Background

Ageing populations have major socioeconomic repercussions for municipalities and subnational units across Europe. Both in Denmark and Sweden, municipalities have strong political authority, and are responsible for the provision of critical services, such as early childhood education, primary education, and elderly care. Ageing population structures impact the demand, funding, and delivery of social and welfare services by municipalities. It is, therefore, important to identify which municipalities are most vulnerable to the pressures of population ageing, and why.

Research Question

We ask, what drives the differences in population growth among the municipalities in Denmark and Sweden? To what extent do differences in age composition of the municipalities contribute to these changes?

Data

We use data from Statistics Denmark and Statistics Sweden (Statistics Sweden 2023; Statistics Denmark 2023). We used 1-year population, birth, death, immigration, and emigration counts for the 98 Danish municipalities and the 290 Swedish municipalities. We focus our analysis on data from 2007 to 2019 for both countries, this is due to the Danish municipality reform in 2007 which created the current municipality and regional structure of Denmark.

Methods

The crude growth rate (CGR) can be expressed as a function of the crude birth rate (CBR), crude death rate (CDR), crude immigration rate (CIR) and crude emigration rate (CER)

$$CGR(t) = CBR(t) - CDR(t) + CIR(t) - CER(t), \tag{1}$$

following the Kitagawa decomposition, the difference between two crude rates can be decomposed into (1) the contribution of the difference in the age-specific rate and (2) difference in the population structure (Kitagawa 1955). For example, the difference in the CDR between population A and B can be decomposed as follow:

$$CDR(t)^A - CDR(t)^B = \sum_x \Delta m(x,t)\,\overline{p(x,t)} + \sum_x \Delta p(x,t)\,\overline{m(x,t)}, \tag{2}$$

where Δ is the difference and the bar on top of the variable represents the average between populations. The same decomposition can be applied to the CBR, CIR and CER.

By combining eq. (1) with the Kitagawa decomposition (eq. 2), the difference in CGR can be decomposed as:

$$\begin{aligned} \Delta\, CGR(t) = \\ \sum_x \Delta b(x,t)\,\overline{p(x,t)} + \sum_x \Delta p(x,t)\,\overline{b(x,t)} - \\ \sum_x \Delta m(x,t)\,\overline{p(x,t)} - \sum_x \Delta p(x,t)\,\overline{m(x,t)} + \\ \sum_x \Delta i(x,t)\,\overline{p(x,t)} + \sum_x \Delta p(x,t)\,\overline{i(x,t)} - \\ \sum_x \Delta e(x,t)\,\overline{p(x,t)} - \sum_x \Delta p(x,t)\,\overline{e(x,t)} \end{aligned} \tag{3}$$

where $b(x,t)$ is the age-specific birth rate, $m(x,t)$ the age-specific death rates, $i(x,t)$ the age-specific immigration rates and $e(x,t)$ the age-specific emigration rates. Since each component is weighted by the same difference in population structure, the formula can then be rearranged and written as follows:

$$\begin{aligned} \Delta\, CGR(t) = \\ \underbrace{\sum_x \Delta b(x,t)\,\overline{p(x,t)}}_{Fertility\ componment} - \underbrace{\sum_x \Delta m(x,t)\,\overline{p(x,t)}}_{Mortality\ comp.} + \end{aligned} \tag{4}$$

$$\underbrace{\sum_{x} \Delta\, i(x,t)\, \overline{p(x,t)}}_{Immigration\ comp.} - \underbrace{\sum_{x} \Delta\, e(x,t)\, \overline{p(x,t)}}_{Emigration\ comp.} +$$

$$\underbrace{\sum_{x} \Delta\, p(x,t)\, (\overline{b(x,t)} - \overline{m(x,t)} + \overline{\imath(x,t)} - \overline{e(x,t)})}_{Age-structure\ comp.}$$

Here each demographic component is quantified in relation to the crude growth rate, while also showing how the difference in population structure influences the growth rate. In this paper, the difference between the municipalities (population A) CGR and the national (population B) CGR is decomposed with equation 4.

Preliminary findings:

Figure 1 shows a map of Denmark showing the crude growth trend difference ($\Delta\, CGR$) for the municipalities for the 2013-2019 period. The scale is broken into quintiles of values above and below zero with white representing observations around zero. Green to blue colours represent growth rates that are below the average and yellow to red indicate growth rates that are above the national average. The western coastline municipalities are facing varying levels of depopulation whereas the growth is located in urban centres and cities. The greater Copenhagen area which can be seen in the box with the Copenhagen municipality with the highest growth rate difference from national rate of 12.51 persons.

More specifically, for every one-thousand inhabitant in Denmark, Denmark grows on average by 5.5 people per year, however, Copenhagen specifically grows on average by 12.51 persons more than the 5.5. Alternatively, the national rate can be added to the Copenhagen rate summing up to the Copenhagen standard crude rate of 18 people per thousand, so for every one-thousand people in Copenhagen, the municipality grows on average by 18 people per year over the period 2013-2019.

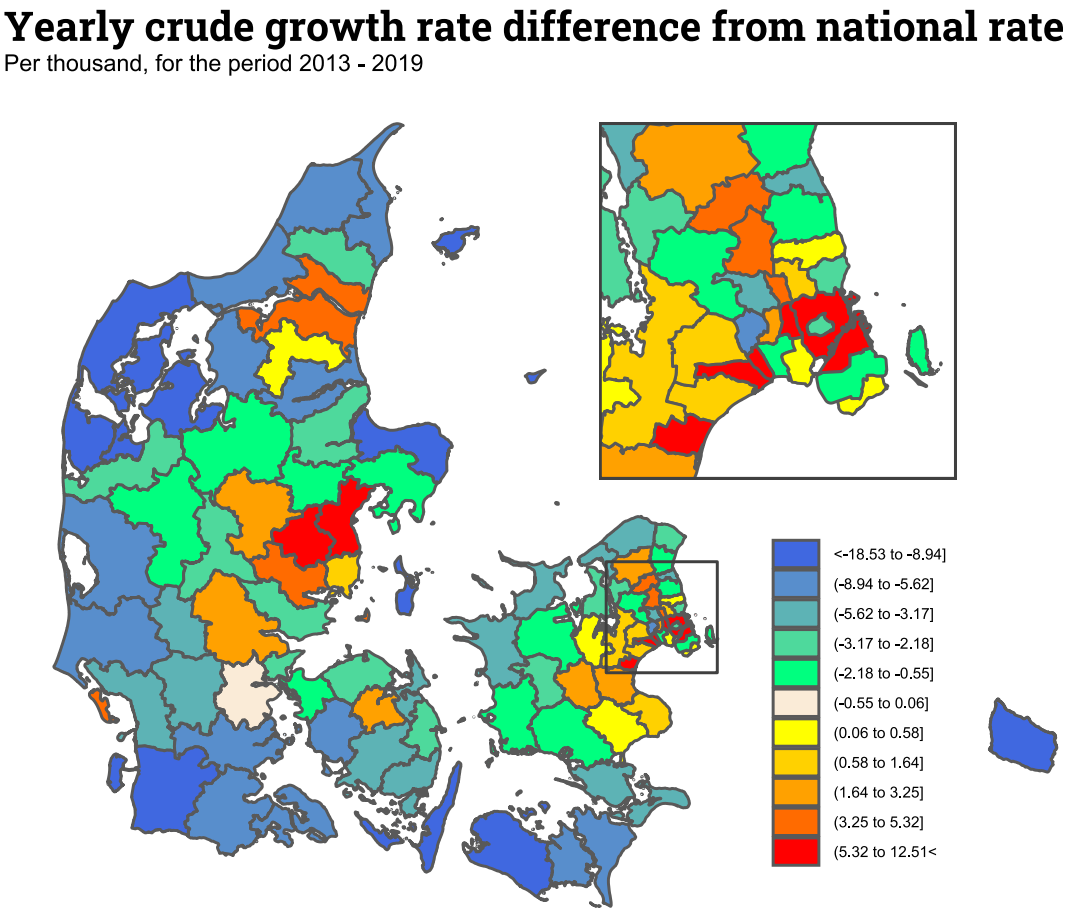

Figure 1

We apply the decomposition for Swedish municipalities and a similar pattern of rural – urban divide emerges. There is clear depopulation in rural municipalities, specifically in northern Sweden. Municipalities around the greater Stockholm area as can be seen within the box. Although Stockholm municipality is not the fastest growing municipality for the period as was the case for Copenhagen, the greater Stockholm area constitutes the municipalities with on average the highest growth in the period.

The two municipality maps only show the crude growth difference ($\Delta\ CGR$) of the decomposition, which is not indicative of what constitutes the difference in municipal growth. Figure 3 shows the decomposed drivers of the crude growth differences between the Danish municipalities. The crude growth rate difference is indicated with a black dot, and each component has a unique colour. Red indicates the contribution of mortality to the difference, blue for births, purple for net migration and green for age structure. The list is ordered by population size within each region. The blue dotted line indicates the national growth rate for the period, if a black dot falls left of this line, then the municipality is experiencing depopulation.

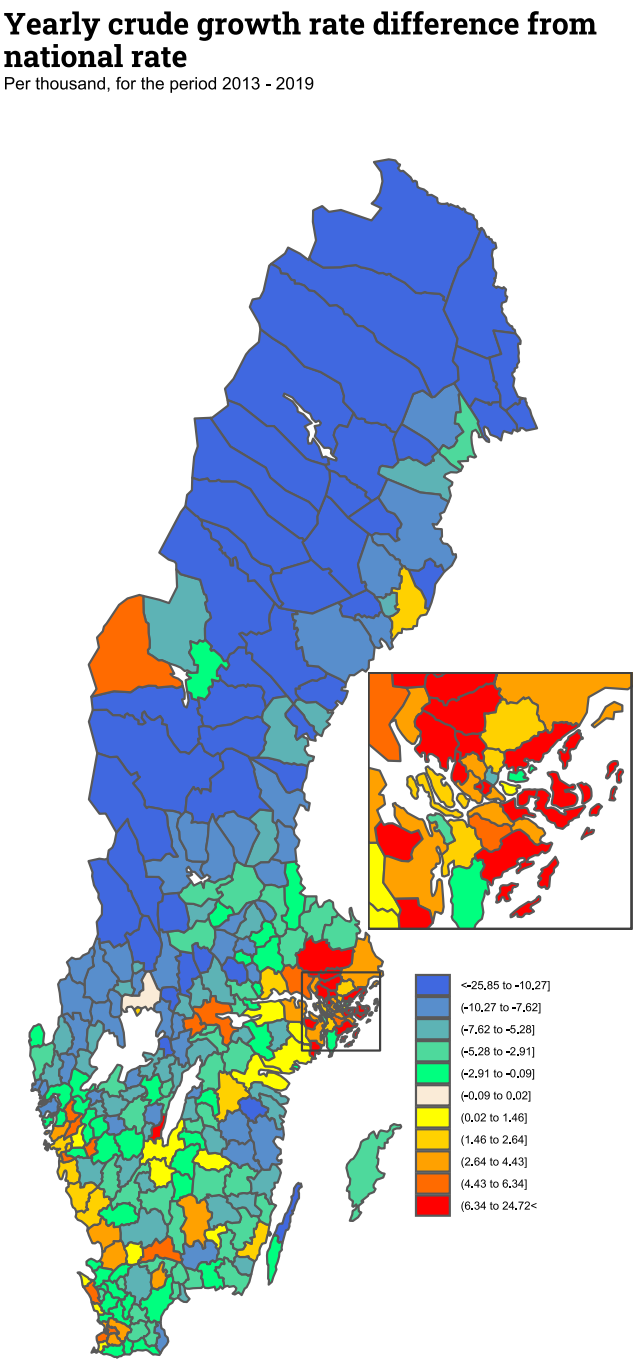

Figure 2

Nearly exclusively the largest urban areas of greater Copenhagen, Aarhus, Odense, and Aalborg are growing at a faster rate than the national average. The growth found in these cities can mostly be attributed to their young age structure and to a lesser extent migration. While municipalities outside the capital region are depopulating solely due to negative contributions from net migration and age structure even though they almost always have positive contribution from the birth and mortality (barring Zealand) component. While most municipalities found within the capital and partly Zealand region are growing older the proximity to Copenhagen keeps their growth elevated or constant to the national rate, through positive contributions from net migration. Enabling us to highlight the phenomenal population growth of the greater Copenhagen area is mostly done so at the cost of provincial Denmark.

Ideally, in the final paper we would create a similar figure for the 290 Swedish municipalities. Due to brevity of this extended abstract, we only show results for the 98 Danish municipalities.

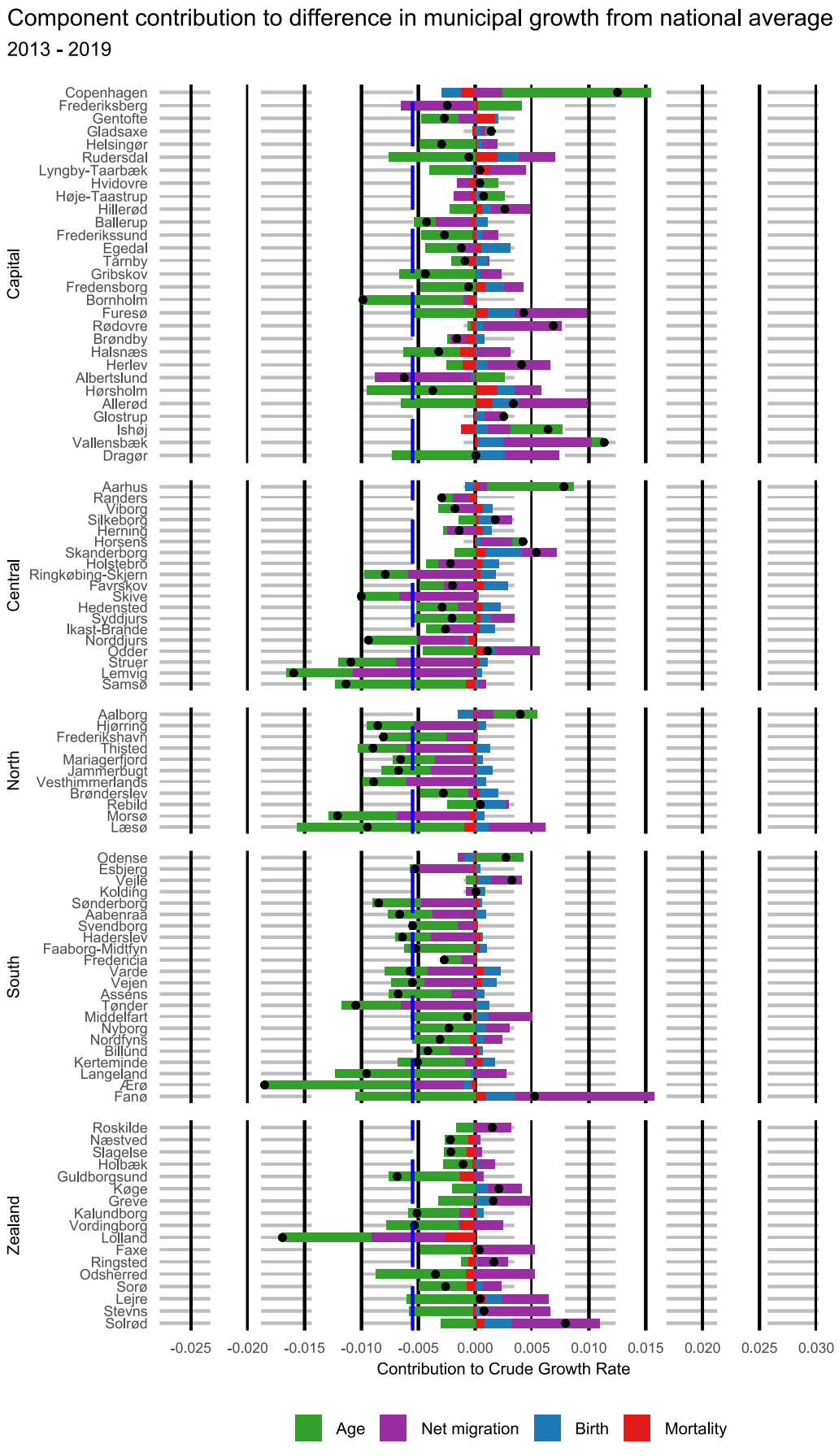
Component contribution to difference in municipal growth from national average
2013 - 2019
Capital
Copenhagen
Frederiksberg
Gentofte
Gladsaxe
Helsingør
Rudersdal
Lyngby-Taarbæk
Hvidovre
Høje-Taastrup
Hillerød
Ballerup
Frederikssund
Egedal
Tårnby
Gribskov
Fredensborg
Bornholm
Furesø
Rødovre
Brøndby
Halsnæs
Herlev
Albertslund
Hørsholm
Allerød
Glostrup
Ishøj
Vallensbæk
Dragør
Central
Aarhus
Randers
Viborg
Silkeborg
Herning
Horsens
Skanderborg
Holstebro
Ringkøbing-Skjern
Favrskov
Skive
Hedensted
Syddjurs
Ikast-Brande
Norddjurs
Odder
Struer
Lemvig
Samsø
North
Aalborg
Hjørring
Frederikshavn
Thisted
Mariagerfjord
Jammerbugt
Vesthimmerlands
Brønderslev
Rebild
Morsø
Læsø
South
Odense
Esbjerg
Vejle
Kolding
Sønderborg
Aabenraa
Svendborg
Haderslev
Faaborg-Midtfyn
Fredericia
Varde
Vejen
Assens
Tønder
Middelfart
Nyborg
Nordfyns
Billund
Kerteminde
Langeland
Ærø
Fanø
Zealand
Roskilde
Næstved
Slagelse
Holbæk
Guldborgsund
Køge
Greve
Kalundborg
Vordingborg
Lolland
Faxe
Ringsted
Odsherred
Sorø
Lejre
Stevns
Solrød
-0.025
-0.020
-0.015
-0.010
-0.005
0.000
0.005
0.010
0.015
0.020
0.025
0.030
Contribution to Crude Growth Rate
Age
Net migration
Birth
Mortality

Figure 3