (2012) sets a high bar for their recent effort to provide an international methodology for determining functional urban areas:

> *"A harmonised definition of functional urban areas can help assess the links* ***between the scale and type of urban growth, better understand processes of change, development and relative performance; and address opportunities and*** *challenges for sustainable development of a country at even the national level."*

Defining urban areas (or systems) is particularly important because urban agglomerations are increasingly the driver of growth in production and services, labour market, innovation, technology, social and cultural life (e.g., Castells, 2002). Economic geography is reshaping public policy as

economic competitiveness is viewed through the lens of cities, challenging hierarchies and governance arrangements between cities, regions and nations in the era of globalisation (Cole & Payre, 2016). The tense political and economic relationship between ailing central (or national) governments and booming metropolitan areas is an interesting globally relevant phenomena. The point is: well defined national borders are steadily losing significance in the process of economic globalisation and being replaced by spatial and economic concepts of metropolitan agglomerations (e.g., Clark, 2016; Goess et al. 2016).

Of particular concern for researchers in the fields of economics and regional sciences is that national definitions of cities are inconsistent across countries and we therefore see a reliance on administrative, political or legal boundaries for analysis. Administrative, political and legal boundaries (or collections of them) do not necessarily represent economic entities or systems. The difficulty for researchers in a public policy context goes beyond the known statistical inference issues: the modifiable areal unit problem (Openshaw 1977a, 1977b); aggregation bias (Paelinck, 2000); the ecological fallacy (Robinson, 1950). It cuts to the core of our understanding of urban dynamics, regional policy setting, policy evaluation and metropolitan governance arrangements.

Different authors and different disciplines of course use different concepts to define cities, but one useful interpretation is that there are three classifications: administratively defined cities, functionally defined cities and natural cities (Veneri, 2016). We will not concentrate on the concept of 'natural cities', which relies on a morphological approach, for example: using measures of built environment extent – often excluding economic linkages. We instead focus on the concept of 'functionally defined' cities and their increasingly tense relationship with administratively defined cities.

The ***European Observation Network for Territorial Development and Cohesion (ESPON)*** began in the middle of the previous decade to describe urban areas using densities and car accessibility isochrones (Antikainen, 2005). More recently the OECD (2012) and Dijkstra with co-authors (2019) have pursued system delimitation based on a more comprehensive view of commuter networks, which intend to operationalise labour market extents. The joint European Commission/ Organisation for Economic Co-operation and Development (EC-OECD) concept of functional urban areas has important advantages compared with data for administratively defined cities. The fact remains though: ***commuting*** only represents one purpose for spatial interactions between actors (primarily households and firms). Perhaps incorporating a diversity of activities would better represent the daily urban system (Marlet & van Woerkens, 2014).

A functional urban area is defined in the EC-OECD view as an urban core (of sufficient population density > 1500 residents per square kilometre) and the surrounding area that is economically integrated evidenced by thresholds in commuting flows (Dijkstra et al., 2019). Importantly, the urban cores are identified using a continuous dataset representing residential population per square kilometre. The

surrounding area is ultimately made up of or matched to aggregated local (administrative) units. A more detailed description of the three step process is provided at Appendix B.

In another strand of literature, a daily urban system is similarly defined as a spatial conglomerate of companies, institutions and households, related to each other through daily mobility – forming one housing and labour market that is spatially inseparable (e.g., Gastelaars et al., 1980; de Graff, 2019). The concept of daily urban systems was the basis for the definition of Metropolitan Statistical Areas (MSAs) in the United States of America around the middle of last century (Bretagnolle et al., 2009).

Yet another multinational representation of spatial administrative and economic systems is the European Union's ***Nomenclature of Territorial Units for Statistics*** (NUTS). The system has developed over the period from the 1970s, with the latest major set of amendments carried out in 2019 (Eurostat, 2019). The objective of the common geographies is to aid: the collection, development and harmonisation of EU regional statistics; socioeconomic analyses of regions; and framing of EU regional policies (Eurostat, 2019). Of particular interest to us is the ***NUTS level 3 geographies: small regions for specific diagnoses***. The areas are initially built up from (continuous) square kilometre population grids, however, the outputs generally *"mirror the territorial administrative divisions of each EU Member State"* for practical reasons (Eurostat, 2019). They therefore become more about defining areas administratively than functionally, but provide an interesting point of comparison.

Functional urban areas are better suited than administrative areas to capturing agglomeration economies and other economic phenomena primarily because they include a representation of an urban area's labour market. Even though they ultimately consist of aggregated administrative areas, they may be particularly useful for guiding the planning of infrastructure (including social) and housing simply because they represent the right scale to address issues that affect both the city core and its surrounding labour force (or indeed other markets). The EC-OECD concept of functional urban areas provides a good starting point for exploring metropolitan political and economic phenomena – in our case specifically the emergence of and potential for metropolitan governance in the Netherlands.

2.2. Theoretical frameworks

Vertical and horizontal arrangements of government

Charles Tiebout's (1956) influential argument about revealed consumer (citizen) preferences for local public goods based on their choice of administrative area for residence led to a large conversation where economists tried to apply neo-classical principles to the problem of metropolitan governance. The orthodoxy stemming from Tiebout (1956) was: decentralised, heterogeneous local administrative areas in a city partially solves the Samuelson (1954) problem of efficient provision of public goods. And indeed, when given a choice of a variety of administrative areas, there is an almost indisputable body of empirical research showing citizens live in areas that closely approximate their demand for services and their preference for taxes – an equilibrium perhaps reached by citizen movement between areas.

Tiebout's (1956) argument was presented at a time when many of the issues of (spatial) social and environmental inequalities we take for granted in current economic debates were not on the tip of the discipline's tongue (Howell-Moroney, 2008). Without the ability to see the future problems resulting from urbanisation and fragmented governance, Tiebout (1956) made the very strong assumption that no spillovers occur between communities in separate administrative areas, but in the same urban system. In practical terms: if Tiebout's (1956) model of decentralised governance is to maximise social welfare, there cannot be spillover effects between local government areas. If non trivial spillovers exist, which they almost certainly do in metropolitan systems, then there are also efficiency and equity problems (Howell-Moroney, 2008). We of course recognise this as an uncompensated externality. It is sufficient grounds to call into question the orthodoxy of an equilibrium multiplicity of government administrative areas making up an efficiently and effectively governed metropolitan area.

One first view that seems to be a reasonably strong statement. We can demonstrate its potential validity by considering two main tactics for preserving decentralised governance in the Tiebout (1956) model, while addressing the externalities: either a deal making (bargaining) process between areas or the internalisation of external effects by recasting administrative (political) boundaries to encompass the benefits and costs of services (Young, 1976). The former might represent a collaborative (non-democratic) form of metropolitan governance, whereas the later would likely represent metropolitan governance by (democratic) metropolitan government.

In the first case where deals must be made between local government areas, we see the potential for very high decision making (transaction) costs as external effects become more complicated and necessitate negotiation between multiple areas or governments (note: the functional urban area of Amsterdam currently includes 47 municipalities!). As preference heterogeneity or polarisation increases between these component areas, the political and economic transaction costs may also increase.

In the second case we face the task of defining a city boundary large enough to internalise external effects, but small enough so local decisions are still relevant to a majority of a local population. The second point (appropriate 'smallness') is likely a function of preference heterogeneity or polarisation across the urban area. Add to this the complexity of multiple services and delivery models in a metropolitan government and you have a very tricky problem indeed – some might even say insurmountable.

A consistent, but more policy focused view comes from a United Cities & Local Governments and World Bank (2009) report on decentralisation in local democracy, which highlights three policy challenges for metropolitan areas consisting of multiple administrative areas:

1. Functional issues of growth, poverty and environment
2. Institutional issues of power, organisation and finance
3. Issues of democratic representation

Fiscal federalism (perhaps better thought of as fiscal decentralisation) in its early conception was a subfield of public finance that sought to answer questions about the vertical structure of the public sector (Oates, 1972; Oates, 1999). The resulting wave of ***government reform*** as a national public policy agenda – in particular the ongoing process of amalgamation in developed economies – offers another important perspective on the administrative or political (de)centralisation required for metropolitan governance. Wallace Oates (1999) provides a concise reflection on early fiscal federalism research before acknowledging the need for a new direction: *"It explores, both in normative and positive terms, the* ***roles of the different levels of government and the ways in which they relate to one another through such instruments as intergo****vernmental grants."* One of the main concerns is therefore the decentralised delivery of those public services with localised costs and benefits. The implication, similar to Tiebout's thesis, is smaller local government areas might be better able to match public services to local preferences. The key insight, however, is that public services should be matched to the scale where the costs and benefits are felt. As amalgamation programs continue, urban systems expand and the cost of distance changes in most of the developed world, we might consider more closely the governance challenges for the metropolitan scale.

We can see that while decentralisation is generally associated with benefits related to preference heterogeneity, merging or consolidating local administrative areas to make fewer, larger units is typically connected with efforts to internalise spillovers and chase benefits associated with economies of scale, size or scope (e.g., Allers & Geertsema, 2016; Bish, 2001; Blom-Hansen et al., 2016; Fox & Gurley, 2008; Tavares, 2018). As a result both policy arguments regularly exist in the same place. It captures the struggle in the Netherlands where the scale of current municipalities are increasingly called into question by the increasing size of urban systems (Marlet & van Woerkens, 2014). One result of challenging the scale of municipalities is an increased focus on governance of urban systems, for example through the ***Metropoolregio Amsterdam***[1], ***Metropoolregio Rotterdam Den Haag***[2]***, Metropoolregio Eindhoven***[3] or ***Stichting Metropoolregio Zwolle***[4].

Optimal government size

Optimal local (or metropolitan) government size is a question explored frequently in the literature building on earlier work by Ladd (1992) and Boyne (1995). Very little evidence has been found supporting a generalisable expression for ideal size based on a cost minimisation problem. The difficulty for economists is that different public services very likely exhibit different scale characteristics (at least cost functions) and indeed production models, so no single organisation (or area) will be a size that produces all public services at lowest cost (Bish, 2001). Given the challenges presented by a cost of

[1] https://www.metropoolregioamsterdam.nl/
[2] https://mrdh.nl/
[3] https://metropoolregioeindhoven.nl/
[4] https://regiozwolle.info/; https://www.metropoolregiozwolle.nl/

services per capita view, we might consider an emerging role for transaction cost economics to tackle the question of complex public service governance (delivery) models (Williamson, 2010).

Another body of literature focuses on ***Size and Local Democracy***. Denters and co-authors (2014) systematically develop evidence for a negative relationship between size and four of their ten local democracy indicators: personal political competence, satisfaction with local government, local party activity and contacting officials (Denters et al., 2014). Two other indicators present less compelling evidence of a negative relationship: confidence in politicians and distinctiveness of local voting (Denters et al., 2014). To state the results more explicitly for our context: it seems an increase in subnational government size is related to a decrease in some elements of local democratic legitimacy and participation. The relationship between size and preference heterogeneity is not ddressed in detail, but we consider these measures when we choose relevant dimensions for our analysis.

Governance and transaction costs

If we are to explore the shape of subnational government, ***governance*** is clearly an important concept. The difficulty is governance theory is particularly interdisciplinary – it crosses political science, public administration, sociology, economics and law at the very least (Ansell & Torfing, 2016). Complicating matters further in the urban areas context, it has become apparent that metropolitan governance can and does occur (effectively) in the absence of a consolidated metropolitan government (Feiock, 2004). Governance is therefore a particularly difficult term to define and we borrow from the work of Torfing and co-authors (2015): "***the process of steering society and the economy through collective action and in accordance with common goals***". To be clear: we use the term ***metropolitan governance*** to mean an effective process for society and the economy to act according to the common goals of the metropolitan area. We can see that preference heterogeneity and diversity within metropolitan areas will influence the type and effectiveness of the process.

It is important to acknowledge the ***transaction cost economics*** discussion kicked off by a Williamson (1971) interpretation of Coase (1937, 1960) and Arrow (1969). The ***Transaction Costs Framework*** implies the presence of institutional costs associated with different types and sizes of subnational governance (for example: using external public service delivery mechansims). As transaction (institutional) costs increase, they would offset any cost efficiency resulting from for example: economies of scale in production or externalising public service provision. Transaction costs depend on service characteristics and political context (Brown & Potoski, 2003). The economic and political transaction costs of different modes of public service delivery can be measured while controlling for contextual factors that influence decision making. And in this way of thinking, the most appropriate governance mechanism for public service delivery is the one that minimises transaction costs (e.g., Brown & Potoski, 2003). It provides an alternative way of looking at 'total cost' for public services. Most importantly it moves away from considering governance of subnational areas as a classical cost

minimisation problem and instead acknowledges the role of complex organisational forces and uncertainty.

As subnational governments (particularly in urban areas) increasingly gain importance by providing complex services, transaction cost economics becomes more applicable as a framework to understand the delivery of these public services to diverse communities. It raises questions about the effectiveness of metropolitan governance of functional urban areas given the potential for vast heterogeneity in preferences. The challenge here from an empirical perspective is that functional urban areas do not currently have governments and the governance arrangements are therefore narrow, nondemocratic or very complex if they exist.

Since we will be addressing issues of governance, some currently accepted measures of the effectiveness of regional governing provide important guidance. Hamilton (2013) develops a neat summary of approaches from the literature – the political dimension is clearly a challenge:

Dimension	***Measure***
Service delivery	Cost efficiency; effectiveness
Quality of life	Area wide equity in service delivery; equity in distribution of income; regional economic development; effective land use
Political	Democracy measures; extent of participation in the governing process; extent of civic involvement in governance; ability to address regional policy issues; sense of community and region

Table 1: measures of effective regional governance recreated from table 1.1 in Hamilton (2013)

We consider these measures later when deciding on relevant dimensions for our analysis.

2.3. Diversity indices

The aim of this research is to better understand the spatial patterns of within heterogeneity in functional urban areas in the Netherlands. In formal terms we want to provide evidence on the dissimilarity in the indicator composition of each component area compared with the structure of an aggregate (metropolitan) area.

Index based analysis has been common in studies of income inequality, market concentrations, international trade and ecological diversity, but it is far less common as a tool for exploring subnational governance arrangements. One notable exception is a study by Ritsema van Eck and co-authors (2006) that explores whether the Randstad operates as one metropolitan system. The title – 'many cities do not yet make a Randstad' (***Vele steden maken nog geen Randstad***) – adequately summarises their findings, however, what we are interested in is their use of indices to describe the locational arrangements in the Randstad. They rely on the location quotient, variants of the Krugman Specialisation Index (Krugman, 1991), the Theil index (Theil, 1967) and variants of the Shannon Entropy Index (Shannon, 1948).

Before we progress to analysis of functional urban areas and their component administrative parts in the Netherlands, we should explore the construction and use of different indices. We focus on the descriptive work of location theorists and the related research on structural heterogeneity: income inequality, market concentrations and diversity (e.g., Alesina & Perotti, 1996; Combes & Overman, 2004; Hale & Koenig-Archiburgi, 2016).

The underlying logic for the indices considered relevant to this study is entropy and they tended to develop concurrently across the fields of economics, finance and ecology (Gini, 1921; Herfindahl, 1950; Hirschman, 1964; Krugman, 1991; Shannon, 1948; Simpson, 1948; Theil, 1967). These measures tend to be strongly correlated, but emphasise different parts of the distribution. The latter can have huge implications, which makes it important to either develop a set of axioms or principles before deciding on an appropriate index based analysis approach (e.g., Dalgaard & Vastrup, 2001). More detailed information on the range of diversity (specialisation) and concentration indices considered can be found at Appendix D.

There are established methods to aggregate indices across dimensions. We focus on the body of work stemming from the Kogut and Singh (1988) index of composite cultural distance. The technique is based on Euclidean distance and although Konara and Mohr (2019) have recently shown Kogut and Singh (1988) mistakenly specified the square of Euclidean distance, we find the specification suitable to adapt for our purposes.

The next step is clearly now to select dimensions and appropriate measures we can use to assess the heterogeneity within functional urban areas in the Netherlands as a way of understanding the conceptual ‘distance’ between communities. That is indeed how we proceed in the following section, which brings the theoretical and empirical frameworks from this section together into an analysis relevant to metropolitan governance transition in the Netherlands.

3. Methodology and data

We begin this section by describing the metropolitan and component administrative areas we will analyse. The definition of metropolitan areas is clearly important given our research question and the preference for relative indices (see Appendix D for more detail). We then select a spread of dimensions to capture the potential for preference heterogeneity and polarisation in a metropolitan area. A detailed description of the datasets used is provided at Appendix A, although we summarise the relevant datasets as we go. The section concludes with a comparison of relevant indices and the construction of specific (sets of) indices for each dimension of analysis.

3.1. Spatial units of analysis

The review of the different spatial extents of urban areas in the previous section highlighted some of the possibilities for our analysis. We want to define possible areas of metropolitan governance in the future (perhaps as a result of the ongoing amalgamation program) and the administrative units that make up those metropolitan areas in the Netherlands. For this reason we choose the ***EC-OECD Functional Urban Areas*** as a defendable representation of metropolitan systems in the Netherlands and the current local government areas ('municipalities') as the administrative units. The process for determining EC-OECD Functional Urban Areas is described at Appendix B.

To make sure the analysis plots a path towards real world conversations and applications, we choose to focus analysis on the four previously mentioned existing and ongoing conversations about metropolitan governance in the Netherlands. The most developed conversations are about metropolitan governance arrangements in Amsterdam, Rotterdam/ Den Haag, Zwolle and Eindhoven. Amsterdam and Zwolle have a reasonably straightforward core periphery structure. Eindhoven has two clear 'urban cores': ***Gemeente Eindhoven*** and also ***Gemeente Helmond***, which is recognised in the EC-OECD definition. Rotterdam/ Den Haag has at least two metropolitan cores (as the name would suggest) and is in fact split into separate functional urban areas by the EC-OECD definition.

3.2. Selecting relevant dimensions for analysis

Our main ambition here is to select a spread of dimensions with available data that might capture the potential for preference heterogeneity and polarisation in a metropolitan area. We take as a starting point the summary of measures of effective regional governing provided by Hamilton (2013), concentrating on the quality of life and political themes rather than the financial efficiency of service delivery. We also consider a discussion in the Hale and Koenig-Archibugi (2016) study of preference heterogeneity, polarisation and crosscuttingness in the European Union, although they ultimately side with available opinion surveys over socio-demographic or socio-political indicators. What we take from the work is the need for a spread of demographic, political and economic dimensions. We proceed with:

a. Age (group shares)

b. Income inequality
c. Migration background (group shares)
d. Stated religion (group shares)
e. Stated political preferences (vote shares)
f. Budget allocations (category shares)

Data comes from Statistics Netherlands (***Centraal Brueau voor de Statistiek***), the Electoral Council (***Kiesraad***) and the Public Administration Council (***Raad voor het Openbaar Bestuur: Financiën Decentrale Overheden***). A table of data descriptions is at Appendix A. It should be noted that we take a cross sectional approach to analysis and as such use the most recent year where data is available for all these dimensions: 2018. Choosing a single year for analysis is necessary for consistency, ease of interpretation and because the spatial arrangement of municipalities in the Netherlands changes year by year due to voluntary amalgamations.

Some of this data has limitations that are worth mentioning here:

Stated religion

Communication of adult resident's religion at the municipality resolution was discontinued by Statistics Netherlands (***Centraal Bureau voor de Statistiek***) in 2014. We aggregate it up to 2018 boundaries in the same proportions and given the amalgamations over the period. In addition, there are obvious sensitivities associated with stating ones religion in official government surveys and so we would expect under reporting of religious beliefs, especially in religions subject to persecution in the past or relatively less common religions in the Netherlands. We assume that the under reporting effect does not differ across space, but this seems a strong assumption given the potential for the effect to become more pronounced in relatively smaller religious communities or in places with a more dominant religion.

Stated political preferences

Elections clearly do not happen yearly. We aggregate voting data from the most recent election on 15 March 2017 to the 2018 municipality boundaries using information on amalgamations. We include blank and incorrect votes as a category of voting since we consider it an indicator of political preference. We use national voting data since local elections (***Gemeenteraad***) in the Netherlands include many locally specific parties/ independent members targeting locally specific issues not easily comparable across municipal areas. Differences in the ***Gemeenteraad*** clearly tell us something about the potential for transition to metropolitan governance, but the data is not suited to this style of relative analysis.

Municipal budget allocations

Even though the budgetary data is reliable, budget allocations vary significantly over time depending on for example: project portfolios or accounting pressures. This is perhaps the dimension where the decision to pursue a cross sectional approach has the most impact.

3.3. Developing appropriate measures of diversity

With the relevant dimensions decided upon, we proceed with selection of the most appropriate diversity (specialisation) indices to give us an indicator of the conceptual 'distance' between two communities in a functional urban area. It is important to consider the strengths and weaknesses of possible indices, which we do in detail in Appendix D. For the purpose of our broad based analysis we look to the aforementioned literature for an idealised set of principles indices should aspire to. It is highly unlikely selected measures will meet the long list of idealised criteria, but it is important we state them here to avoid subsequent misinterpretation or overinterpretation of findings. We are not trying to hide from the fact empirical results could differ depending on the index applied. We adapt the work of Coombes and Overman (2004) to arrive at a comprehensive set of principles for our context:

a. Anonymity: reordering has no effect
b. Adding new zero (or extremely small) share should have no (or a negligible) effect
c. Defined bounds: unique value under the 'null hypothesis'
d. Unbiased given arbitrary changes in spatial and indicator classification
e. Mean preserving spread – also referred to as the 'transfer principle' by for example: Hannah and Kay (1977)
f. Decomposability: can be split into a weighted average of the inequality existing within and between subgroups
g. Comparable across dimensions

We add to this a preference more than a principle: for relative over absolute measures. We are interested in the comparative heterogeneity relative to the reference group (the functional urban area) and not some kind of absolute position on whether this level of heterogeneity will contribute to good or bad metropolitan governance. For the purpose of this analysis we are unlikely to be interested in a comparison with an equal share (uniform) distribution, which is a feature of absolute indices.

At Appendix D you will find a comparison of the common entropy/ heterogeneity based diversity and concentration indices using these principles as a framework. The comparison facilitated the systematic selection of specific indices for the dimensions we are interested in. Since we are primarily interested in relative measures, we summarise the comparison of the relative Hirschman-Herfindahl index (Herfindahl, 1950; Hirschman, 1964), the Krugman Specialisation index (Krugman, 1991), the relative Gini index (Gini, 1921) and the Theil index (Theil, 1967) in Table 2.

	a. anonymity	b. 0 share	c. bounds	d. class.	e. transfer	f. decompos.
Rel. HHI	✓	✓	✓	✓	✓	✓
KSI	✓	✓	✓	✓	✓	x
Rel. Gini	✓	x	✓	x	x	x
Theil	✓	x	✓	x	✓	✓

Table 2: properties of relative measures

In Table 2 we begin to see the advantages of the Krugman Specialisation Index and the relative Hirschman-Herfindahl Index. The relative Gini Index and Theil Index may be useful to understand income inequality at different scales.

The task then is to use this information to construct specific indices for each dimension with careful thought given to the spatial phenomena of interest, groupings and reference scales. Essentially what we are asking is: if there was an immediate move to metropolitan government (or another decision making arrangement) in functional urban areas, how much would the component areas who need to come together differ across relevant dimensions? What might the conceptual distance between them be? We imply that larger distances require more effort in transition and may have implications for government legitimacy in the democratic process (see the concept of 'problematic diversity' in Hale and Koenig-Archiburg, 2016), but make no judgement as to whether those metropolitan governance arrangements would ultimately be 'good' or 'bad'. It may indeed be that large distances between communities make mergers difficult, but produce significant public benefit.

Bringing the dimension specific analysis into the policy world will require some form of aggregate understanding. Practically this means two things: first the dimension results should be summarised at the municipality scale (since these are the communities we want to measure the conceptual distance between) and second the individual results should be able to be put together in a relatively simple way.

We briefly describe the dimension specific indices so that each may be easily reproduced, before concluding discussion of our method.

We attempt a consistent notation:

- i is a subgroup index
- g is a municipality (***Gemeente***) index
- FUA is a functional urban area index

Age, migration background and religion

A Krugman Specialisation Index based measure is used for each of these demographic characteristics to describe how the structure in each municipality differs from its FUA. Higher values indicate a structure that differs more from the FUA.

$$AI_g;\ MBI_g;\ RI_g = \sum_{i=1}^{I} \left| \frac{P_{ig}}{P_g} - \frac{P_{iFUA}}{P_{FUA}} \right|$$

Where in all cases P is residential population.

For the AI i denotes age groupings as determined by Statistics Netherlands (***CBS - Centraal Bureau voor de Statistiek***).

For the MBI i denotes CBS migration background groupings (including Dutch background).

For the RI i denotes CBS religious groupings.

In all cases the lower bound is zero (perfect replication of reference FUA structure) and the upper bound is $\frac{2(I-1)}{I}$ (complete diversity from the reference FUA structure).

Income inequality

The Gini-coefficient of income inequality for each municipality to understand the level of income inequality within component communities. See Appendix D for detailed method.

Stated political preferences (party votes)

A Krugman Specialisation Index based measure of House of Representatives (***Tweede Kamer)*** voter differences in the municipality relative to FUA. Higher values indicate a structure that differs more from the FUA.

$$VI_g = \sum_{i=1}^{I} \left| \frac{V_{ig}}{V_g} - \frac{V_{iFUA}}{V_{FUA}} \right|$$

Where V is votes and i is the index for political parties in the House of Representatives (***Tweede Kamer)***.

The lower bound is again zero and the upper bound is $\frac{2(I-1)}{I}$.

Budget allocations

A Krugman Specialisation Index based measure of difference in municipality budget shares from the FUA. Higher values indicate a structure that differs more from the FUA.

$$BAI_g = \sum_{i=1}^{I} \left| \frac{B_{ig}}{B_g} - \frac{B_{iFUA}}{B_{FUA}} \right|$$

Where B is budget allocations in Euros and i denotes nine pre-determined categories of expenditure.

The lower bund is again zero and the upper bound is $\frac{2(I-1)}{I}$.

Having calculated these measures of diversity for each dimension, we consider how they might be aggregated in a composite measure that represents the conceptual distance between communities in a functional urban area. As mentioned previously our assumption is that moving towards effective

governance in a defined functional urban area is the objective. We adapt the Kogut and Singh (1988) index of cultural distance to arrive at a composite measure of difference between the municipalities within the EC-OECD functional urban areas:

$$D_{rg} = \sum_{k=1}^{6} \frac{\left(I_{kr} - I_{kg}\right)^2 / V_k}{6}$$

Where D_{ij} represents the distance between municipalities r and g.

k is the index for the six stated dimensions.

I represents the dimension value.

V represents the variance of results and the number 6 (dimensions) is to capture the arithmetic mean.

The use of the Kogut and Singh (1988) approach has recently been called into question by Konara and Mohr (2019) in ***Why We Should Stop Using the Kogut and Singh Index***. Their central finding is that the Kogut and Singh (1988) index is incorrectly specified and in fact represents the squared Euclidean distance and not the Euclidean distance itself. Konara and Mohr (2019) suggest use of the standardised Euclidean distance:

$$D_{rg} = \sqrt{\sum_{k=1}^{6} \frac{\left(I_{kr} - I_{kg}\right)^2}{V_k}}$$

We calculate the Konara and Mohr (2019) measure alongside the Kogut and Singh (1988) measure for comparison and indeed find the expected effect: less emphasis on larger distance values, but no change in ranking. We decide to proceed with the Kogut and Singh (1988) based specification.

The reason understanding the potential distance between communities is important is because it allows us to form a position on the transition to metropolitan government in those areas where discussions about metropolitan government are most progressed. In effect it allows us to form a position on the important questions: what should we do first in the move towards metropolitan government? and who is more likely to agree on key issues in a metropolitan governance model without metropolitan government? The assumption is shortest distance may indeed be the path of least resistance for a transition to metropolitan government or other decision making in functional urban areas.

A key assumption of the composite measure is that metropolitan areas are determined by the EC-OECD definition (of functional urban areas) and therefore inclusion of those component administrative parts is the overall objective of any governance arrangement. In other words, we start with the functional urban area and its core urban area as given and then work our way towards that arrangement. We make this assumption to sharpen our analysis, however the method could be applied to any aggregation of component parts, for example Provinces.

4. Results

We begin with a brief description of functional urban areas in the Netherlands. It is important context for the subsequent diversity measure results, which are presented only for the five functional urban areas (four metropolitan regions) where discussions about metropolitan governance are most progressed. Results for each of the dimensions are visualised and briefly summarised. We then show how individual dimension results can be expressed in a composite measure and taken towards practical application.

Since we integrate methods of descriptive spatial analysis and an index based approach, we find the visual representation of data particularly important. We therefore take guidance from Schwabish (2014) when visualising data and results.

4.1. Description of Functional Urban Areas in the Netherlands

According to the EC-OECD process there are 35 functional urban areas (FUAs) in the Netherlands. They include 279 Municipality areas of the current 355. If metropolitan governments were to form in these functional urban areas as a result of amalgamations over time, the Netherlands would be left with 111 subnational governments at the municipal level, which is slightly higher than the 57 suggested by Marlet and van Woerkens (2014) in their analysis of the potential for consolidation. There might indeed be opportunities for further consolidation outside of urban areas, but we focus here on urban areas only. To orient the reader the total set of FUAs are shown in Figure 1. You will note the major functional urban areas usually contain more than one urban core by the EC-OECD definition, although in many cases these urban cores are contiguous.

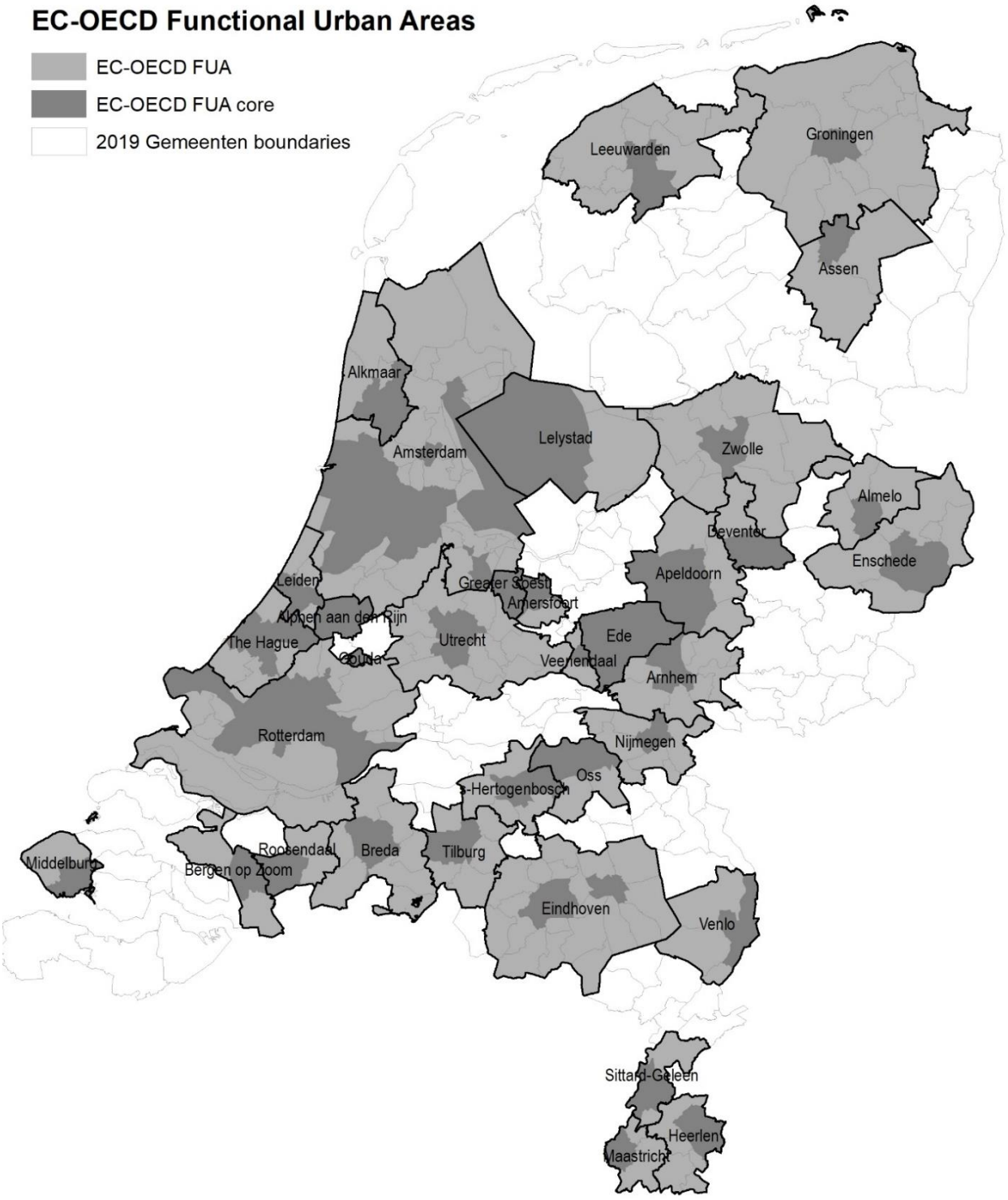

Figure 1: FUAs and their cores in the Netherlands

The FUAs differ in the number of component administrative areas and of course population and employment. The number of component administrative areas already gives us an indication of how difficult any transition to effective metropolitan governance might be. Note that there are two FUAs that include only one municipality area and separate Amsterdam from Rotterdam: ***Gouda*** and ***Alphen aan den Rijn***. We show the number of component municipalities in Figure 2.

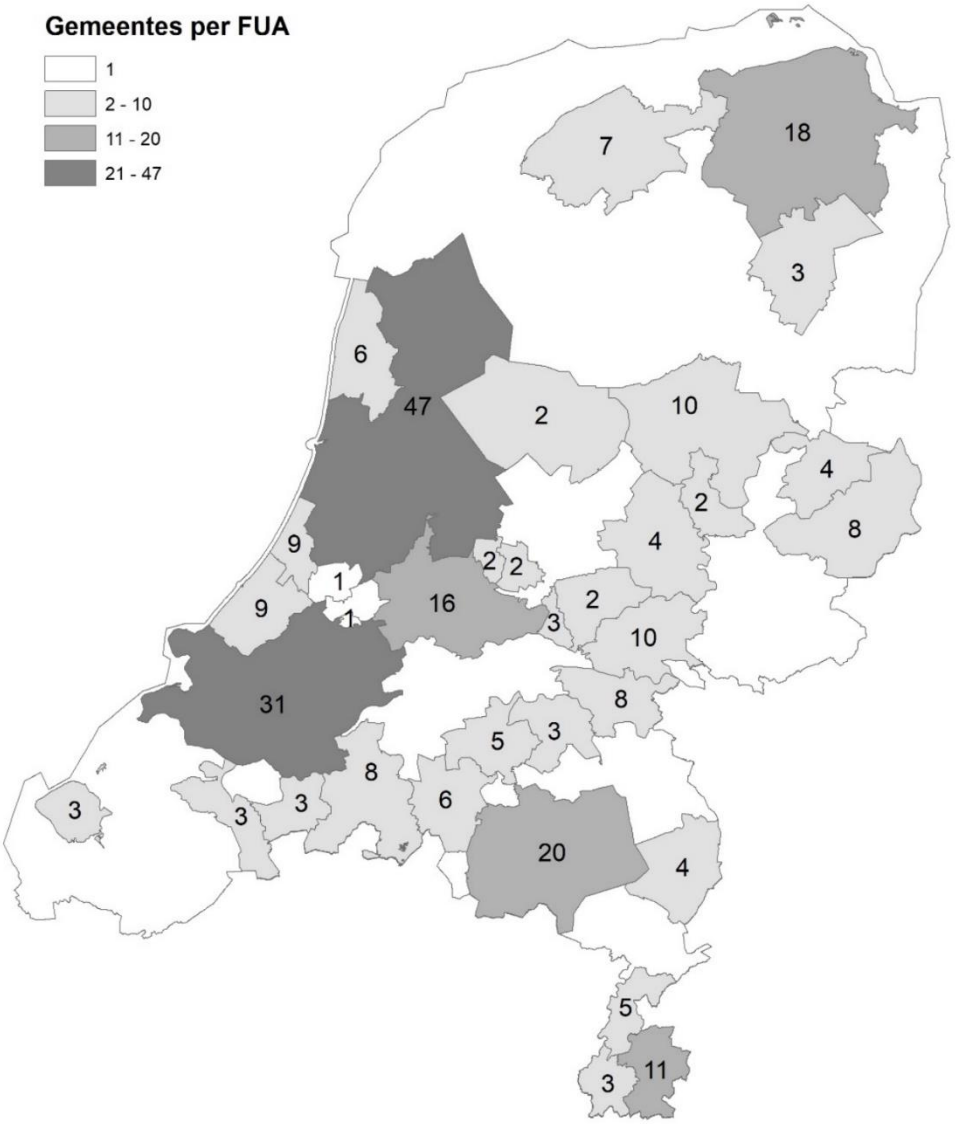

Figure 2: FUAs and their component administrative areas

The cities with far reaching labour markets are clearly visible: Amsterdam (47 municipalities), Rotterdam (31), Eindhoven (20), Groningen (18), Utrecht (16), Heerlen (11) and Zwolle (10). It is of course highly likely there is significant overlap between the labour and housing markets in for example Den Haag and Rotterdam, but we proceed with this arrangement since metropolitan government and to an extent governance requires clear definition of boundaries. The treatment of Rotterdam and Den Haag already highlights an inconsistency between the EC-OECD definition of functional urban areas and the continuing metropolitan region discussion locally.

We might also orient ourselves by describing the residential population and number of jobs in each FUA. In Figure 3 we make use of a continuous population dataset to show areas where residential population density is higher than 1500 people per square kilometre for consistency with the EC-OECD process of determining FUAs (Dijkstra et al., 2019). The more populated urban areas (cores) are clearly visible and we can see visually the relationship with ‘core areas’.

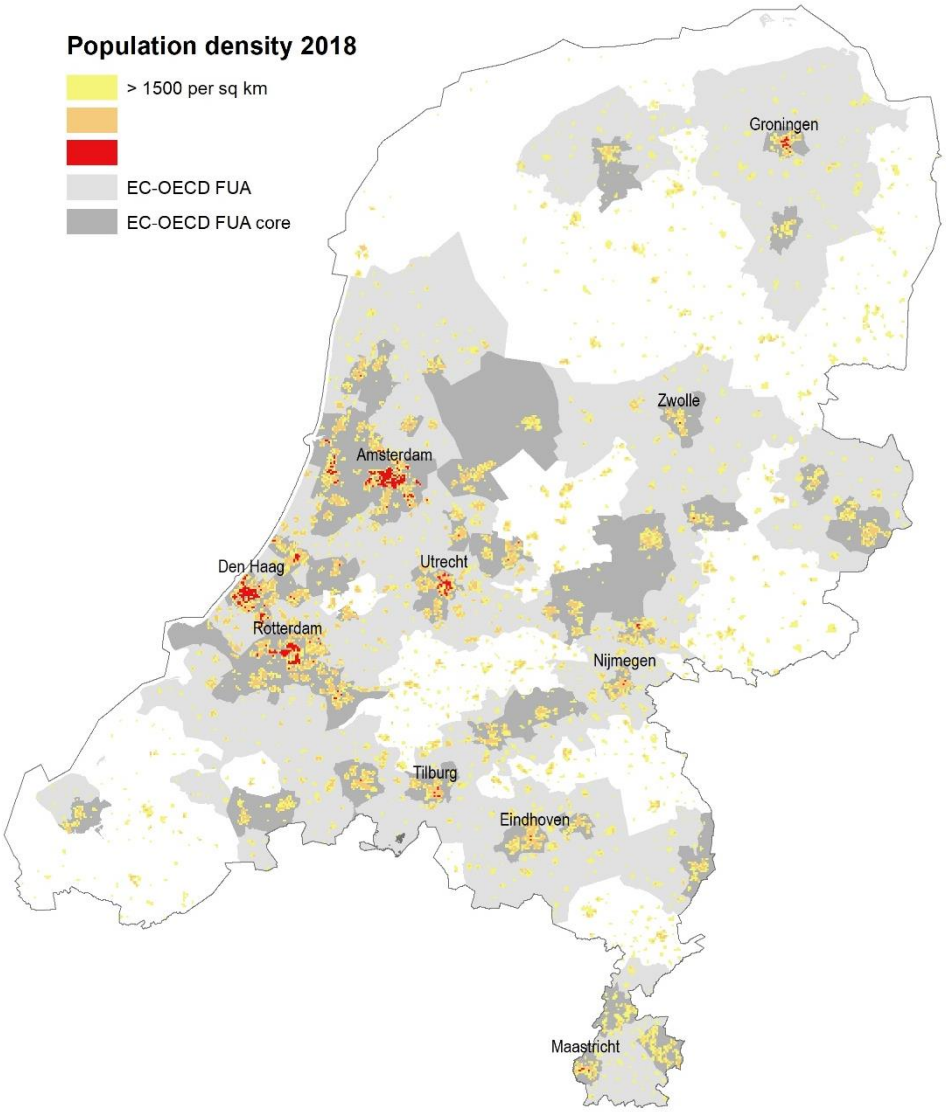

Figure 3: Population density in FUAs

The last description we provide is of the level of job accessibility across FUAs. Rather than simply providing the number of jobs available in a given area, we present a relatively simple measure of job accessibility and name it 'effective job density'. A full diagrammatic description of the process is at Appendix C, but since we are only describing functional urban areas here, we simply present the results indexed to Amsterdam (highest EJD) in Figure 4. A summary of the calculation method is:

$$EJD_r = E_r + \sum_{g=1}^{G} \frac{E_g}{d_{rg}}$$

Where E is the number of jobs in an area and d represents a natural distance decay using real network travel time (minutes) on a given representative day (in our case 8:00 a.m. Tuesday 3 December 2019) between the major cities in two given areas r the subject and g any other municipality.

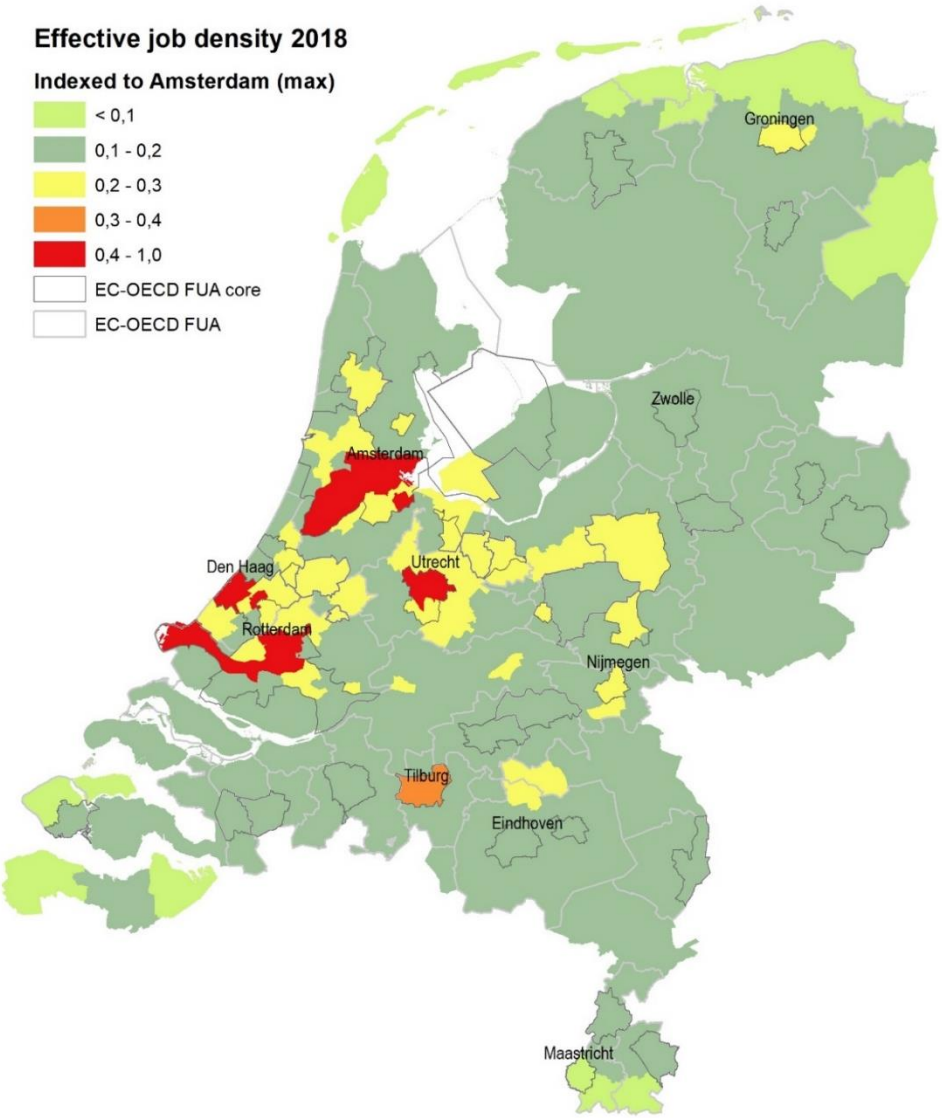

Figure 4: Effective job density in FUAs

We see clearly in Figure 3 and Figure 4 the dominance of the four big cities in the Randstad area, but more importantly the spread of population levels, densities and access to economic opportunities across and within functional urban areas. The differences in access to economic opportunity seem to be very pronounced. The effective job density in Eindhoven is particularly interesting because it appears the highest effective job densities do not coincide with the urban cores as they do in other major urban areas. We conclude from this brief descriptive exercise it is highly likely there exists heterogeneity across a variety of dimensions both within and between functional urban areas in the Netherlands. Since we are interested in transitions to metropolitan governance and cooperation, we concentrate now on results for within functional urban area diversity.

4.2. Structure diversity in key functional urban areas

We proceed with the results for the dimensions and diversity measures described in the method section. Results were calculated for six different dimensions in 35 functional urban areas and 279 municipalities, but we maintain our focus on the five functional urban areas with mature metropolitan governance discussions. We show the summation for each component part arranged in intervals. It is worth making explicit: the reference is the individual FUA, so each FUA should be interpreted separately even though they are mapped together. There is an important choice that has been made here: we start with the EC-OECD functional urban area as the defined objective, rather than building in a piecemeal fashion out from the existing urban core without an end goal in mind.

Age

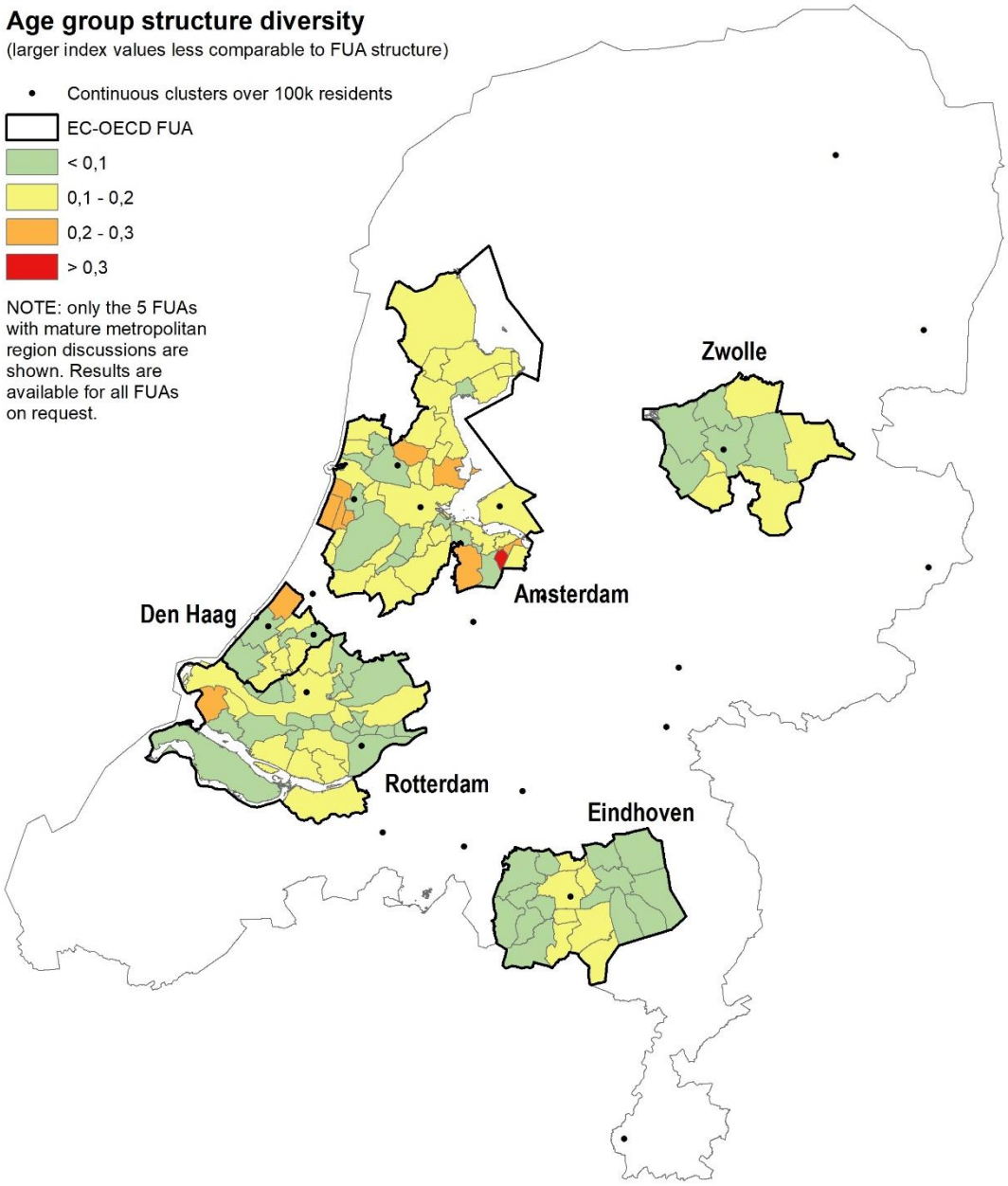

Figure 5: diversity in age structure in key FUAs

Figure 5 shows us the degree to which each municipality area age structure differs from the FUA's age structure. It is a measure of the diversity of age structures within an FUA, the insinuation being two or more areas with vastly different age structures may have differences of opinion on key issues. The recent ***Brexit*** vote is an example where age or 'generational cleavages' seems to have been a critical dimension (e.g., Bell & Gardiner, 2019). It is conceivable that merging areas of different age structures could also be beneficial, for example: bringing a population with a relatively high share of working age people together with a population that has a relatively high proportion of retired people may help to balance funding arrangements for key social infrastructure and public services. The fact remains though that doing so would require some kind of redistributive policy, which could involve relatively high transaction costs and be complex to implement. What this makes clear is that (in all dimensions) a high indicator value does not say whether administrative areas should or should not work together or merge; simply that doing so may be relatively more difficult and even have higher political transaction costs.

We see some mid-range differences in the age structure within the major FUAs – and this is indeed consistent across all FUAs. What is clear is that the largest relative differences in age structure tend to exist outside the areas of highest population density. Of the five FUAs, Amsterdam appears to experience the most age structure diversity between component areas.

Migration background

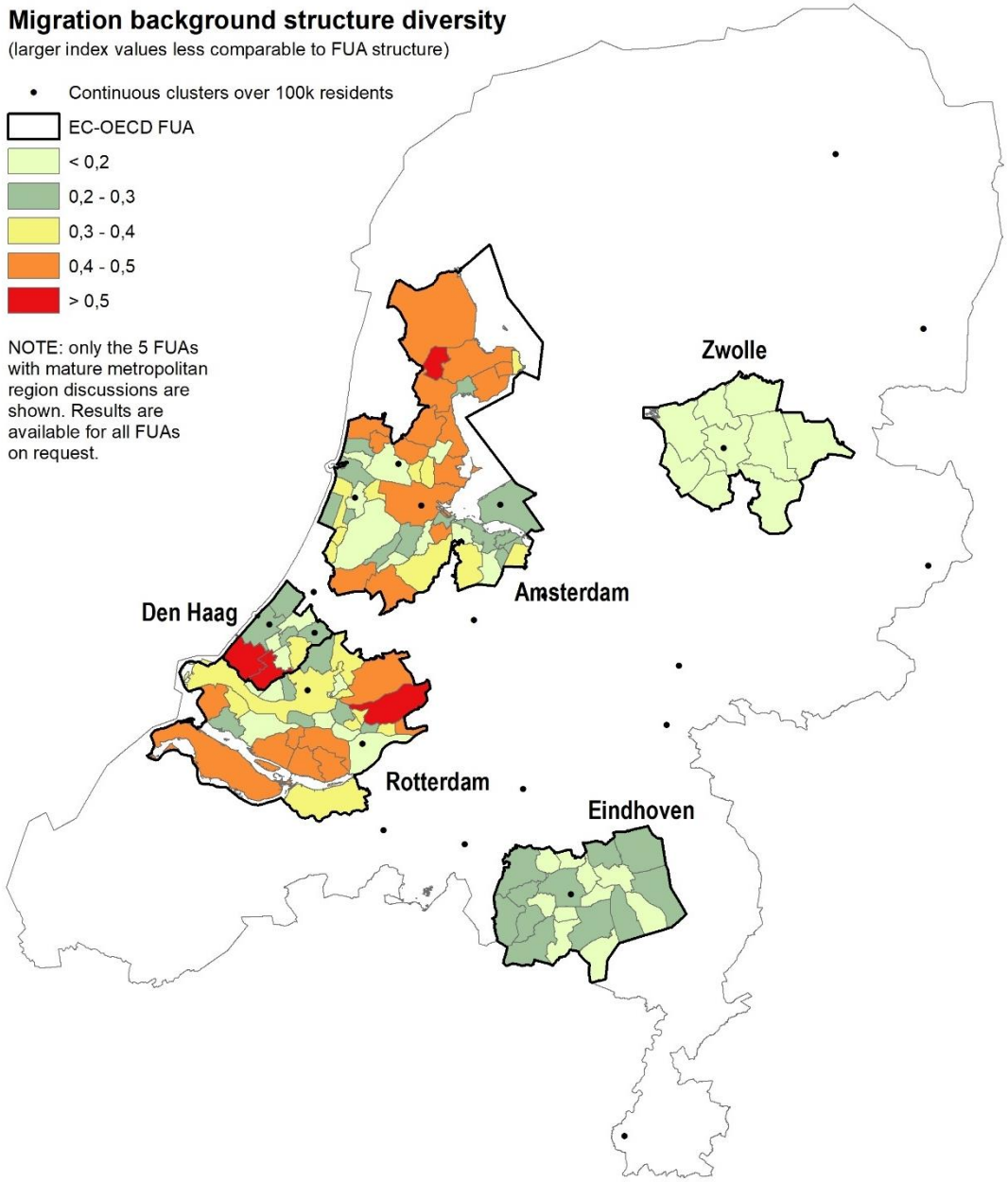

Figure 6:diversity in migration background structure in key FUAs

Areas that differ in migration background structure may indeed differ in socio-political preferences. Although some researchers have focused on the effect of the share of migrants in an area, for example on democratisation (Pfuzer, 2012), we are not particularly interested in a commentary on migrant levels or indeed political differences between specific migrant backgrounds. What we are interested in is the extent to which each component area differs from the migrant background structure in the FUA. A striking pattern emerges in Figure 6. Eindhoven and in particular Zwolle seem to expereince relatively less diversity of migration background structures in component areas. The similarity in migration background structures may be due to the relatively high proportions of people with a Dutch background in these areas: 90% in Zwolle and 80% in Eindhoven, however, our measure does not emphasise large

shares. We see realtively large differences in structure between component parts in Amsterdam, Rotterdam and Den Haag and the differences seem to cluster. What's more the larger variations in relative migration background structure tend to be in the periphery of the FUA (outside the core). This may simply be because the core structure dominates the FUA due to higher popultaion levels. Even in that case it shows a potentially significant difference between populations within the highly urbanised areas and populations in the peripheries of these FUAs.

Looking at the unsummed parts of the measure for the Amsterdam FUA reveals a specific pattern. The urban core of Amsterdam contains a very high proportion of people with a non-Dutch background, whereas the peripheral areas generally contain a very high proportion of people with a Dutch background. The urban core of Amsterdam (***Gemeente Amsterdam***) has a high index value because it has a much smaller proportion of people with Dutch backgrounds than the FUA. The peripheral areas (particularly in the north) have a high idex value because they have a much larger proportion of people with Dutch backgrounds than the FUA. This highlights another important attribute of our measures: the summations only tell us the extent to which structures differ from the metropolitan area, not in which direction and not which group dominates the value (although looking at the components reveals this).

Stated religion

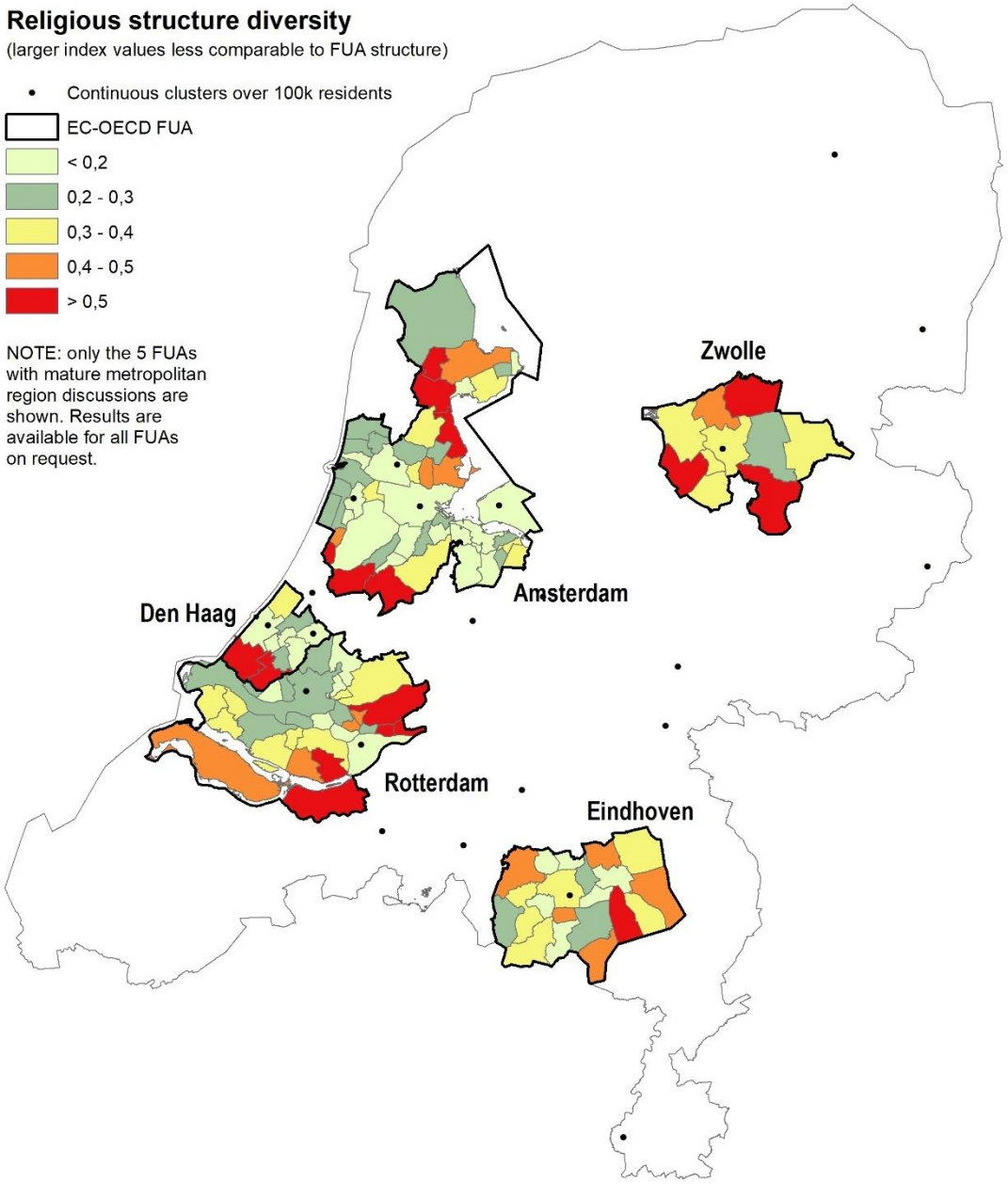

Figure 7: diversity in religious structure in key FUAs

The death of religion (i.e. religious decline in industrialised societies or 'secularisation') was the conventional social sciences wisdom throughout the twentieth century, but it is a position that is now being strongly challenged (Norris & Inglehart, 2011). Religion is clearly still a part of politics in the Netherlands and a determinant of preferences in communities: the Christian Democratic Appeal (***Christen-Democratisch Appèl***) has participated in all but three national governments since its beginning in 1977. We treat the religious structure dimension in a similar way to how we treat migrant background structures – we are not interested in the levels or ideologies of religiosity. We are interested in the differences in the religious structure of communities between the components of functional urban areas. Results include people who identify as non-religious since that is also a statement.

In Figure 7 we see a striking pattern of diversity, which is consistent in all functional urban areas except a cluster consisting of Tilburg, Den Bosch, Oss and Nijmegen (not mapped). Two observations are particularly important. First the urban cores tend to be more representative of their FUAs in religious structure and the peripheries tend to be less representative. Second all major urban areas exhibit a strong relative diversity of religious structures across component parts. We are starting to see a consistent spatial pattern in Amsterdam, where the northern areas tend to differ in structure – we see it again looking at religiosity. In Den Haag we see again the most southern areas (***Westland*** and ***Midden-Delfland***) differ markedly in structure. Interestingly there are no particular areas in Zwolle that are particularly representative of the aggregated functional urban area.

Income

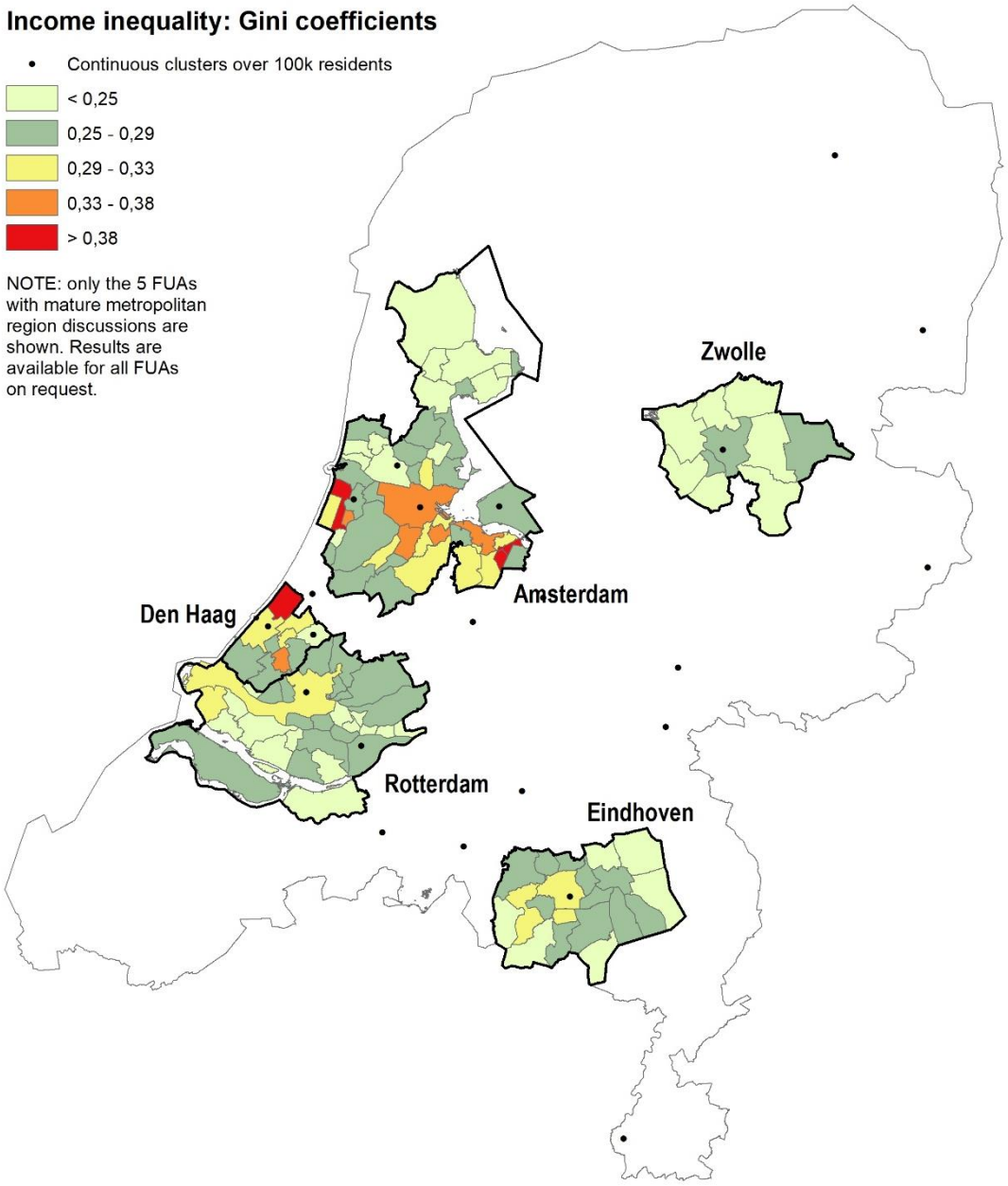

Figure 8: Income inequality in key FUAs

Here we focus on income inequality in municipalities. The broad ranging effects of income inequality are an ongoing discussion, however, it is conceivable income inequality matters for socio-political stability at the very least (e.g., Alesina & Perotti, 1996). We are interested in the level of income inequality within municipalities shown in Figure 8. It is interesting to note the highly urbanised areas tend to experience higher levels of income inequality, although there are exceptions. Zwolle, Eindhoven and Rotterdam seem to experience relatively less income inequality than Den Haag and Amsterdam. In Den Haag we see ***Gemeente Wassenaar*** experiences a particularly high degree of income inequality.

Stated political preferences

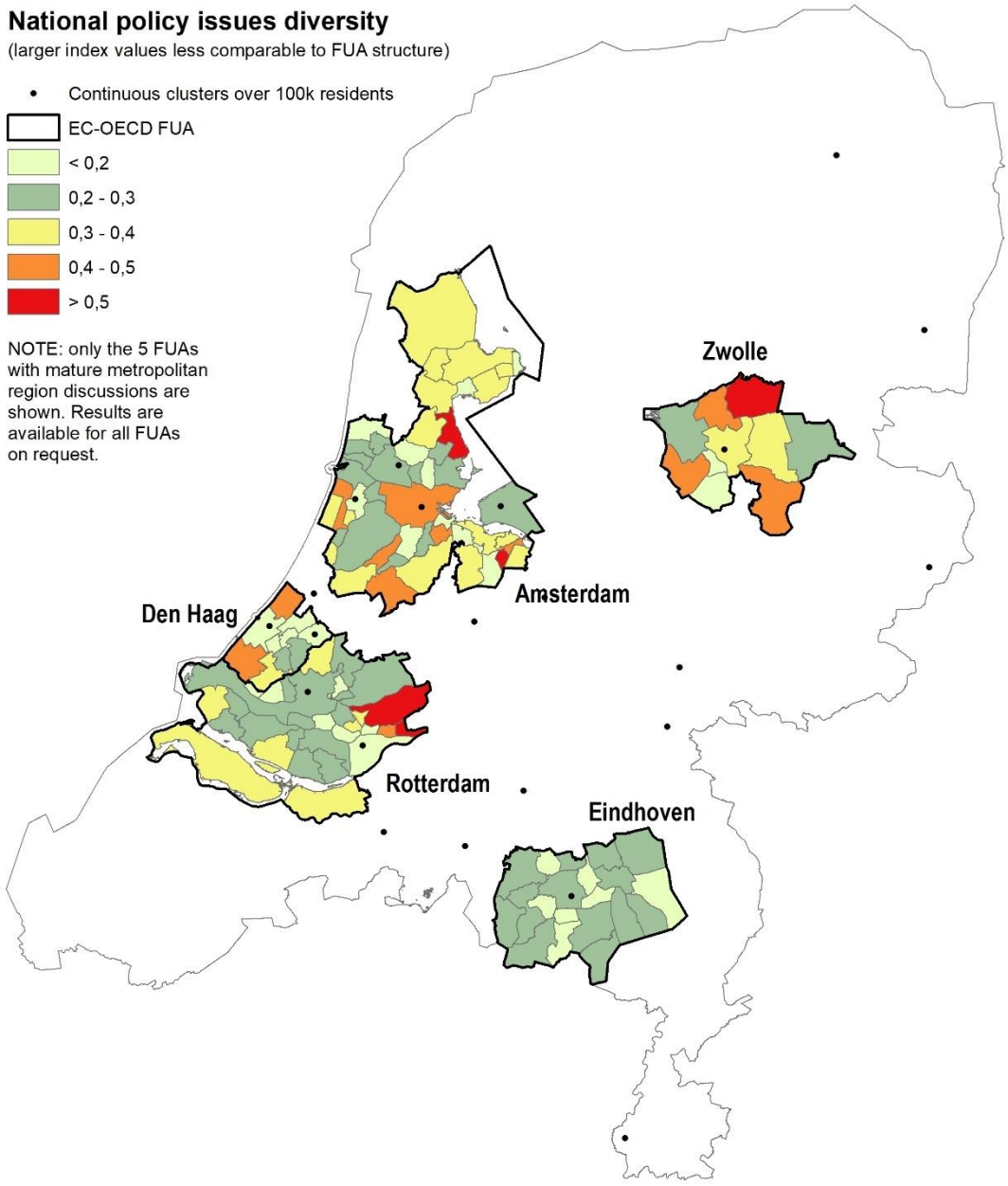

Figure 9: diversity in stated national policy preferences in key FUAs

We take voting for the House of Representatives (***Tweede Kamer***) as a form of stated political preference given it is likely to represent either a political ideology or a preference for a set of national

policies. The larger the measure, the less comparable the voting structure is to the FUA, which suggests differences in political and policy preferences between communities. We have deliberately chosen to assess voting structure rather than placing voters on a left-right dichotomy, which allows us to form an opinion on the diversity of voting shares in an area rather than specific political ideologies. Figure 9 shows the difference in voting structure between local communities within an FUA. Eindhoven is the clear exception, representing an FUA with relatively homogeneous voting structure between communities whereas Zwolle has a high degree of relative diversity between communities. Amsterdam is an interesting case because the central area ***Gemeente Amsterdam*** differs in structure to surrounding areas. Rotterdam shows a surprising level of homogeneity given the differences in other dimensions. We notice in Den Haag the southern areas (***Westland*** and ***Midden-Delfland***) and the northern area of ***Wassenaar*** differ again from the structure of the functional urban area.

Municipal budget allocations

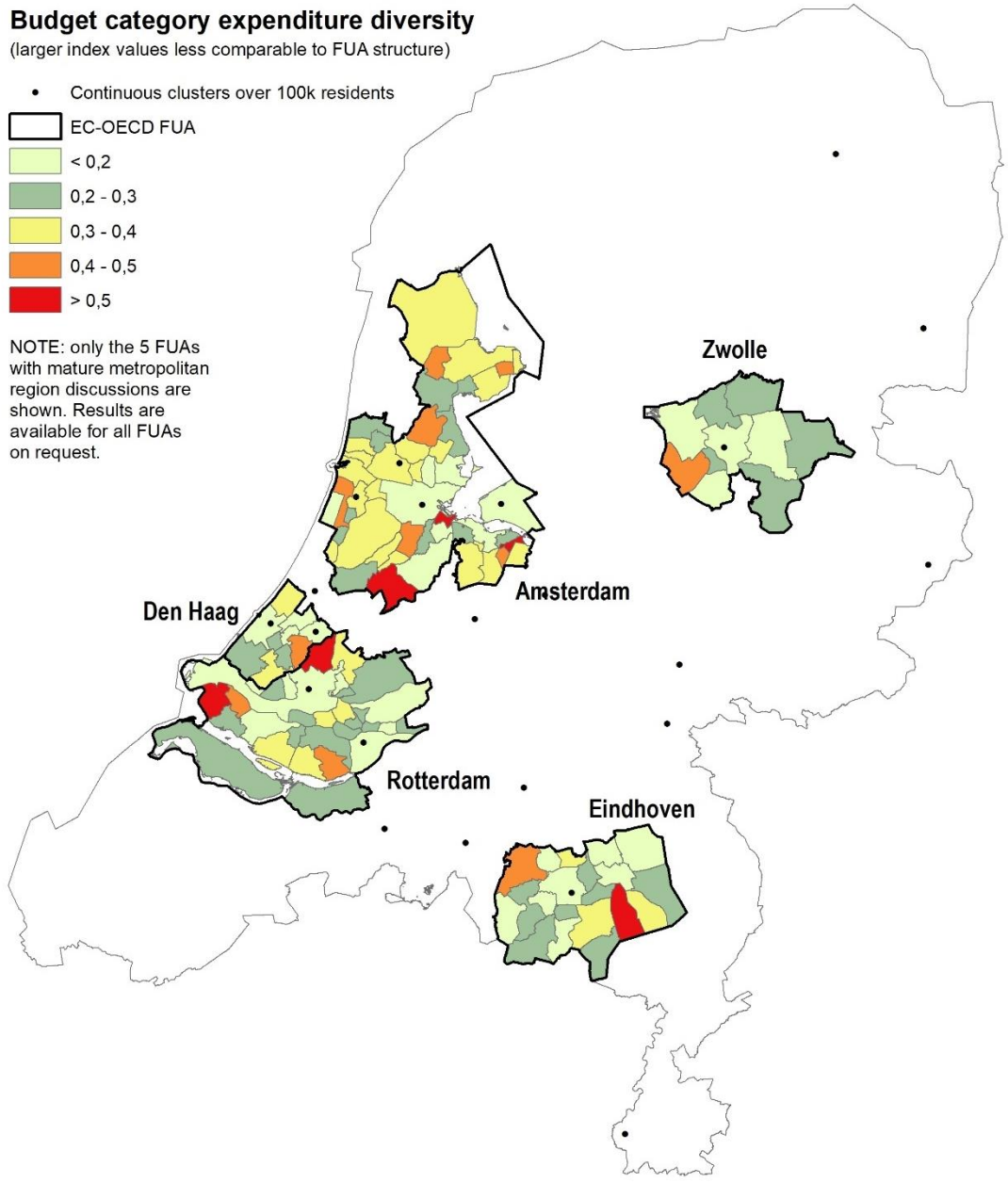

Figure 10: diversity in budget allocation in key FUAs

Finally we look at the differences in budget category allocation between municipalities, which may suggest underlying differences in the preferences of the community or the agendas of local governments. The assessment is made using the nine budget categories presented yearly by the Dutch central government (***Rijksoverheid***) on the ***Data Financiën Decentrale Overheden*** platform (more detail at Appendix A). We see a surprising amount of variation among component communities of Amsterdam. Interestingly though, highly urbanised communities seem to set the expenditure structure – almost all exhibit little to no variation from the structure of the functional urban area. We see clear outliers on the borders of functional urban areas, for example ***Lansingerland*** in the Rotterdam area and ***Nieuwkoop*** in the Amsterdam area.

We move now into a practical application of the results presented in this subsection. We make use of a Kogut and Singh (1988) style composite measure to conclude our results with an aggregate insight into possible transitions to metropolitan governance in key areas.

4.3. Towards practical application

We described in the methods section how the work of Kogut and Singh (1988) provides an opportunity to develop a composite measure between component areas based on the concept of Euclidean distance. We are primarily interested in the resulting ranking within each functional urban area, which comes in symmetric matrix form since a unique distance exists between every pair of areas. Although results can be interpreted in matrix form (available in the attached workbook for each FUA), it is cleaner and more insightful to look at individual columns (or rows).

Before we present and interpret results it is worth making clear exactly what these distance values mean. Simplistically they represent the composite difference in all dimensions between two areas. The slight peculiarity is the original dimension indicators are calculated with the functional urban area as a reference. The distance measures therefore represent how different two areas are from each other in how they differ from the FUA structure. The issue then becomes if two urban areas differ from the FUA strongly in structure, but in opposite directions, we would say the distance between them is short implying similarity. And they are similar in the extent to which they differ from the FUA structure, but the two areas do not necessarily share the same structure. We make this clear to avoid over interpretation of results.

The contribution of the income inequality dimension is also a little more complicated than the other dimension values. Two areas experiencing the same level of income inequality (even if large) would have a relatively small distance contribution from the income dimension between them. The drawback is the underlying indicators do not include/ transfer any information on the distribution of income inequality in the two areas. Again we only understand the relationship between the magnitude of the income inequality in both areas.

Before we dive into specific (row or column) results from the perspective of one area, it is useful to see how the full set of results can be interpreted. They have been calculated in symmetric matrix form, which means the results for Amsterdam are represented by a 47 x 47 matrix. To make explicit the process by which we are moving towards application of our analysis we present the composite results for Den

Haag in Table 3 because it is a much more reader friendly 9 x 9 matrix. Full sets of results for the other FUAs are available in the attached excel workbook: ***Composite_distance_results_FINAL.xlsx***.

	GM0503	GM1916	GM1842	GM1926	GM0603	GM0518	GM0629	GM1783	GM0637
	Delft	Leidschendam-Voorburg	Midden-Delfland	Pijnacker-Nootdorp	Rijswijk	's-Gravenhage	Wassenaar	Westland	Zoetermeer
Delft	0,00	2,01	1,57	1,53	2,71	1,19	4,40	3,08	3,29
Leidschendam-Voorburg	2,01	0,00	1,00	1,92	1,08	0,93	3,38	2,35	0,91
Midden-Delfland	1,57	1,00	0,00	1,45	1,39	1,43	1,44	0,83	1,74
Pijnacker-Nootdorp	1,53	1,92	1,45	0,00	2,85	1,19	3,95	3,74	2,24
Rijswijk	2,71	1,08	1,39	2,85	0,00	1,13	3,62	2,34	0,87
's-Gravenhage	1,19	0,93	1,43	1,19	1,13	0,00	4,60	3,83	0,66
Wassenaar	4,40	3,38	1,44	3,95	3,62	4,60	0,00	1,77	4,59
Westland	3,08	2,35	0,83	3,74	2,34	3,83	1,77	0,00	4,04
Zoetermeer	3,29	0,91	1,74	2,24	0,87	0,66	4,59	4,04	0,00

Table 3: composite distances between areas in Den Haag

The matrix of distance values is of course symmetric with a zero diagonal, so reading any row is the same as reading the corresponding column. Table 3 can be interpreted as a crude measure of the potential for component municipalities to have the same view on key issues in any metropolitan governance arrangement. We see clearly communities that may differ substantially from the FUA: ***Wassenaar*** and ***Westland***. We might consider whether they would be more aligned to another neighbouring metropolitan area. Another way we can look at the results is through the lens of how a metropolitan government might form over time. An adjacency matrix is calculated (assuming areas should be contiguous in order to merge governments) and it is multiplied by the composite distance results in Table 3.

	GM0503	GM1916	GM1842	GM1926	GM0603	GM0518	GM0629	GM1783	GM0637
	Delft	Leidschendam-Voorburg	Midden-Delfland	Pijnacker-Nootdorp	Rijswijk	's-Gravenhage	Wassenaar	Westland	Zoetermeer
Delft			1,57	1,53	2,71	1,19			
Leidschendam-Voorburg						0,93	3,38		0,91
Midden-Delfland	1,57				1,39			0,83	
Pijnacker-Nootdorp	1,53					1,19			2,24
Rijswijk	2,71		1,39			1,13		2,34	
's-Gravenhage	1,19	0,93		1,19	1,13		4,60	3,83	0,66
Wassenaar		3,38				4,60			
Westland			0,83		2,34	3,83			
Zoetermeer		0,91		2,24		0,66			

Table 4: composite distances between contiguous areas in Den Haag

Table 4 allows us to see where we might expect mergers to be more or less difficult. We want to make it clear this is not a commentary on whether mergers should or should not happen, simply how much the underlying communities might differ along key dimensions. The results could be useful to understand how we might form a metropolitan government over time, for example: ***Den Haag*** and ***Zoetermeer*** (0,66) might consider a merger, while ***Westland*** and ***Midden-Delfland*** (0,83) might also consider a merger and so on. A similar exercise can be conducted for each of the key functional urban areas.

Den Haag was chosen because it is yes smaller, but also an interesting case. As previously discussed, ***Gemeentes Wassenaar*** and ***Westland*** seem to differ a lot in structure compared to the Den Haag FUA along key dimensions. One might like to understand beyond the composite measure: what is contributing to the large distance? Table 5 decomposes the composite distance.

		Westland						
		Composite	*Income*	*Age*	*Budget*	*Mig. Bkg.*	*Religion*	*Voting*
GM0503	Delft	3,08	0,02	0,95	0,33	0,96	0,37	0,44
GM1916	Leidschendam-Voorburg	2,35	0,02	0,93	0,01	0,07	0,26	1,05
GM1842	Midden-Delfland	0,83	0,10	0,25	0,10	0,00	0,32	0,06
GM1926	Pijnacker-Nootdorp	3,74	0,22	0,70	1,72	0,05	0,45	0,60
GM0603	Rijswijk	2,34	0,02	0,02	0,00	0,04	1,14	1,11
GM0518	's-Gravenhage	3,83	0,00	0,97	0,30	0,03	1,50	1,03
GM0629	Wassenaar	1,77	1,54	0,00	0,01	0,05	0,15	0,01
GM0637	Zoetermeer	4,04	0,02	0,70	0,11	0,34	1,86	1,01
		Wassenaar						
GM0503	Delft	4,40	1,95	1,01	0,47	0,56	0,05	0,35
GM1916	Leidschendam-Voorburg	3,38	1,18	0,99	0,04	0,24	0,01	0,91
GM1842	Midden-Delfland	1,44	0,87	0,29	0,19	0,04	0,03	0,03
GM1926	Pijnacker-Nootdorp	3,95	0,60	0,76	2,02	0,00	0,08	0,49
GM0603	Rijswijk	3,62	1,95	0,03	0,03	0,19	0,45	0,96
GM0518	's-Gravenhage	4,60	1,54	1,03	0,44	0,00	0,69	0,88
GM1783	Westland	1,77	1,54	0,00	0,01	0,05	0,15	0,01
GM0637	Zoetermeer	4,59	1,18	0,75	0,20	0,65	0,94	0,86

Table 5: composite distances decomposed

We see clearly in Table 5 ***Wassenaar*** differs from other areas primarily in its income inequality and age structure, while ***Westland*** differs in its religion and voting structure. If a metropolitan government was to be pursued through merger, this provides key information as to what differences between the communities might need to be acknowledged and dealt with. It also raises the question: might these communities consider themselves part of a different neighbouring metropolitan area? We deal with this later in the section.

Another way of presenting results takes the perspective of core areas of economic activity and population density in each FUA. Figure 11 thematically represents the composite distances between core municipalities and other areas in the FUA. Red represents larger composite distances to the core and green smaller. The information might help the transition to metropolitan government by suggesting transitional (intermediate) mergers and might be useful in other metropolitan governance arrangements because it suggests areas with similar preferences to collaboratively tackle key policy issues.

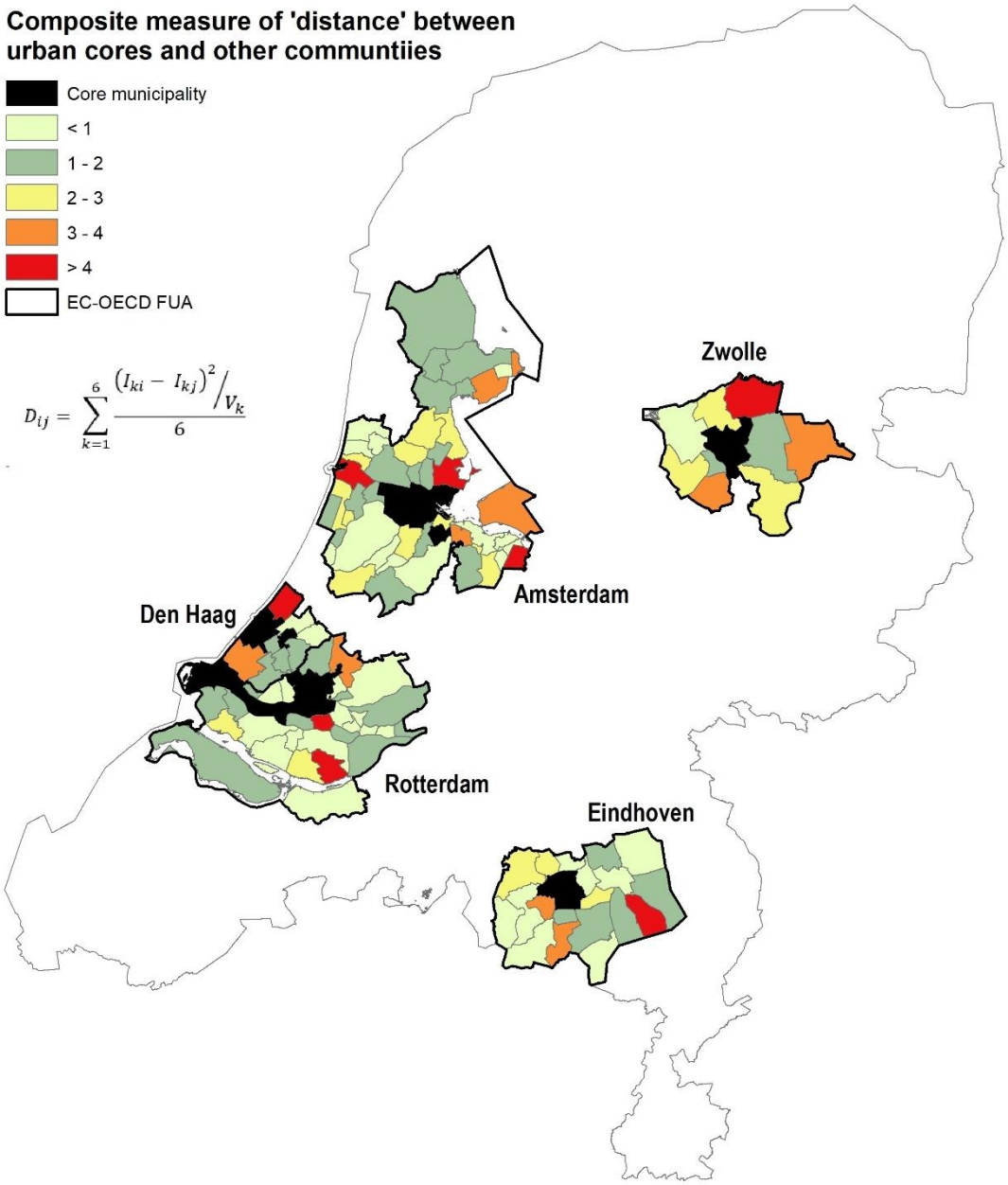

Figure 11: composite distance between central areas (i) and other areas (j) in the FUA

Figure 11 reminds us there are relatively straightforward cases like Amsterdam and Zwolle where there is a clear core municipality, then there are slightly less straightforward cases like Eindhoven where we might also consider ***Gemeente Helmond*** a core municipality. Finally there are complicated cases like Rotterdam and Den Haag where there are dual centres, other close by centres (***Leiden*** for example) and multiple legitimate perspectives on where the 'metropolitan area' boundaries should be drawn.

Our analysis lends itself to an assessment of the Eindhoven case. We can simply consider the perspectives of both core municipalities concurrently as shown in Figure 12.

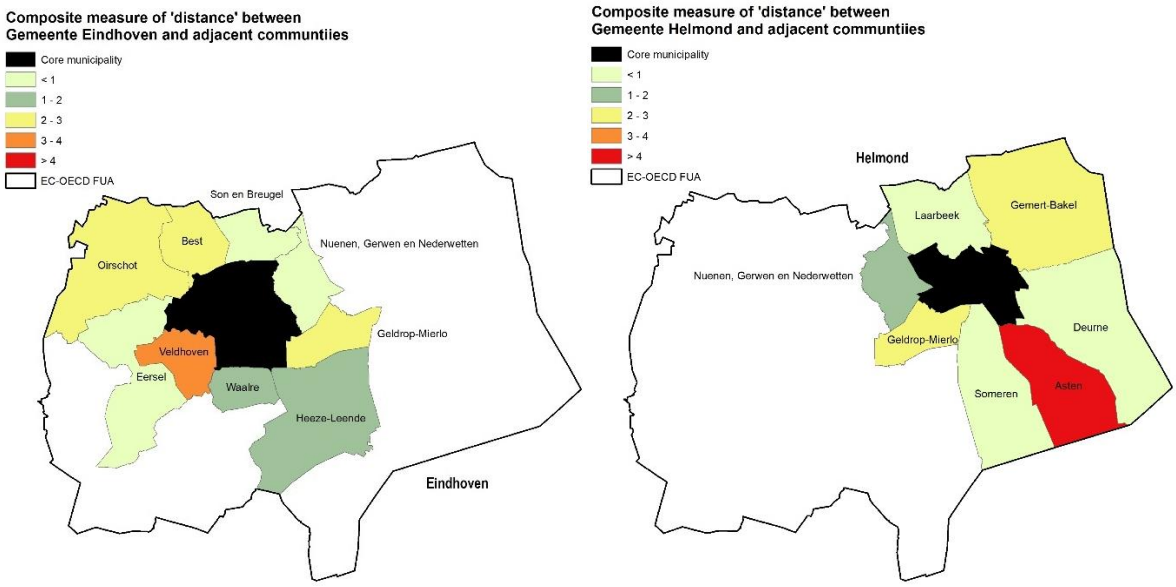

Figure 12: composite distance between central municipalities and surrounding areas in Eindhoven

Figure 12 allows us to see possible mergers or allies from two perspectives. We see clear candidates for interim cooperation for both core municipalities. Interestingly ***Nuenen, Gerwen en Nederwetten*** might be better suited to a transitional merger with ***Gemeente Eindhoven*** than ***Gemeente Helmond***. ***Geldrop-Mierlo*** is roughly equidistant to both.

The metropolitan area of Rotterdam-Den Haag is shown in Figure 11 as two separate metropolitan areas. Since the ***Metropoolregio Rotterdam Den Haag*** has already formed, we might gain insights from considering them as one metropolitan area, which requires recalculating each dimension and the composite measures, then presenting the perspectives of each core municipality.

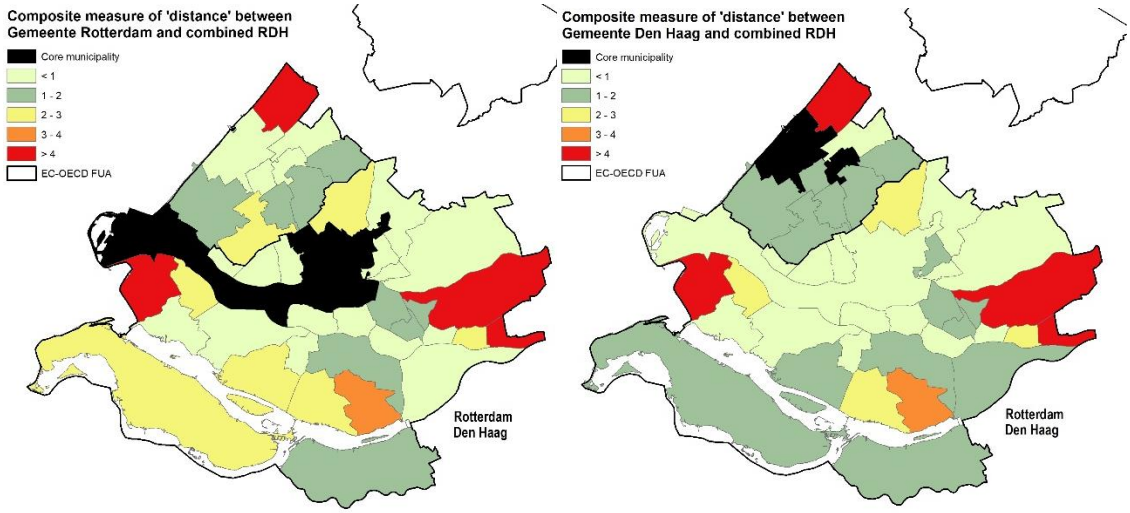

Figure 13: composite distance between central municipalities and surrounding areas in Eindhoven

Unfortunately Figure 13 doesn't seem to provide us with a clear partner for ***Westland***, however other interesting patterns emerge. The first is the small distance between ***Gemeentes Rotterdam*** and ***Den Haag***

given an ambition for a combined metropolitan region. The second is the consistent mid-range distance between the line of municipalities separating the cores from each other – almost presenting as a spatial barrier between the two. The third is the consistently large distance between both core municipalities and ***Gemeentes Wassenaar***, ***Westvoorne***, ***Molenwaard*** and ***Hardinxveld-Giessendam*** suggesting a few of these municipalities may identify more with surrounding metropolitan areas on key dimensions.

Our analysis is starting to reach the extents of its usefulness, but we have shown how results can be used to better understand the transition to metropolitan governance in specific areas. We now move on to a brief discussion of assumptions that could be changed, implications and limitations of the work.

5. Discussion and conclusion

We set out to better understand the locational patterns in metropolitan areas in the Netherlands through the lens of a potential transition to metropolitan governance. We wanted to look beyond the production cost minimisation framework that has been used so often to justify the consolidation of subnational governments or to move decision making to a non-democratic larger scale entity.

The research approach relied on measures of diversity in the underlying communities that make up functional urban areas. The assumption was greater 'distance' between communities in key dimensions might make either decision making in any metropolitan governance arrangement or the formation of a metropolitan government more difficult. The results are not necessarily a commentary on which governments should merge or seek to collaborate and why, but instead provide further insight on the issues that might require effort if effective metropolitan governance is to be delivered in specific metropolitan areas. We necessarily explore questions of metropolitan government scale and shape too – in particular as it relates to the ***Metropoolregio Rotterdam Den Haag***. We show there are some areas on the fringes of metropolitan areas that may indeed orient themselves more towards other surrounding metropolitan areas along key dimensions. We show that functional urban areas with a distinct core periphery shape tend to be dominated along key dimensions by the structure of the core and there seem to be consistent differences between the core and the periphery communities.

One of the theoretical frameworks considered was the Tiebout (1956) argument about revealed consumer (citizen) preferences for local public goods based on their choice of administrative area for residence. We address through our analysis and results two of the key concerns relating to the potential for externalities between component areas in a metropolitan area. The first is transaction costs resulting from the need for different communities and their representatives to make increasingly complex deals as metropolitan areas expand. The composite distance between communities clearly matters here. The second is the need for 'appropriate smallness' so that decisions made maintain relevance to citizens. The composite distance between communities along our key dimensions may provide a better basis for determining the appropriate smallness than geographic distance or political polarisation.

We are not aware of similar index based approaches at the subnational scale and therefore the work has been as much about exploring a different methodological approach to questions of metropolitan governance as it has been about arriving at specific results. The resulting approach, while novel in this context, is directly informed by assessments of regional economic specialisation and concentration, regional income inequality and even supranational governance arrangements like the European Union (e.g., Alesina & Perotti, 1996; Combes & Overman, 2004; Hale & Koenig-Archiburgi, 2016).

The application of a descriptive location based analysis to sensitive political and social dimensions comes with clear drawbacks. Metropolitan governance arrangements are highly complex with many actors and it is unlikely we can successfully summarise the potential for them in a given area by selecting

a spread of dimensions, then aggregating them into a set of ‘composite distances’. Specific limitations are presented later in the section. What we hope to have done is provide a more coherent starting point/ set of insights for discussions about the transition to metropolitan governance in the Netherlands, since as far as we can see there is limited evidential basis for the definition of metropolitan areas and indeed which subnational governments should consider merging or making decisions together and why.

Although we might have provided an alternative starting point for future conversations, there are clear limitations associated with the results, which we now discuss briefly. Identification of these limitations leads us to opportunities for further research and application by policymakers.

5.1. Limitations

Any research using a relative index based approach to locational descriptive analysis has to be clear about the issues of scale. Underlying data is necessarily aggregated at a certain component scale and then referenced to a larger scale (or some other reference area). We have justified the use of municipalities as component areas and EC-OECD functional urban areas as a representation of the metropolitan area, however, there are other options that might lead to different results. One could, for example, use the current members of the ***Metropoolregios*** as aggregate metropolitan areas and the ***Wijks*** (neighbourhoods) as component parts. Provinces might benefit from knowing the conceptual distance between the component municipality areas along key dimensions. All of this is to say the selection of scale and borders, although justified, is as it stands somewhat arbitrary and open to criticism. Our results only say something specifically about the spatial relationship between municipalities within the given functional urban area.

Equally the selection of dimensions to analyse is one taken by the researcher. There is clearly no specified or generalised set of dimensions that definitively shows you how easy or difficult a transition to complex metropolitan governance will be in the future. Our exploration of the literature, in particular the Hamilton (2013) approach to measuring effectiveness in regional governing systems, suggested a good spread of dimensions. Others might argue there are better datasets or better ways to operationalise the key dimensions. And importantly, the dimensions for analysis might be chosen according to the specific context in a specific metropolitan area.

An attempt was made to select an underlying index that suited the problem statement. You can see the range of diversity and concentration indices we considered at Appendix D. Using the Krugman Specialisation Index (1991) and Gini index (1921) as a base allowed us to compare structures across communities, but also made interpretation of aggregated Kogut and Singh (1988) results somewhat peculiar. The choice matters and there are a lot of entropy based measures to choose from. One could even construct a more bespoke entropy based diversity measure.

Since the results for individual dimensions remained somewhat abstract, we chose to establish a composite measure based on Euclidean distance. Our measure gives essentially equal weighting to the underlying dimensions. There are of course other legitimate ways to establish a weighted composite result, for example using a mutli-criteria analysis approach. In addition, our simplistic composite distance value has the potential to be misleading if taken into the wrong context by people who do not understand the construction of measures for the underlying dimensions. Looking at the decomposed composite measure is incredibly important because as we've discussed throughout the thesis, differences in structure between two areas is not necessarily a negative force nor does it imply complete similarity between the two. We are not arguing for greater homogeneity in urban areas, simply a way to approach the transition to a democratic governance arrangement step by step.

5.2. Implications for research and practice

There are some obvious extensions of the research aside from improvements related to the limitations already discussed. Econometric methods could be used to test the association between either dimension index values or composite distance values and relevant phenomena (for example: time taken to merge municipalities from initial discussions or total cost per capita of the amalgamation process). Composite distance measures could be tested against future municipality mergers – not just whether they happen, but how and why they happen. As a starting point, it is pleasing to see that the calculated distance between ***Haarlemmerliede en Spaarnwoude*** and ***Haarlemmermeer*** who merged in 2019 (we use 2018 data) is relatively low at 0,99. Counterfactuals where specific municipalities have wanted to, but ultimately struggled to make joint decisions or to merge could be looked at in more detail.

We talked about the challenges associated with scale in the limitations section and something not well addressed in the current research is the potential for metropolitan area boundaries to vary depending on the economic phenomena being observed. By choosing EC-OECD functional urban areas we lean heavily towards labour markets defining cities. Marlet and van Woerkens (2014) provide an interesting way to aggregate different economic activities into defined metropolitan areas, which could be incorporated into our style of analysis.

Beyond the instrumental extensions, the research approach needs refining in the context of transitions to metropolitan governance. The aim has been to provide a different economic perspective on the problem of transition to metropolitan governance (beyond amalgamation) and it is for others to decide whether or not they find it valuable or legitimate. Clear areas for improvement are being more specific about the relationship to inter-disciplinary governance theory and the relationship to political and economic transaction costs. The calculated distances may be related to political transaction costs and we might use them as the basis for a fresh perspective on the cost minimisation problem.

Another path for further research might be understanding how the composite distance between component communities translates more concretely into democratic legitimacy and the legitimacy of

redistributive policy in any merged government. Lipset (1959) describes legitimacy as an affective and evaluative concept. Weede (1996) recognizes that legitimacy is a form of social capital that reduces transaction costs, which is efficiency enhancing. Rudolph and Evans (2005) reinforce this view finding voters are more prone to support larger government expenditures when they regard government as trustworthy. Levi and co-authors (2009) build on the concept of government legitimacy, describing it as an attitude towards the government that *"...derives from the beliefs citize**ns hold about the normative** appropriateness of government structures, officials, and processes"*.

Legitimacy makes people more willing to obey and defer to the government (Berggren et al., 2015). This in turn affects how given government resources are used. Governments with low legitimacy have less obedient and deferential citizens and must devote more resources to the enforcement of its policies and to maintaining order (Levi et al. 2009). High legitimacy enables government, at any given size, to use resources freed up by obedient citizens to raise expenditures (such as infrastructure, education, subsidies or benefits) and/or lower taxes, without sacrificing the de facto quality of the legal institutions. Given the potential for preference heterogeneity and diversity at the scale of functional urban areas in the Netherlands, the resulting legitimacy of any metropolitan government and its redistributive policies should be considered more carefully. We have shown democratic legitimacy may be hard to achieve in some metropolitan areas even if a metropolitan government represents a central government cost saving.

For policymakers the research serves two primary purposes. The first is it goes part of the way to confirming phenomena already felt and partially observed, but not well defined. An example is the in depth analysis of the metropolitan area Rotterdam-Den Haag, and in particular the treatment of ***Wassenaar*** and ***Westland***, which may orient to other surrounding metropolitan areas. The second is it provides insights for central government tacticians who have an economic stake in better coordinating the transition to certain types of metropolitan governance in major city regions. The results offer them insights on metropolitan area composition (size) and where to look for first steps towards consolidated metropolitan government if that is in fact the objective.

5.3. Concluding remark

We have shown here how the transition to metropolitan governance in the Netherlands might rely on more than promises of reduced public expenditure and better infrastructure decision making. Metropolitan governance is likely to take the form of municipality amalgamation in addition to various collaborative decision making structures focused on specific policy agendas, for example economic development. In both cases the heterogeneity of preferences in component communities is important for the transition. Understanding the extent to which component communities differ in structure along key dimensions allows us to form a position on how difficult the transition to consolidated government or decision making platforms might be and what role we might expect political transaction costs to play. It

also gives us an evidence base for how communities might orient themselves towards different established metropolitan centres of economic activity and population density.

We see significant diversity exists along different dimensions in different metropolitan areas. We see areas with consistent core periphery structures and north-south or east-west divides along key dimensions. The transition to metropolitan governance will therefore have different challenges (transaction costs) in different areas and democratic legitimacy of any metropolitan government may be difficult to achieve in some. What we now know is the communities more likely to merge with lower transaction costs and the communities where it might be more difficult. The information should be helpful for multiple actors as we move towards a more metropolitan mode of subnational government in the Netherlands with 111 municipalities.

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Appendix A: description of datasets

Content	Source	Date	Notes
Wijk- en buurtkaart	Centraal Bureau voor de Statistiek (CBS)	2018	Municipality areas, demographic descriptions (geaggregeerde kerncijfers) including: residential population, households, jobs. (Note: join to jobs data relies on GM_NAAM (text) field and some cleaning was required to match these datasets).
EC-OECD functional urban areas: Netherlands	OECD	2019	Shapefile determined by process detailed at Appendix B
Netherlands largest cities and towns	World Population Review	2019	CSV with lat/long points converted to shapefile with populations.
Netherlands places	OpenStreetMap.org	2019	Used under the: Open Data Commons Open Database License OpenStreetMaps is a user contribution platform. Shapefiles are therefore added to frequently. Quality is ensured by a 'peer review' type process.
Household income	Centraal Bureau voor de Statistiek (CBS): regionale gegevens in Statline	2018	Inkomen van huishoudens; huishoudenskenmerken, regio (gestandaardiseerd inkomen)
Votes per political party per municipality	Kiesraad: databank verkiezingsuitslagen	2017	Tweede Kamer 15 maart 2017. Includes number of eligible voters.
Municipality budgets	Ministerie van Binnenlandse Zaken en Koninkrijksrelaties: FINDO	2018	Gemeentelijke informatie: baten en lasten begroting per taakveld (nieuwe stijl)
Age structure per municipality	Centraal Bureau voor de Statistiek (CBS): regionale gegevens in Statline	2018	0 – 14; 15 – 24; 25 – 44; 45 – 64; 65+
Migration background per municipality	Centraal Bureau voor de Statistiek (CBS): regionale gegevens in Statline	2018	Dutch; Western; Morocco; Antilles and Aruba; Surinam; Turkey; Other
Religiosity per municipality (18 years of age and older)	Centraal Bureau voor de Statistiek (CBS) Statline	2014	Religie en kerkbezoek naar gemeente: Katholiek; Hervormd; Gereformeerd; PKN; Islam; Joods; Hindoe; Boeddhist; Anders

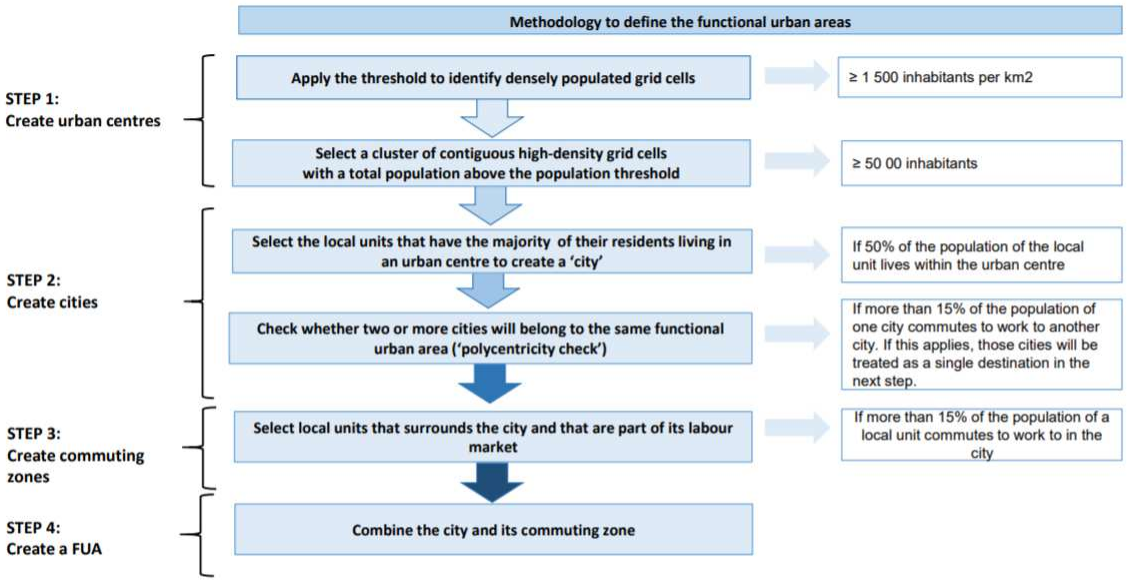
Appendix B: determining EC-OECD functional urban areas

The EC–OECD definition of functional urban areas is described in a simple spatial analysis flow:

Step 1 partitions the European surface into 1 km2 grid cells and identifies high-density cells with a population density greater than 1500 inhabitants per km2 based on categorized satellite images.

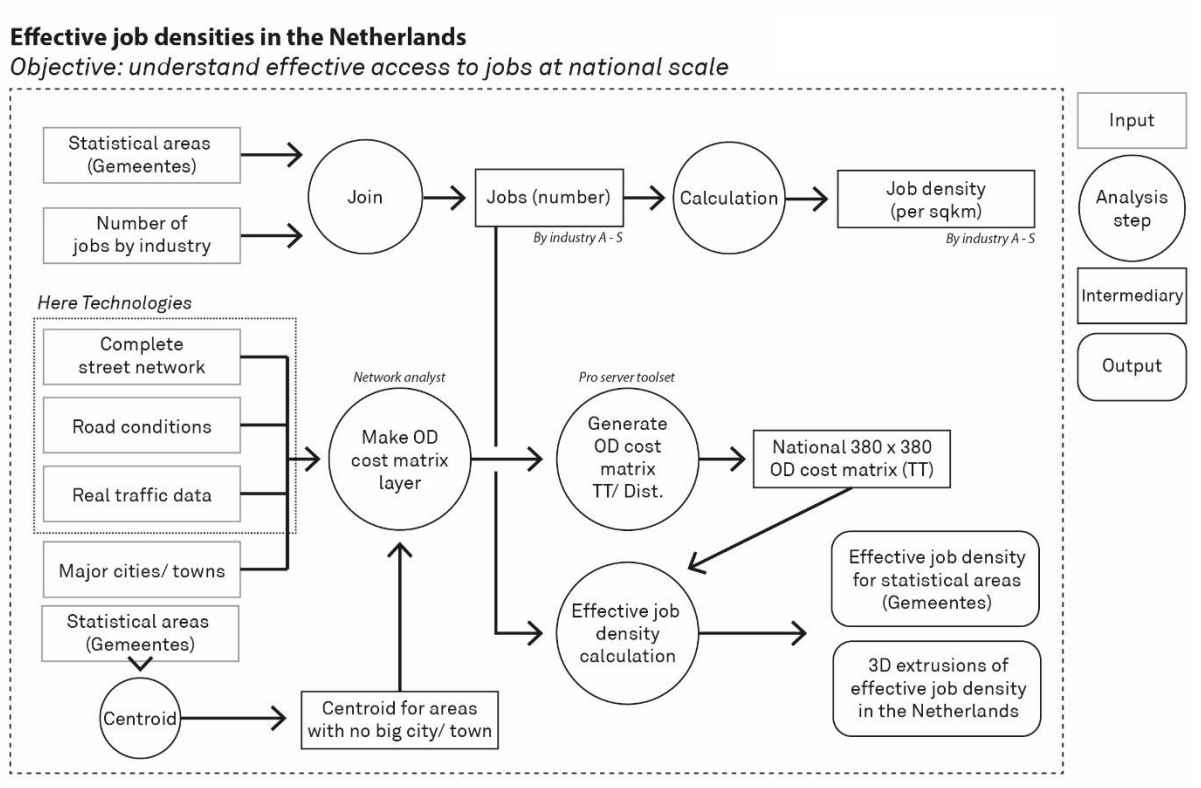
Step 2 generates clusters of contiguous (sharing at least one border) high-density cells. Low-density cells encircled by high-density cells are added. Clusters with a total population of at least 50,000 inhabitants are identified as urban centres.

Step 3 uses administrative data to calculate commuting flows from local administrative units (municipalities) into urban centres. Local administrative units with 15% of employed persons working in an urban centre are assigned to the urban centre. A contiguous set of assigned local administrative units form a larger urban zone. Non-contiguous local urban centres with bilateral commuting flows of more than 15% of employed persons are combined into a polycentric larger urban zone.



Note: taken directly from ***The EU-OECD Definition of a Functional Urban Area*** (Dijkstra et al., 2019)

Appendix C: calculating 'effective job density'



Appendix D: comparison of diversity and specialisation measures

Absolute measures

Hirschman-Herfindahl index

The Hirschman-Herfindahl index (Herfindahl, 1950; Hirschman, 1964) is commonly used for studies of market concentration, but has also been used in studies of economic diversity/ macroeconomic specialisation (e.g., Tauer, 1992; Beine and Coulombe, 2007). Although there are many variants (e.g., Hannah & Kay, 1977) the most common form is:

$$HHI = \sum_{i=1}^{I} s_i^{\alpha}$$

Where s_i is share of a subgroup i and higher values of α place emphasis on larger shares. Note with the commonly used α=2, the HHI takes equiproportional as a reference (or its lower bound 1/I) and 1 as an upper bound.

Shannon Entropy index

The Shannon Entropy Index (Shannon, 1948) and variants are widely used for studies of income distribution, but also specialisation (e.g., Aiginger & Pfaffermayar, 2004). The most common form is:

$$SEI = -\sum_{i=1}^{I} s_i \ln(s_i)$$

Where again s_i is a share of a subgroup i. Note the lower bound of 0 and the upper bound of ln(I), which represents 'complete diversification'.

Absolute Gini index

An absolute form of the Gini Index (Gini, 1921) was also considered, but discounted because it has not been commonly applied in studies of heterogeneity outside the income dimension. We tabulate the properties of these absolute indices according to our principles described and listed above.

	a. anonymity	b. 0 share	c. bounds	d. class.	e. transfer	f. decompos.
HHI	✓	✓	✓	✓	✓	✓
SEI	✓	x	✓	✓	✓	✓
Abs. Gini	✓	x	✓	x	x	x

Table 6: properties of absolute measures

Relative measures

Relative Hirschman-Herfindahl index

It is possible to establish a relative variant of the Hirschman-Herfindahl index (Herfindahl, 1950; Hirschman, 1964) and introduce spatial scale. The formulation is commonly used to asses relative concentration in regions.

Krugman Specialisation index

The Krugman Specialisation Index (Krugman, 1991) is essentially the standard error of group shares. The most common form is:

$$KSI = \sum_{i=1}^{I} |s_i - \bar{s}_i|$$

Where s_i is a share of a subgroup i and $\bar{s}_i$ is some reference (or mean area) value. Note the lower bund of zero and the upper bound of $\frac{2(I-1)}{I}$. The lower bound represents an identical structure to the reference.

Relative Gini index

The relative Gini Index (Gini, 1921) can be arrived at by ranking shares according to their location quotient before plotting the cumulative shares against some reference (area) share. By doing this, the Lorenz Curve is reincarnated as a 45-degree line and becomes the lower bound. The value of twice the area between the plotted line and the Lorenz Curve (45-degree) gives use the Gini-coefficient with an upper bound of $1 - \frac{1}{I^2}$. Although it is somewhat cumbersome to calculate, the relative Gini Index gives a measure of difference between the composition of one area according to a reference.

Theil index

The final relative index considered was the Theil Index (Theil, 1967), most commonly used to determine income inequality. The index construction borrows from Shannon (1948) and should be familiar in its most common form.

$$T = \frac{1}{I} \sum_{i=1}^{I} \frac{s_i}{\bar{s}_i} \ln\left(\frac{s_i}{\bar{s}_i}\right)$$

Where s_i is a share of a subgroup i and $\bar{s}_i$ is some reference (mean area) value. We tabulate the properties of these relative indices according to our principles described and listed above. While decomposability is an advantage of the Theil Index, one clear problem is that adding a subgroup with a zero share leads to an undefined index value. If the target group is perfectly structured according to the reference group then the value of the index is zero. If, however, the target group exists only in a single category the index

is equal to negative infinity. This is unlikely in our context and we should say that if other subgroups are very small (non-zero) we see a convergence to Iln(I), which is sufficient to claim bounds.

	a. anonymity	b. 0 share	c. bounds	d. class.	e. transfer	f. decompos.
Rel. HHI	✓	✓	✓	✓	✓	✓
KSI	✓	✓	✓	✓	✓	x
Rel. Gini	✓	x	✓	x	x	x
Theil	✓	x	✓	x	✓	✓

Table 7: properties of relative measures